



Neagh Bann Flood Risk Management Plan



Department of
**Agriculture and
Rural Development**
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Foreword

There have been a number of very significant flood events during the last ten years which have had severe impacts on homes and businesses throughout the Province highlighting the vulnerability of many communities to flooding. These are clear reminders of our reliance on our critical infrastructure so the finalisation of these Flood Risk Management Plans is to be warmly welcomed. Climate change projections indicate that we should expect more heavy rain in the future and so flood risk is also likely to increase. Add to this the fact that sea levels are rising and it can be quickly concluded that flood risk must be proactively managed across government, with meaningful engagement with communities that are vulnerable to flooding. If the weather events we have experienced recently become more common, then planning for flooding is critically important.

The EU Directive on, “the Assessment and Management of Flood Risk” was introduced in 2007 and is widely referred to as the ‘Floods Directive’. This legislation has been transposed into local regulations and it sets out a systematic approach to managing flood risk. Firstly it requires Member States to carry out a national risk assessment to understand the flood hazards and, using this information, to identify the most vulnerable areas. It then requires the production and publication of flood hazard and flood risk maps for those areas. Thirdly, and most importantly for those adversely affected by flooding, is the production and publication of these Plans which set out objectives and measures to manage the risks of flooding in a sustainable way. The Directive then requires these steps to be repeated on a six yearly cycle so that there is a process for refreshing our understanding of the risks and demonstrating where improvements to reduce such risks have been made.

A Preliminary Flood Risk Assessment was completed in 2011 and this identified twenty ‘Significant Flood Risk Areas’; Flood Hazard and Risk Maps for these areas were published in 2014. These two steps have considerably enhanced our understanding of flood risk and this information is already being used to educate those communities at greatest risk about their vulnerability. The focus on ‘Significant Flood Risk Areas’ has highlighted the need for works to enhance flood protection within a number of our principal towns and cities and this is currently shaping our construction programme and informing our bids for capital funding. Planning policies together with the detailed flood maps are key to taking informed decisions on land use planning. These Plans also outline improvements in the emergency response to flooding and how flood warning and informing engagement activities with those at known flood risk, will help communities become more resilient to flooding.

The process of developing these Flood Risk Management Plans has also been important. It has provided numerous opportunities for information on flood risk to be shared with others for discussion to take place on alternative methods of flood mitigation and for the wider impacts on the environment to be better understood.

These discussions have led to this very comprehensive document which will underpin the ongoing management of flood risk during a period when public expenditure is likely to be under continual downward pressure.

Extensive engagement with both the public and interested parties through a number of stakeholder groups and flood forums has also enabled those whose job it is to manage flood risk on a daily basis, to understand specific local needs. We have worked closely with the Department of Environment as the Flood Risk Management Plans need to have regard to the environmental objectives of the Water Framework Directive (2000/60/EC) so that both Plans achieve a wise use of resources.

Close working with colleagues in the Department for Regional Development has been required as we have developed a shared understanding of flood risk from different sources. This has also refined our collective understanding of the various roles and responsibilities in managing this risk. There is more work required in this area but we have started and the formation of the new Department for Infrastructure containing Rivers Agency, Transport NI and NI Water can only improve how we address and manage flood risk.

Importantly, we share two of our 3 river basins, North Western and Neagh Bann, with the Republic of Ireland and the Plans have been coordinated with the Office of Public Works (OPW) in the Republic of Ireland, through a structured programme of engagement.

We fully recognise the importance of the water environment in which we work and a Strategic Environment Assessment (SEA) and Habitats Regulatory Assessment (HRA) have been carried out on the Flood Risk Management Plans. This is a necessary requirement and the attached Environmental Report, SEA and HRA documents and Appendices set out the findings.

I hope that readers find these first Flood Risk Management Plans informative and I look forward to seeing the benefits of their implementation and further development over this initial 6-year Planning cycle.

David Porter
Chief Executive
Rivers Agency

Acknowledgments

Rivers Agency is grateful to all of the organisations that have supported, contributed to and helped develop these Flood Risk Management Plans. These include:

- Floods Directive Steering Group
- Flood Investment Planning Group (FIPG)
- Northern Ireland Water (NIW)
- DRD Transport NI
- DRD Water Policy Division
- DOE Northern Ireland Environment Agency

The Agency acknowledges the support and contribution made by members of the following consultative groups and organisations:

- Local Flood Forums
- Floods Directive Stakeholder Group
- Critical Infrastructure Stakeholder Group
- Respondents to the draft Flood Risk Management Plans

List of Abbreviations

AEP	Annual Exceedance Probability
ASSI	Area of Significant Scientific Interest
AOD	Above Ordnance Datum
BRA	Belfast Royal Academy
CPD	Central Procurement Directive
DARD	Department of Agriculture and Rural Development
DRD	Department for Regional Development
DOE	Department of Environment
FIPG	Flood Investment and Planning Group
FRMP	Flood Risk Management Plan
FRISM	Flood Risk Metric Tool
GIS	Geographical Information System
HEC-RAS	Hydrologic Engineering Center - River Analysis System
ICM	Integrated Catchment Model
IPPC	Integrated Pollution Prevention and Control
ISIS	Integrated Spectrographic Innovative Software
LFMA	Local Flood Management Area
LGD	Led Government Department
LiDAR	Light Detection and Ranging
LMA	Local Management Area
NIEA	Northern Ireland Environment Agency
NPV	Net Present Value
Nr	Number
PFRA	Preliminary Flood Risk Assessment
PPS 15	Planning Policy Statement 15
RBD	River Basin District
RCRG	Regional Community Resilience Group
RRA	Reservoir Risk Area
SAAR	Standard Annual Average Rainfall
SFRA	Significant Flood Risk Area
SOF	Standard of Protection
WFD	Water Framework Directive

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Section 1

1. Introduction

Flooding in Northern Ireland in recent years has had significant impacts on communities, businesses, infrastructure and the environment. With a changing climate, there could be more extremes in the weather which may lead to more frequent and severe flooding. The management of this flood risk is most effectively approached by identifying areas where potential significant flooding may occur and developing plans that contain a broad range of measures which will reduce this risk. These Flood Risk Management Plans (FRMPs) highlight the flood hazards and risks from rivers, the sea, surface water and reservoirs and set out how the relevant authorities will work together, and with communities, to reduce flood risk.

1.1 Flood Risk Management Plans

Flood Risk Management Plans (FRMPs) are a key requirement of the Floods Directive (*Directive 2007/60/EC on the assessment and management of flood risks*) and are aimed at reducing the potential adverse consequences of significant floods on human health, economic activity, cultural heritage and the environment. The FRMPs are coordinated at the River Basin District level to align with the Water Framework Directive's River Basin Management Plans and focus on managing the flood risk in the twenty Significant Flood Risk Areas (SFRAs) identified through the Preliminary Flood Risk Assessment (PFRA) for Northern Ireland that was completed by the Department in December 2011. In practice, the FRMPs provide the information and evidence necessary to support risk management decision making. The Plans also help promote greater awareness and understanding of the risks of flooding amongst the public, Government Departments, local authorities and other organizations. This creates the opportunity for a more proactive and co-operative approach to flood risk management.

The Floods Directive encourages the active involvement of interested parties in the production of the FRMPs. The steps taken to provide opportunities for the general public, statutory consultees and other interested parties to participate in the exchange of information or views in preparing the Plan, including through formal consultation on the draft Flood Risk Management Plan, is detailed in section 4.3.2.

The FRMPs address all aspects of flood risk management, focusing on prevention, protection and preparedness and take into account the characteristics of the particular river catchments in which the SFRAs are located. Key elements contained within the FRMPs include:

- A description of the objectives set for the management of flood risks.
- Identification of structural and non-structural measures for achieving those objectives within each SFRA and their priority.

- A summary of the information and consultation measures taken in connection with the preparation of the FRMPs and a description of the coordination process with the Republic of Ireland's Office of Public Works in relation to our shared International River Basin Districts.

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Section 2

2. Background/Context

2.1 Sources of flooding

Flooding is a natural process that cannot be entirely prevented. It can happen at any time and there is a consequent risk to people, property, infrastructure and the natural environment. There are four main sources of flooding:-

- **Flooding from rivers**, also known as fluvial flooding, occurs when the river channel capacity is exceeded and water is conveyed and stored within the natural flood plain of the river. Northern Ireland has one of the largest rates of run-off per unit area in the British Isles. Much of the country is low-lying and many of its rivers and streams have gentle gradients in their lower reaches. With lowland soils that are mostly clay rich and of low permeability there is the widespread potential for localised flooding.
- **Coastal flooding** occurs when inundation from the sea takes place along coastal areas and estuaries as a result of a combination of high tides, storm surge and wave action. Significant coastal flooding is a relatively infrequent occurrence in Northern Ireland. However coastal flooding is often characterised by flows that are more rapid and dynamic than for other sources of flooding and therefore the consequential risk to public safety and property is relatively high. Also, the long term economic and environmental damage is generally higher due the effects of saltwater inundation. In order to reflect the relatively high potential impacts from coastal flooding the Flood Hazard and Risk Maps on the [Flood Maps NI](#), webpage indicates the likelihood of coastal flooding occurring with a medium probability as a 200 year event, or an event with 0.5% chance of occurring in any one year.
- **Surface water**, also known as **pluvial flooding**, occurs as a result of rainfall which overwhelms natural or man-made drainage systems resulting in water flowing overland and ponding in depressions in the ground. It is a particular problem in urban areas, which are often dominated by non-permeable surfaces (i.e. roofs, roads and car-parks). As a consequence of the predicted increase in the frequency and intensity of extreme rainfall events urban areas are susceptible to an increasing risk of this type of flooding. It is estimated that in Northern Ireland, surface water flooding accounts for around 50% of recent flood events. Belfast has a long history of pluvial flooding and there are extensive reports of major flooding in the city as far back as the early 1900s. Responsibility for surface water flooding is cross departmental and is shared between DARD (Rivers Agency) and DRD (NI Water and Transport NI). The surface water flood map indicates that around 20,000 or 2.5% of the properties in Northern Ireland are sited in an area where the likelihood of flooding is greater

than or equal to a 1 in 200 year event and at a depth greater than 300mm deep. Many of these properties would also already be at risk of flooding from fluvial and/or coastal flooding.

- **Flooding from reservoirs.** Flooding from water impounding structures such as reservoirs, constitute a potential source of flood risk. Flooding of surrounding areas can occur if the reservoir either fails structurally or by an unusually high release of water, via spillways. Although the likelihood of flooding is low, the impact on communities is high due to the sudden release and rapid inundation of flood water. The Department is acutely aware of the importance of managing the risk of flooding from reservoirs. It is for this reason that the Department sought, and obtained, the agreement of the NI Executive to bring forward primary legislation to regulate reservoirs in Northern Ireland capable of holding 10,000m³ or more of water. The primary legislation, known as the Reservoirs Bill, was introduced in the Assembly in January 2014 and completed the legislative process on 24th June 2015. The Reservoirs Bill received Royal Assent on 24th July 2015 and has received the title Reservoirs Act (Northern Ireland) 2015. While the precise number will not be known until the registration process is completed, it is considered that approximately 130 reservoirs in Northern Ireland will be regulated by this Act. This will ensure that those responsible for managing and operating reservoirs capable of holding 10,000m³ cubic metres or more of water do so to industry standards thereby reducing the risk of flooding from an uncontrolled release of water due to dam failure. More information on the Reservoirs Bill is available at **Appendix F**.

It is generally accepted that we are likely to experience more regular flooding in the future. In urban areas, surface water flooding may increase due to the development of green spaces and the paving of gardens and driveways. Most urban drainage systems are designed to cope only with a 1 in 30yr (3.3% AEP) rainfall event. In addition, deforestation, together with agricultural drainage and changing land management practices has, as a consequence, increased conveyances and flows in watercourses and increased flood risk in urban areas lower down the catchment areas. Climate change predictions also suggest a rise in sea level, an increase in winter precipitation and an increase in the frequency and intensity of extreme rainfall events.

A fundamental reason why many people and property are at risk of flooding is that many towns and cities are located within functional flood plains. Historically, people chose to select locations for settlement close to rivers based on the need for drinking water, foul drainage, transport, commerce and fishing. The pressure for development within towns and cities that have a known flood risk has continued largely unabated until the introduction of relatively recent planning policies such as PPS 15, "Planning and Flood Risk".

Flood risk has historically been addressed through a reactive approach by providing local engineered solutions to solve repeated flooding. However, this approach, particularly on a larger scale can cause increased flooding elsewhere through the removal of valuable flood storage areas.

2.2 Flood Risk Information

Flood risk information is currently presented through the use of the Flood Risk and Hazard maps on the Flood Maps NI webpage. The extent of the floodplains for river and coastal flooding for the significant risk areas included in the Plans have been estimated by using predictive computer modelling techniques. Each of the floodplains highlighted in the maps is associated with a flood event which has a particular chance of occurring. For example, the area highlighted within the 1% AEP floodplain outline for rivers has a 1% or greater chance of flooding in any year. The Flood Hazard and Risk Maps, [Flood Maps NI](#), indicate 3 levels of flood risk:

- 1,000 year event - Flood Event with low likelihood of occurrence.
- 100 year event - Flood Event with medium likelihood of occurrence.
- 10 year event - Flood Event with high likelihood of occurrence.

It is estimated that around 5.5% or 46,000 properties in Northern Ireland are within either the 100 year fluvial floodplain or the 200 year coastal floodplain. One third of these properties currently have some level of protection.

The extent of surface water flooding is hard to predict, as small changes to the height of ground surfaces can markedly change the direction of surface water flows and it is difficult to predict with certainty the exact route along which surface water will flow and pond. It is for this reason, therefore, that the surface water maps are strategic in nature and use the 0.5% AEP or 1 in 200 year flood event to predict flooded areas.

2.3 Legislative Context

2.3.1 The Floods Directive

The FRMPs have been produced as a key requirement of *Directive 2007/60/EC on the assessment and management of flood risks* which was brought into force on 23 October 2007. This Directive known as the Floods Directive was introduced in response to recent catastrophic floods that occurred across Europe. It is estimated that over 213 major floods have occurred between 1998 and 2009 and that these have caused some 2016 deaths, displaced about half a million people and cost at least £52 billion in insured losses. The Floods Directive is designed to help Member States establish a framework for managing flood risk and aims to reduce the adverse consequences of flooding on human health, the environment, cultural heritage and economic activity.

In August 2009 the Department consulted with the public on its proposed legislation for implementing the Floods Directive in Northern Ireland and in November 2009 the legislation was introduced and is known as the Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.

The main requirements of the legislation and the dates for their completion are as follows:

- Carry out at Preliminary Flood Risk Assessment for each River Basin District and on the basis of this assessment identify areas for which potential significant flood risks exist or might be considered likely to occur. **22 Dec 2011**
- Prepare flood hazard maps and flood risk maps for each Significant Flood Risk Area (SFRA) identified, **22 Dec 2013**
- Consult the public on draft Flood Risk Management Plans that contain objectives and measures to reduce the flood risk within the SFRA and focus on prevention, protection and preparedness. **22 Dec 2014**
- Produce final Flood Risk Management Plans that take account of the views and representations received through the publication. **22 Dec 2015**

The Directive requires these deliverables to be reviewed, and if necessary updated, on a six yearly cycle.

2.3.2 The Water Framework Directive

The Water Framework Directive 2000/60/EC, which was introduced in 2000 has a number of links with the EU Floods Directive. Its primary focus, however, is improvement in water quality, rather than flooding. Its approach is based around the same River Basin Districts as the Floods Directive and this provides a number of opportunities for Government to dovetail the activities of both Directives.

2.3.2.1 Synergies between Flood Risk Management Plans and River Basin Management Plans

In December 2009, the Department of Environment (DoE), as competent authority for the EU Water Framework Directive (WFD), published the first River Basin Management Plans (RBMPs) for Northern Ireland under the WFD. DoE Northern Ireland Environment Agency (NIEA) was responsible for delivery of these first RBMPs in conjunction with a number of Northern Ireland Executive Departments including the Department of Agriculture and Rural Development (DARD). This recognised the important roles DARD and Rivers Agency had in managing aspects of the water environment and in implementing WFD requirements.

The RBMPs identified the condition of the water environment and set out objectives for the improvement, or the prevention of deterioration, of individual water bodies for the next three river basin planning cycles ending in 2015, 2021 and 2027. A Programme of Measures was published in the RBMPs setting out actions required to meet the objectives of improving the status of all water bodies. An interim update on the measures was published in 2012. The WFD requires that RBMPs are reviewed and updated every 6 years. Consequently the Department of Environment published its 2nd cycle draft Plans for public consultation between December 2014 and June 2015, aiming to publish new Plans by December 2015. In parallel with this timescale, DARD Rivers Agency published its first draft Flood Risk Management Plans (FRMPs) for public consultation again aiming to publish final FRMPs by December 2015.

The importance of coordination of FRMPs with the RBMPs is recognised by, and is a requirement of, the EU Floods Directive. To this end, the geographical coverage of the FRMPs in Northern Ireland is directly aligned with WFD's River Basin Districts of Neagh Bann, North Western and North Eastern, two of which (North Western and Neagh Bann) are International River Basins shared with the Republic of Ireland.

There is continued engagement between Rivers Agency, the competent authority for the Floods Directive and NIEA, the competent authority for the WFD through the interdepartmental Floods Directive Steering Group and the local Flood Forums. Rivers Agency is reciprocally engaged on the corresponding groups for WFD at interdepartmental, interagency and catchment stakeholder group level; this engagement has been on-going for many years and pre-dates the preparatory phase of the first cycle of RBMPs. In particular, the work of the Inter-agency group on River Restoration and Continuity (now the Catchment oversight Group) provides a sound basis for developing catchment based projects in future. This group aims to develop projects at the catchment and local level, through partnership working. In this way, both funding and benefits can be shared, providing better value for money, and developing the idea of adapting and delivering measures that have a number of drivers. Membership of the Catchment Oversight Group includes statutory fisheries groups, and DARD Countryside Management Division, thus providing excellent opportunities to develop partnership working and synergies in the long term.

The Flood Risk Management Plans focus primarily on areas which have been identified as being at potential significant flood risk. As these are predominately urban areas, any reduction in flooding as a result of implementing measures, may also reduce the risk of pollution incidents given the fact that flooding often results in pollution problems from oil tanks, sewerage overflows, etc. The development and implementation of measures proposed under the FRMPs also provides potential opportunities for more natural flood risk management e.g. improving floodplain storage, re-establishing connectivity, fish passage, sediment continuity, morphological and other enhancement of watercourses etc. during capital works. Collaborative working by personnel and stakeholders implementing the FRMPs could potentially both reduce flood risk and help to manage the adverse consequences that flooding has on the environment, human health, cultural

heritage and economic activity, thus satisfying the requirements of both Directives. Where the sites of such measures overlap with 'Natura 2000' sites (under the Habitats and Birds Directives), or are hydrologically connected, there are opportunities to seek benefits through liaison and information sharing.

Measures within the draft RBMPs highlight the need for multi-agency working at a catchment level to deliver benefits for water status, morphology, flooding and fisheries through a coordinated, joined up approach. Similarly, the FRMPs identify the need to achieve the objectives of the WFD in terms of good status through the Environmental Objectives as set out in Section 3.1 of the FRMPs. The coordination of river basin planning and flood risk management planning is therefore important in delivering the objectives and measures of both Directives.

2.3.3 Strategic Environmental Assessment Directive, (SEA)

The SEA Directive, 2001/42/EC provides a framework for assessing the effects that certain plans and programmes may have on the environment. The Floods Directive promotes coordination with the Water Framework Directive, particularly in relation to sustainable land use practices, the retention of natural flood storage areas and the potential adverse consequences of flooding on the environment. It was considered that the Flood Risk Management Plans, are "likely to have significant environmental effects" and therefore a SEA assessment should be included as part of the development of the Plans.

2.3.4 Habitats Regulatory Assessment, (HRA)

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, (the Habitats Directive), provides the framework for the legal protection for species and habitats of European importance. Although the Habitats Directive has a narrower focus than the SEA, it has been deemed prudent to undertake an appropriate assessment of the Flood Risk Management Plans in order to determine whether they will have a "likely significant effect" on sites designated at an international level (European Designated Site) for their nature conservation value.

2.4 Broader Legislative and Policy context

In addition to, but outside the direct legislative requirements of the Floods Directive, it should be noted that work is ongoing on a number of other policy/legislative initiatives which will, over time, contribute to the longer term management of flood risk in Northern Ireland. As well as legislative requirements, we need to continue to meet our long term obligations and challenges for managing flood risk by developing policies and strategies that can be delivered in the longer term. Some of these, amongst others, include:-

- **Long Term Water Strategy:** this is led by DRD and extends beyond flooding issues. However it highlights the need to manage flood risk in relation to integrated drainage systems, including funding and delivery arrangements.
- **Floods Bill:** work needs to commence on a Floods Bill to enable the effective delivery of all components of Flood Risk Management. This will add clarity to organisational roles and responsibility and encompass broader Flood Risk Management approaches.
- **Reservoirs Act:** as indicated in the Preliminary Flood Risk Assessment and Identification of Areas of Potential Significant Flood Risk report, legislation to regulate reservoirs was required. This legislation was enacted in July 2015 as the Reservoirs Act (Northern Ireland) 2015. The Act is similar to that which is in place elsewhere in the UK and it is proposed to commence the implementation of the Act in 2016. The Act places a legal responsibility on the managers of controlled reservoirs (i.e. 10,000 cubic meters or more capacity above the natural level of the surrounding land) to effectively manage controlled reservoirs and therefore any associated flood risk. Detailed inundation maps for each controlled reservoir will be published by the Department in 2016. These maps show the areas that could be flooded if controlled reservoirs were to fail and release the water they hold. The maps will be used by reservoir managers, government bodies, organisations and others dealing with flood risk from reservoirs, particularly those engaged in planning and emergency response.
- **Water Bill:** DRD is seeking to introduce a Water Bill to improve how water and sewerage services are delivered. One strand of this is to consider reducing the volume of surface water entering the public combined sewerage system by placing restrictions on the right to connect to public sewers and promoting the use of Sustainable urban Drainage Systems (SuDS)
- **Northern Ireland Climate Change Adaptation Programme:** As a result of the first Northern Ireland Climate Change Adaptation Programme, published early in 2014, a range of adaptation activities and actions has been identified for each Government Department with a role in flood risk management.
- **Building Regulations** Engagement with Department of Finance and Personal (DFP) is necessary for the inclusion in the Building Regulations of flood resistance/resilience construction techniques for those properties within flood risk areas.
- **Countryside Management Strategy** Opportunities need to be identified to build on the links between sustainable agricultural land use and managing flood risk. A catchment based approach,

and practical linkages will be sought over the life cycle of these Plans. Other opportunities in relation to fishing measures and forestation will be explored as appropriate.

The use of Flood maps NI will be essential in determining areas of focus in terms of conveyance routes and areas with the potential to retain flood water.

The use of informed Agricultural and Forestry land use practice will also contribute to reduced run off and sediment control. Opportunities throughout the cycle of this plan will be explored to embrace this approach.

2.4.1 Stormwater Management and Sustainable Drainage Systems (SuDS)

The spread of urbanisation has increased the risk of flash flooding occurring after heavy downpours. Such flooding is becoming more frequent, with recent notable events occurring during 2007 and 2012 in Belfast and other towns. As areas of vegetation (green land) are replaced by impermeable concrete, bituminous macadam, roofed or paved areas (a process known as ‘urban creep’) the land loses its ability to absorb rainwater. In some instances, rainfall may be directed into combined sewers, often overloading them resulting in out-of-sewer flooding and pollution.

The probability of surface water flooding can be reduced by the use of sustainable drainage systems (SuDS) and surface water management, each of which is described below.

SuDS are systems designed to reduce the quantity and / or rate of runoff into drainage systems and watercourses; there are two broad types of SuDS:

- **Hard SuDS:** attenuation tanks, enlarged pipes and flow control devices within chambers
- **Soft SuDS:** systems that are open to the atmosphere. Examples of this type of system are:
 - retention basins (shallow landscape depressions that are dry most of the time when it's not raining);
 - rain-gardens (shallow landscape depressions with shrub or herbaceous planting);
 - swales (shallow normally-dry, wide-based ditches);
 - filter drains (gravel filled trench drain);
 - bio-retention basins (shallow depressions with gravel and/or sand filtration layers beneath the growing medium);
 - reed beds and other wetland habitats that collect, store, and filter dirty water along with providing a habitat for wildlife. Sometimes when soft SuDS contain vegetation as a key working element they are called ‘vegetative’ SuDS.

Soft SuDS is preferred as it can provide a wide range of other benefits, including: aquifer recharge, provision of visually attractive amenity areas, provision of habitat for flora and fauna, and the removal of silt and pollutants carried by the stormwater before discharge.

SuDS can be used in a number of locations, such as:

- source control – which is the control of water before it enters any drainage pipes. For example water butts, rain water harvesting, permeable paving, small buried attenuation tanks (stormcells) and rain gardens.
- site control – which is the control of water before it leaves the boundary of the development site, for example filter strips, permeable paving (infiltration), permeable paving (retention), infiltration trenches, swales and geocellular systems.
- system control – which is the control of water through the provision of systems that mimic the natural process such as ponds and lagoons, before discharge to streams and water courses.

The cost of building SuDS may be similar to conventional drainage whilst delivering a range of wider environmental benefits including the management of flood risk.

Surface Water Management

Surface water management is the use of other options to manage surface water. Techniques include the removal of surface water from combined sewers (which is called ‘storm separation’), and the creation of preferential flood pathways to direct flows away from areas of high consequence when the capacity of the infrastructure has been exceeded (which is called ‘design for exceedance’).

Policy Development

Stormwater Management options are endorsed under the Department for Regional Development’s (DRD’s) draft strategy entitled ‘Sustainable Water - A Long-Term Water Strategy for Northern Ireland (2014-2039)’ with proposed measures to make SuDS the preferred drainage option, clarify long term maintenance issues and establish arrangements to deliver SuDS policy in new developments. To support implementation of this, DRD is currently developing ‘Guidance for Implementation of Storm Water Separation’ for use by NI Water and Transport NI. DRD believes that actively managing surface water and making provision for flood storage in urban areas is key to helping reduce the risk of urban flooding and the risk of pollution of rivers and groundwater sources. In addition, DRD’s proposed Water Bill will require the consideration of SuDS for both residential and non-residential development.

A cross-Departmental Stormwater Management Group (SMG) was set up in April 2012 to examine a range of approaches to develop more integrated Stormwater Management. The SMG is co-chaired by NI Environment Agency and DRD Water Policy & Shareholder Division. Membership includes, NI Water,

Transport NI, DARD Rivers Agency, DoE Planning Division and DoE Environmental Policy. The SMG has been working on developing policy and increasing awareness to promote Stormwater Management and the use of Sustainable Drainage in Northern Ireland. This includes the development of a NI SuDS Planning Process Protocol which will set out how a number of progressive changes in planning and development control processes could greatly assist the wider implementation of SuDS. One of the outcomes flowing from a pilot project developed by the SMG in Ballyclare, is now influencing a stormwater separation strategy for Greater Belfast, in order to mitigate diffuse pollution, reduce 'out of sewer', Combined Storm Overflow (CSO) events and reduce flood risk. The SMG is currently considering how to promote the more widespread use of SuDS during the forthcoming Flood Risk Management Plan period and will be engaging with planners and local government to ensure that opportunities for its promotion are maximised following the reform of local government and planning and the forthcoming Departmental re-organisation.

Planning for the integration of SuDS and Natural Flood Risk Management techniques on a catchment scale, will be taken forward during this Flood Risk Management Plan cycle (2015-21) with a view to increasing the pace of implementation in the next Flood Risk Management Plan cycle.

2.4.2 Natural Flood Management Measures

The traditional approach to flood risk has been to protect people and property by building flood defences, usually close to the locations at risk. As the construction of flood defences can be very expensive and may defend only specific localised areas, there is widespread interest in examining more closely, the potential for changing land management practices and other non-structural measures to deliver flood risk management benefits. This approach, often referred to as Natural Flood Management (NFM), is referenced within the EU Water Framework Directive and the EU Floods Directive.

NFM is most often defined as 'Working with or restoring natural flooding processes with the aim of reducing flood risk and delivering other benefits.' NFM aims to reduce the downstream maximum water height of a flood (the flood peak) and/or delay the arrival of the flood peak which could increase the time available for communities to prepare for possible flooding. It also aims to reduce the amount of water reaching the river channel at a range of stages within the catchment. These aims are achieved by storing and restricting the progress of water throughout the catchment by the introduction of a range of measures including for example:

1. Restoring natural catchment 'sponges' such as bogs
2. Creating new wetland habitats
3. Planting native forests in upland areas of catchments
4. Planting native woodlands in buffer strips
5. Recreating meanders and placing obstructions in watercourses
6. Adopting agricultural practices that reduce soil compaction.

Within the last decade or so, there have been a large number of research projects and studies undertaken within the UK and beyond to examine the effectiveness and potential benefits of NFM. The majority of this research has focused on small scale catchments.

The effects of NFM techniques at a large catchment scale have proven difficult to establish because they are the result of aggregating many local scale effects, which are of themselves hard to quantify and are also dependent on the individual and often very different physical characteristics of catchments. This does not necessarily mean that there are no large scale effects or changes but simply they are often difficult to isolate and measure.

Whilst NFM measures by themselves may not provide a reliable and measurable method of managing more extreme flood risk events, they may however have a role in managing the 'unknown' aspects of flooding likely to arise from climate change. NFM measures may also have other tangible benefits, for example, biodiversity, reduction of soil loss, recreational opportunities and landscape benefits. They should be considered for their overall benefits and not for flood risk management alone. This range of benefits will require partnership involvement and a range of potential funding streams.

In September 2015 the Department hosted Northern Ireland's first workshop aimed at Planning for Natural Flood Management. The workshop, run as part of the Blue Green Cities project, provided a forum for a range of regulators and authorities within Northern Ireland, to get an appreciation of the range of potential measures which are available to contribute towards natural flood management. Whilst acknowledging that the measures alone are unlikely to entirely solve significant flooding issues, it was acknowledged they have a tangible role to play in managing any potential increase in flood risk, as well as providing other benefits to water quality and biodiversity.

NFM measures may offer potential for flow attenuation to improve flood warning times and also for mitigating increasing flood risks due to climate change. In Northern Ireland, the Department will build on the foundation of the recent Blue Green Cities workshop and look to develop studies (catchment planning) and projects through a partnership approach.

There is no doubt that NFM measures provide important wider benefits including water quality improvements, carbon sequestration, habitat restoration, biodiversity and recreation, among others. As things currently stand, much of the evidence suggests that the catchment scale flood risk reduction from NFM may be modest compared with the potential environmental and recreational benefits. Therefore, until we have evidence to the contrary, the key driver for land use changes may be to secure environmental benefits, and the changes should be deployed within priority catchments where the greatest benefits can be achieved. In selecting and prioritising such catchments, flood risk should be a factor but only as a part of a multi-criteria

decision analysis that takes proper account of the relative importance of flood mitigation benefits in conjunction with the more significant wider environmental and recreational benefits. Due to the potential range benefits of such measures, it is likely that this area of work will be developed on an inter-agency basis, to share costs and benefits. Currently, there is an inter-departmental study underway, based on the Moyola river catchment in Co Londonderry, which will identify key players and issues.

In relation to the implementation of NFM for flood risk management, it should be recognised that such measures would involve changes to land management practices which may impact on landowners in parts of catchments which may be unaffected by flooding problems. This poses a challenge to incentivise landowners potentially in the upstream, rural parts of catchments, to change how they manage their land in order to benefit those at flood risk in the lower parts of a catchment. For this reason, it is necessary to look at multiple benefits and partnership working/funding for the implementation of such measures - these may be better considered under the heading, 'catchment management' rather than 'Natural Flood Management' as this better reflects the more holistic nature of the benefits. NFM measures also take considerable time to implement e.g. planting out new forest or undertaking regeneration of peat bog to create the desired attenuation, all takes time. The extended timescales for implementing NFM measures may not be acceptable to communities at flood risk. Therefore, while NFM measures may be introduced over time to mitigate against other gradual changes which may occur in a catchment, they should not be seen as an immediate solution to an urgent flooding problem.

It is acknowledged that there are many stakeholders promoting the widespread use of NFM, research to date indicates that NFM measures may complement, but are unlikely to replace, traditionally engineered solutions such as hard defences and built flood storage which have more predictable and reliable outcomes. Consequently, the Department sees the development of NFM measures at a catchment level, as an inter-departmental process which is aimed to deliver multi-benefits and not just flood risk management. The Department also sees NFM measures as part of an overall package of flood risk management tools which will include structural and non-structural measures.

The Department will consider the use of NFM measures where appropriate in its options appraisals for the flood studies that it undertakes through its capital works programme. These may include solutions such as upstream flood storage, removal of existing flood banks to reconnect rivers with their natural flood plains, removing (*daylighting*) existing culverts to restore natural river channels and the creation of wider and more environmentally sensitive two-stage channels, as opportunities may arise. The Department will also build on the success of the Blue green Cities workshop, and will seek to work with other departments and groups to examine catchment management measures which include those which are considered to have a flood risk management benefit.

Section 3

3. Objectives and Measures for Managing Flood Risk

3.1 The Flood Risk Management Plan Objectives

This Flood Risk Management Plan contains a number of objectives for the management of flood risk from all sources of flooding. The Objectives set out what needs to be achieved and, in accordance with the requirements of the Floods Directive; the Plan should give consideration to:

- Reducing the likelihood of flooding; and,
- Reducing the adverse consequences of flooding for human health, economic activity and the environment including cultural heritage.

The objectives set, in relation to each area of impact are:

Economic Activity

- To reduce the cost of potential future flood damages to properties and infrastructure;
- To reduce the economic costs caused by the disruption to essential infrastructure and services; and,
- To optimise the economic return on flood risk management investment.

Human Health and Social

- To reduce the risk to life, health and wellbeing.
- To increase awareness and understanding of flooding and its adverse consequences and improve community resilience.
- To reduce the impact on people caused by the disruption to essential infrastructure and services.
- To improve recreation and public amenities.

Environmental

- To consider the impact of Climate Change across all areas of impact;
- To support the objectives of the Water Framework Directive and contribute to the achievement of good ecological potential/status for water bodies;
- To protect and enhance the natural environment.

3.2 The Flood Risk Management Plan - Measures

The Flood Risk Management Plan identifies Measures that are the specific actions which will deliver the Flood Risk Management Plan Objectives. In setting the Measures, the Floods Directive requires that these Flood Risk Management Plans should give consideration to:

- **Prevention** of increased flood risk through appropriate land use planning.
- **Protection** of communities and the environment by provision of schemes and approaches to reduce the likelihood of flooding.
- **Preparedness** arrangements to improve dealing with flooding when it occurs.

A table detailing the links between the Objectives and Measures is included at **Appendix H**.

In determining the proposed measures these Flood Risk Management Plans must have regard to:

- the Preliminary Flood Risk Assessment;
- the conclusions that can be drawn from the Flood Hazard Maps and Flood Risk Maps;
- the environmental objectives of the Water Framework Directive;
- the cost and benefits of the various options for managing flood risk;
- the opportunity for natural flood plain management; and
- the impacts of Climate Change.

The measures adopted are:-

3.2.1 Prevention

The Regional Development Strategy provides the strategic planning framework for sustainable development throughout Northern Ireland. It is therefore important that land-use planning decisions do not increase flood risk. Planning Policy Statement, PPS 15, "Planning and Flood Risk", which has been revised recently, adopts a precautionary approach to development with the primary aim of preventing future development that may be at risk of flooding or that may increase the risk of flooding elsewhere. The policy takes account of climate change and emerging information relating to flood risk through the implementation of the EU Floods Directive. The new "Flood Maps NI" are therefore an important tool in identifying and assessing flood risk from the four main sources of flooding, at both the Development planning and Development application stages.

The key approaches in terms of Prevention are:-

Keep new development outside Flood Risk Areas

- Inform the development planning process to ensure, as far as possible, that new zonings within local development plans are located outside flood risk areas.
- Input to the development control process to ensure, as far as possible, that individual applications are located outside flood risk areas.

Ensure new development within Flood Risk areas is suitably constructed

- In accordance with PPS 15 ensure that any development which has to be located, “**by exception**”, in flood risk areas is built in the appropriate manner with adequate flood resistance/resilience measures commensurate with the flood risk to the development and that the development does not cause increased flood risk elsewhere.
- Ensure that all proposed development applications within flood risk areas are accompanied by a flood risk or drainage assessment.

3.2.2 Protection

Flood protection is required where existing property is already located within flood risk areas. Structural measures, such as flood defence walls /embankments or culvert diversion channels are utilised where there is an economic benefit to society that will allow the works to be financed. Environmental measures can also be factored into the scheme, as appropriate.

The key approaches in terms of Protection are:-

Maintenance of the Existing Drainage and Flood Defence Network

- Continue to inspect and maintain designated watercourses and grilles as appropriate;
- Continue to regularly inspect the condition of all drainage and flood defence assets;
- Continue to implement a prioritised programme of works for the maintenance of all drainage and flood defence assets; and,
- Continue to implement a prioritised programme of maintenance of public sewer and drainage infrastructure.

New Flood Alleviation Schemes

- Continue to carry out feasibility studies to identify cost beneficial flood alleviation schemes in relation to property and communities at flood risk;
- Continue to implement a prioritised programme of flood alleviation schemes;
- Continue to implement a prioritised programme of works for integrated surface water drainage schemes; and,
- Continue to implement a prioritised programme of works to separate surface water systems from combined sewer systems.

Catchment Based Management

- Create opportunities to work with others, through partnership arrangements, to deliver sustainable flood risk management measures at a catchment level. These measures potentially include reduction in run-off through wetland creation and tree planting. Fishery enhancement works and improvements in water quality by lengthening flow paths and filtration techniques could also be considered as appropriate. These measures are likely to have a number of benefits that whilst unquantifiable, are still significant.



Photo 3.2.2 – River Bush Fishery Enhancement Measures

Surface Water Management

- Promote the use of SuDS in all new development to ensure that the post development runoff is no greater than the pre development run off rate. Legislation which endorses the use of SuDS, as noted earlier, is essential in underpinning this approach. Design for exceedance needs also to be considered.

3.2.3. Preparedness

It is not possible to prevent or protect against all flooding. Even where flood defences exist, in an extreme event, it is possible that these could be over-topped and flooding could still occur. Consequently there is a need to be prepared for flooding. There will also be situations where a flood protection scheme is not economically viable or not yet in place and therefore it is critical that preparatory activity is undertaken.

The provision of an effective emergency response from Government is a key feature of Preparedness. It needs to be recognised that communities at risk also have a key role in working with Government in order to be better prepared to deal with flooding when it occurs.

The key approaches in terms of preparedness are:-

Flood Emergency Response

- Government Departments, Councils and the emergency services need to continue to maximize the effectiveness of a coordinated emergency response;
- Responders need to continue to share Information and resources in order to streamline the approach to emergency response;
- Emergency response plans need to be used to bring clarity and focus to emergency response.

Exercising

- Regular emergency planning exercises need to continue as part of responders' work programmes to facilitate learning and provide opportunities to test capacity and capability. Roles and responsibilities need to be clearly established and understood by all responders.

Lead Government Department - for the Coordination of Flooding Emergencies

- DARD must ensure that its role as Lead Government Department (LGD) is clearly understood, both internally and among other key responder organisations;
- DARD will continue to undertake such activity as is necessary to ensure that this role adds value to emergency response. This will include the development of emergency planning events,

coordination of communications and provision of technical expertise to inform the overall emergency response from Government Departments and other organisations.

Civil Contingencies Multi-Agency Preparedness Structures with a role in Flooding Emergencies can be found at **Appendix G**.

Flood Warning and informing

Rivers Agency will continue to monitor and refine the approach to the provision of flood warning and informing, which has been developed in response to the PEDU report of 2012. Northern Ireland does not have a flood forecasting centre, unlike the rest of the UK. The reason for this is that catchments here are smaller and any warning time would be much shorter. This would greatly reduce the benefit of such a centre in Northern Ireland. However there are improvements in this area that have been made.

In addition, Rivers Agency currently operates an internet web-based system which is able to provide government users and the general public with access to water level information. The link to this 'Netview' website is below:-

http://netview.ott.com/Rivers_Agency_Hydrometric_Network/

This Netview link will enable any user to gain access to water level information at over 30 locations in the Rivers Agency network of hydrometric and text alert stations.

At an early stage in this cycle of Flood Risk Management Plans, Rivers Agency intends to provide improved hydrometric information on-line to the general public through a new web site. This will include better information on river and lough levels as well as information on river flows.

The Agency considers that by making water level and river flow information more widely available, public users who are at risk of flooding, may be able to access this information easily to be better informed about river conditions during periods of heavy rainfall. This will help them decide if they should take action to be prepared for flooding.

Further details of Flood Warning proposals suitable for Northern Ireland are included at **Appendix D**.

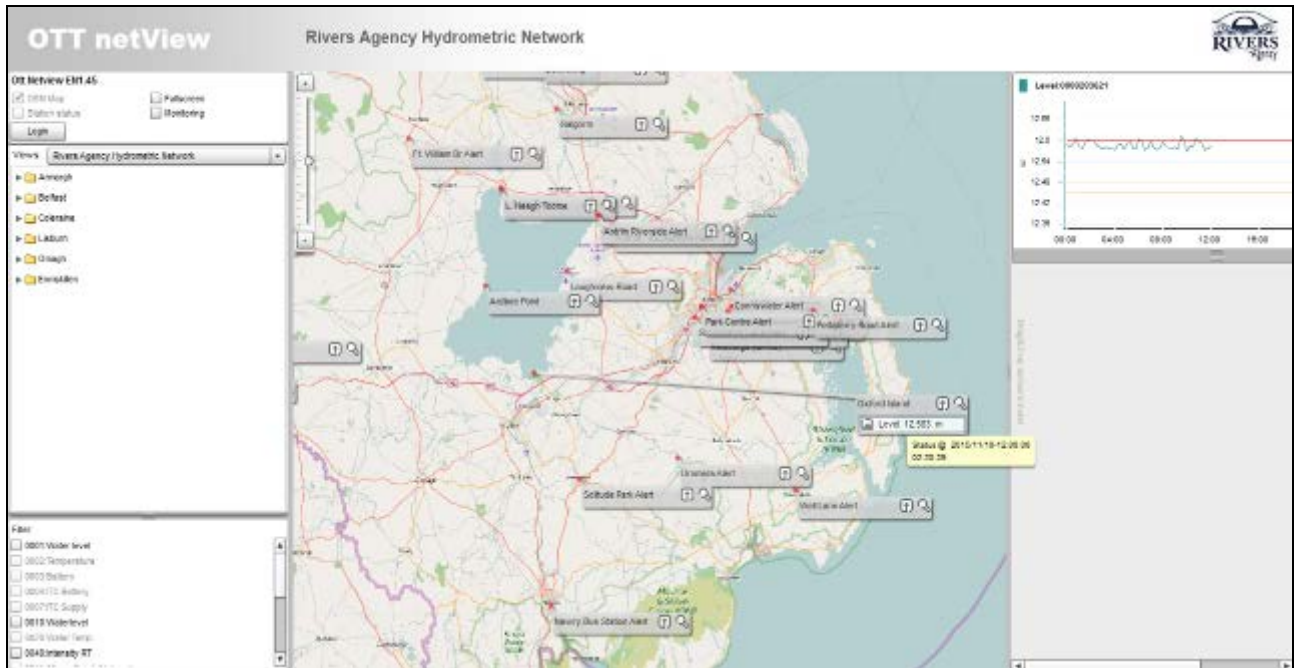


Figure 3.2.3 – Rivers Agency web page for water level information (Netview)



Photo 3.2.3 – Rivers Agency Text Alert Station

Community Engagement – Informing and Building Resilience

- Rivers Agency will continue to work with the other Drainage Agencies, the Emergency Services, Local Government, NIHE, Red Cross, Consumer Council, Met Office, etc, to develop and establish a consistent approach to flood warning and informing activities across Northern Ireland.
- The Regional Community Resilience Group (RCRG), which was established in 2013, will continue to co-ordinate self-help activities, (Through the auspices of this group the co-ordination of self help activities is facilitated. This includes the pre-deployment of sandbags at areas known to flood and the use where appropriate of river level text alerts).
- During this first Planning cycle, Rivers Agency intends to install more Text Alert stations on some watercourses adjacent to communities at known flood risk. This forms a part of the Agency's plans to improve Community Resilience under the remit of the Regional Community Resilience Group and to extend the resilience programme to 20 new communities during the first cycle of Plans. As well as providing text alerts to communities at risk of flooding and to emergency responders, information generated by the new alert stations will be linked to the proposed new on-line website

Further details on the role of the RCRG can be found at **Appendix E**.

Flooding Emergency Communications

Rivers Agency will:-

- Continue to engage with communities to facilitate the informing aspect of 'Flood Warning and Informing' activities.
- Continue to update and improve flood risk information on Flood Maps (NI).
- Continue to improve information on flooding on the NI Direct Website.
- Continue to work with NI Direct in the development of the Flooding Incident Line (FIL).
- Continue to consult and hold flood forums with stakeholders and others to make them aware of their role and responsibilities in managing flood risk.
- Seek to issue timely media messages to inform the Public of significant flooding events.

Individual Property Protection

Within the first year of the Flood Risk Management Plans, the Department proposes to commence the first Grant Scheme for Property Level Flood Protection in Northern Ireland. Funding has been made available for this Scheme which will be piloted over a period of 2 to 3 years. The Scheme is supported by a Business Case which has received approval from the Department of Finance & Personnel N.I. Funding for the Scheme over the 3 financial years spanning 2015-18, will be approximately £950k.

The Scheme which is entitled the 'Homeowner Flood Protection Grant Scheme (Northern Ireland)' is a government scheme being operated by the Department. It is designed to encourage the owners of residential properties that have flooded before and/or are located within known flood prone areas, to modify their properties through the installation of Property Flood Protection products, to make them more resistant to flooding. The Grant Scheme is specifically aimed at residential properties that have flooded internally in the past and which continue to be exposed to frequent flooding. Tenants of rental properties are not eligible to apply.

The Grant Scheme will cover 90% up to a maximum of £10,000, of the total survey and estimated installation costs. Homeowners, who successfully apply, will therefore be required to make a contribution of 10%, plus any additional cost that may be incurred above £10,000. This contribution must be paid before any installation work will commence. The cost of installing a package of flood protection measures varies from property to property but is typically £3,500 to £7,500 and therefore, the Homeowner contribution is likely to be between £350 and £750. The Grant will be paid directly to the Scheme's appointed building surveyor and building contractor so no monies will be paid directly to the Homeowner.

For each successful application, a building surveyor will be appointed to conduct a water entry survey of the Homeowners' property. The building surveyor will then develop a design for appropriate property flood protection measures. Once the Homeowner is content with the design and formally agrees this with the Department, an experienced building contractor will install the flood protection measures in accordance with the surveyor's agreed design and specifications.

On completion of the work to a property, it will be tested, in the presence of the Homeowner, to check its resistance to flood water. The Homeowner will also be provided with an instruction pack on how to maintain any equipment supplied and shown how to fit it in advance of threatened flooding. Should a Homeowner move house, the equipment installed must remain with the property.

While this type of installation is successful in reducing flood damage to individual properties, there is still no guarantee that it will exclude all flood water.

Information on the Homeowner Flood Protection Grant Scheme is available from:-

The Flood Protection Grant Scheme Manager
DARD Rivers Agency
Hydebank
4 Hospital Road
Belfast
BT8 8JP

Flood Recovery, Welfare and Insurance Issues

In the aftermath of flooding, which extends well beyond the actual damage to property, Rivers Agency with others will-

- Continue to carry out and contribute to post flood investigations to gather information and improve knowledge and action on future flood events.
- Continue to report significant flood events to the European Commission as required by the Floods Directive.
- Continue to work with Councils and local communities at risk of flooding in providing advice and information to aid recovery after a flood event.
- Continue to engage and work with voluntary section organisations such as the Red Cross in providing Welfare Support.
- Continue to work with the insurance industry to assist them in introducing FloodRe to NI to help address long term flood insurance affordability issues.

FloodRe

The Flood Re scheme is a not-for-profit flood reinsurance fund, owned and managed by the insurance industry, and established to ensure that those domestic properties in the UK at the highest risk of flooding can receive affordable insurance cover for the flood element of their household property insurance.

Reinsurance is a way for insurers themselves to insure against large scale losses with other insurers. Insurers sell policies to their customers in the usual way, but then may pass the risk carried by those policies to a reinsurance company, or reinsurance vehicle like Flood Re, where those risks are pooled into a fund which pays out to the insurer if claims are made. The contractual responsibility for paying out to the customers if a claim is made still rests with the original insurer but they have their own back-up from the reinsurance pool which they can claim against. This helps insurers take on more risk as the consequences of large claims are more widely spread.

In 2011, the Insurance industry formally agreed to Flood Re as a long-term flood insurance solution; an outline agreement between the Government in GB and the insurance industry was reached in June 2013. In GB, subsequent Water Bill legislation and regulation has paved the way for 'Flood Re' to be designated as the scheme administrator of the Flood Re scheme.

The Flood Re website contains more information on the scheme and can be accessed via the following link: www.floodre.co.uk/

Northern Ireland Climate Change Adaptation Programme

Northern Ireland's commitment to address the impact of climate change is set out in the UK Climate Change Act 2008 which requires Northern Ireland government departments to develop a climate change adaptation programme to address the findings identified in the Climate Change Risk Assessment (CCRA) for Northern Ireland, which was published in January 2012 as part of the overall UK CCRA.

http://www.doeni.gov.uk/climate_change_risk_assessment_ni_2012.pdf).

The first Northern Ireland Climate Change Adaptation Programme (Adaptation Programme) was published by Department of the Environment NI in January 2014.

http://www.doeni.gov.uk/index/protect_the_environment/climate_change/climate_change_adaptation_programme.htm).

It contains a number of actions and activities committed to by all government departments under 4 Priority areas:

- Water,
- Flooding,
- Natural Environment and
- Agriculture & Forestry,

to address the identified risks in the CCRA. Progress on the high level actions and key activities is being reported to the Executive through a Cross Departmental Working Group (CDWG) Annual Progress Report. Following the publication of a second UK CCRA (due in January 2017), a second NI Adaptation Programme will be laid before the Northern Ireland Assembly which will also contain an assessment of the progress made towards implementing the objectives, proposals and policies set out in the first Adaptation Programme.

Flooding

The CCRA for NI identifies flooding as potentially one of the most significant and urgent risks. A range of activities set out in the NICCAP to address these risks, include the preparation of flood hazard maps & flood risk maps for potential Significant Flood Risk Areas and the development of Flood Risk Management Plans. These are activities for which the Department (through Rivers Agency) is responsible and which are designed to mitigate identified flood risks.

Section 4

4. Floods Directive Work to Date

This section of the document provides details of the Flood Directive's key deliverables and actions that were completed in the lead up to the preparation of the FRMPs. It also describes the main activities taken to involve interested parties, including the public in the preparation of the FRMPs and the role of the groups and organisations that have influenced its development and will contribute to its implementation.

4.1 Preliminary Flood Risk Assessment (completed 22 December 2012)

The Floods Directive required each Member State to undertake a Preliminary Flood Risk Assessment (PFRA) for its respective territory by 22 December 2011. The PFRA is a high level screening exercise that uses available or readily derivable information, to assess the adverse consequences of potential future flooding for human health, economic activity, the environment and cultural heritage. The assessment covered all of the main flood sources, which for Northern Ireland has been determined to be rivers, the sea, surface water and reservoirs.

The principle objective of the PFRA was to identify those geographical areas where 'potential significant flood risk exists or might be likely to occur'. The identification of these areas, known as Significant Flood Risk Areas (SFRAs), is a critical milestone in the implementation of the Floods Directive as these are the only areas for which the later requirements to produce detailed flood risk maps and flood risk management plans apply.

The assessment of potential future flood risk required a detailed understanding of the flood mechanisms for each source of flooding, the magnitude and statistical probability of flood events and the scale of the potential adverse consequences arising from these events. The extent of the potential future flood hazards from rivers, sea and surface water for a range of return periods was predicted using digital flood models developed by Rivers Agency. To support the process a GIS application was developed to combine the various flood outlines produced for each of the flood sources with a wide range of readily available receptor datasets. Using this application, a broad range of 'Flood Risk Indicators' were generated within 1km grid squares covering the whole of the Province. These Flood Risk Indicators were used in whole, or in part, to assess the potential adverse consequences on human health, economic activity, cultural heritage and the environment. By computing the Flood Risk Indicators at this spatial scale it was possible to compare and contrast the flood risk across the whole of the province at a broad community scale. Examples of Flood Risk Indicators used in the assessment include the:

- Number of different property types flooded;
- Economic damage arising from flood damage;
- Number of people at risk;
- Vulnerability of people at risk;
- Number of key infrastructure assets flooded;
- Areas of designated environmental sites flooded;
- Number of Industrial Pollution Prevention Control Sites flooded, and
- Lengths of roads/railways flooded.

Full details of the PFRA for Northern Ireland can be found in Rivers Agency's report 'Preliminary Flood Risk Assessment and Methodology for the Identification of Significant Flood Risk (December 2011)' and is available on its website.

The Preliminary Flood Risk Assessment and Identification of Areas of Potential Significant Flood Risk Report (Dec 2011), indicated that management of the risk of flooding associated with reservoirs would be addressed through the introduction of legislation to regulate reservoir safety. This legislation, the Reservoirs Act (Northern Ireland) 2015, was enacted in July 2015 and is similar to legislation that is in place elsewhere in the UK. It is proposed to commence the implementation of the Act in 2016. The Act places a legal responsibility on the managers of controlled reservoirs (i.e. those with a capacity to hold 10,000m³ or more above the natural level of the surrounding land) to effectively manage them to reduce any associated flood risk. Detailed flood maps that illustrate the potential areas that could be inundated from an uncontrolled release of water from for each controlled reservoir will be published by the Department in 2016. These maps show the areas that could be flooded if controlled reservoirs were to fail and release the water they hold. The maps will be used by reservoir managers, government bodies, organisations and others dealing with flood risk from reservoirs, particularly those engaged in emergency planning.

4.1.2 Significant Flood Risk Areas (SFRA)

Based on the PFRA, the Department determined that there are 20 SFRA within Northern Ireland and the details of these SFRA have been reported to the European Commission. The names of the SFRA along with the relevant the River Basin District in which they are located are listed below in Table 4.1 and their geographical extents are illustrated in Map 4.1.

The stacked bar chart in Figure 4.1 uses the combined flood risk index to illustrates the variability in the level of flood risk between the 20 SFRA and the degree to which each of the flood sources contributes to the overall flood risk in an area.

4.1.3 Areas for Further Study (AFS)

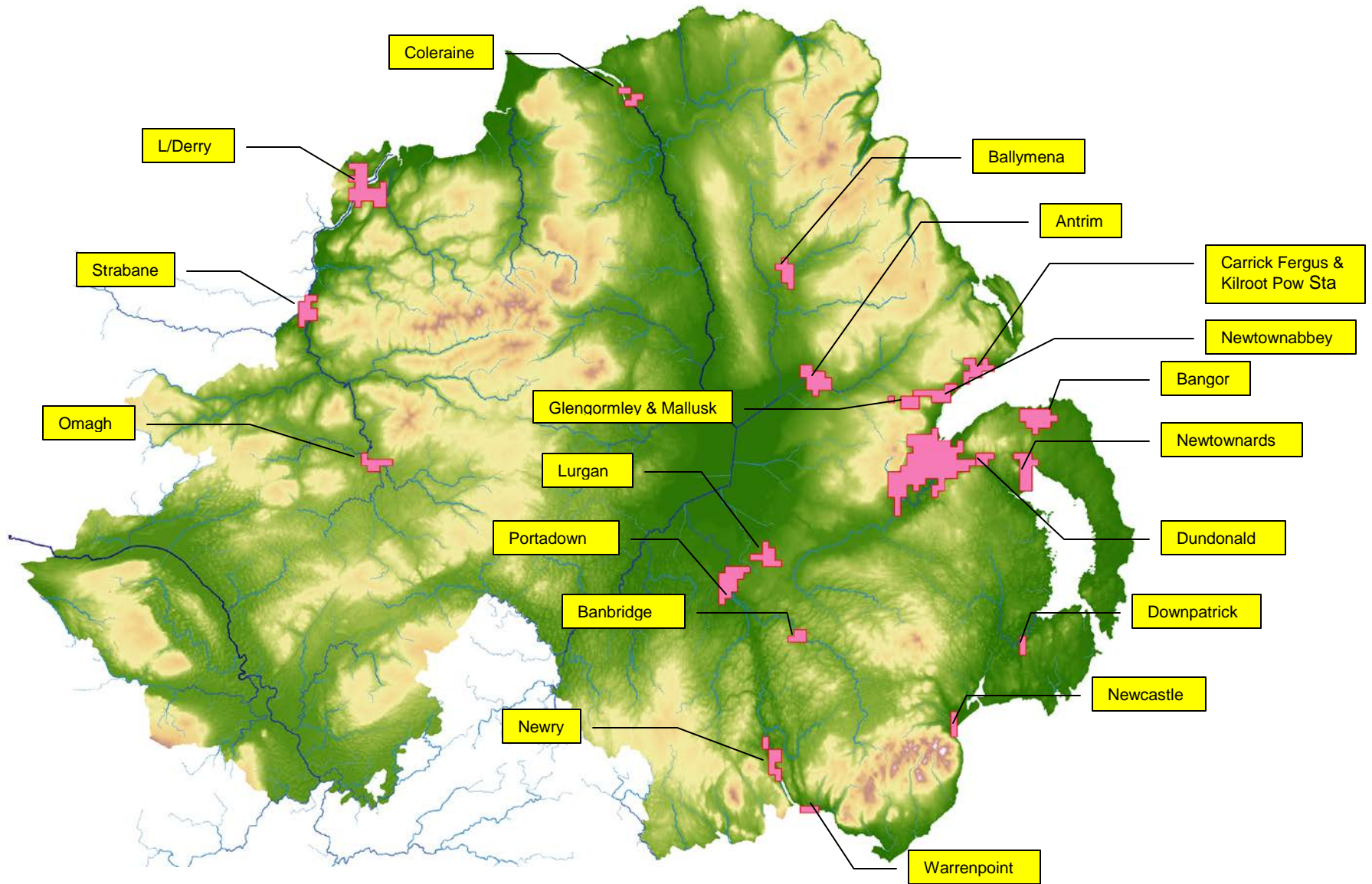
At the time the PFRA for Northern Ireland was undertaken in 2011, the only flood mapping available on which to assess the flood risk to communities was the Strategic Flood Maps (NI). This 'strategic level' mapping was produced for the purposes of highlighting general areas that may be prone to flooding from rivers, the sea and surface water and it is acknowledged that there is a degree of uncertainty with the accuracy of this mapping. As a consequence of the uncertainty it was entirely possible that the risk to some areas could have been substantially higher or lower than estimated through the PFRA.

In view of this uncertainty the Department determined that, in addition to identifying the SFRA, any area which was estimated to have a moderate risk of flooding would be classified as an Area for Further Study (AFS). In total, 49 AFS were identified through the PFRA process. The names of the AFS along with the relevant the River Basin District in which they are located are listed below in Table 4.1 and their geographical extents are illustrated in Map 4.1.1. Detailed flood models for all of these AFS have been developed to the same standard as those produced for the SFRA and these have been used to prepare flood hazard and flood risk maps which are available alongside those for the SFRA through Flood Maps NI.

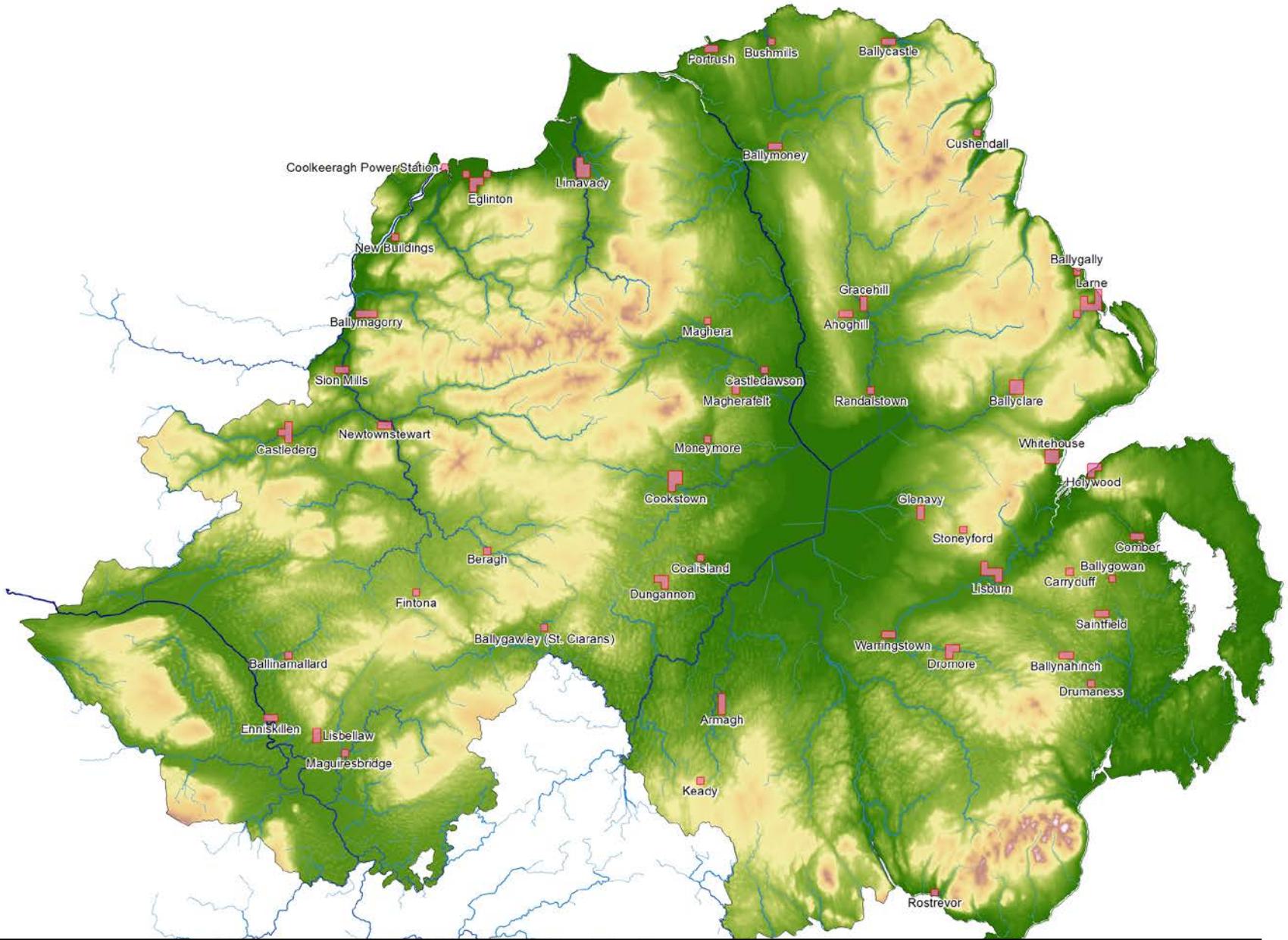
Although the flood risk to these AFS is not specifically addressed within the FRMPs, this approach has provided the information necessary for a more robust assessment of the flood risk regionally. Where it is justifiable, this assessment may lead to the development of a flood alleviation scheme which may be taken forward through the normal business of the drainage authority responsible. The detailed flood maps produced for the 49 AFS will also be used for the purposes of development planning and emergency planning and response. They also serve to increase awareness among the general public, local authorities and other organisations, of the likelihood of flooding and to encourage them to take appropriate action to manage the risk.

	Significant Flood Risk Areas	Areas for Further Study	
Neagh Bann Int. River Basin District	Newry	Magherafelt	Dungannon
	Portadown	Randalstown	Warringstown
	Warrenpoint	Glenavy	Coalisland
	Banbridge	Ballyclare	Keady
	Lurgan	Gracehill	Castledawson
	Glengormley & Mallusk	Cookstown	Rostrevor
	Antrim	Stoneyford	Armagh
	Ballymena	Moneymore	Ballygawley
	Coleraine	Ballymoney	Ahoghill
		Maghera	
North Western Int. River Basin District	Londonderry	Eglinton	Castledearg
	Omagh	Enniskillen	Ballinamallard
	Strabane	Lisbellaw	Coolkeeragh
		Newtownstewart	Sion Mills
		Ballymagorry	Fintona
		New Buildings	Maguiresbridge
		Beragh	Limavady
North Eastern River Basin District	Belfast	Larne	Ballynahinch
	Newtownards	Comber	Lisburn
	C'fergus & Kilroot Power St.	Ballygowan	Saintfield
	Bangor	Holywood	Ballygalley
	Newcastle	Dromore	Drumaness
	Newtownabbey	Bushmills	Carryduff
	Downpatrick	Whitehouse	Cushendall
	Dundonald	Ballycastle	Portrush

Table 4.1 Northern Irelands 20 Significant Flood Risk Areas and 49 areas of further study



Map 4.1 - Map of Northern Ireland's 20 Significant Flood Risk Areas



Map 4.1.1- Map of Northern Ireland's 49 Areas of Further Study

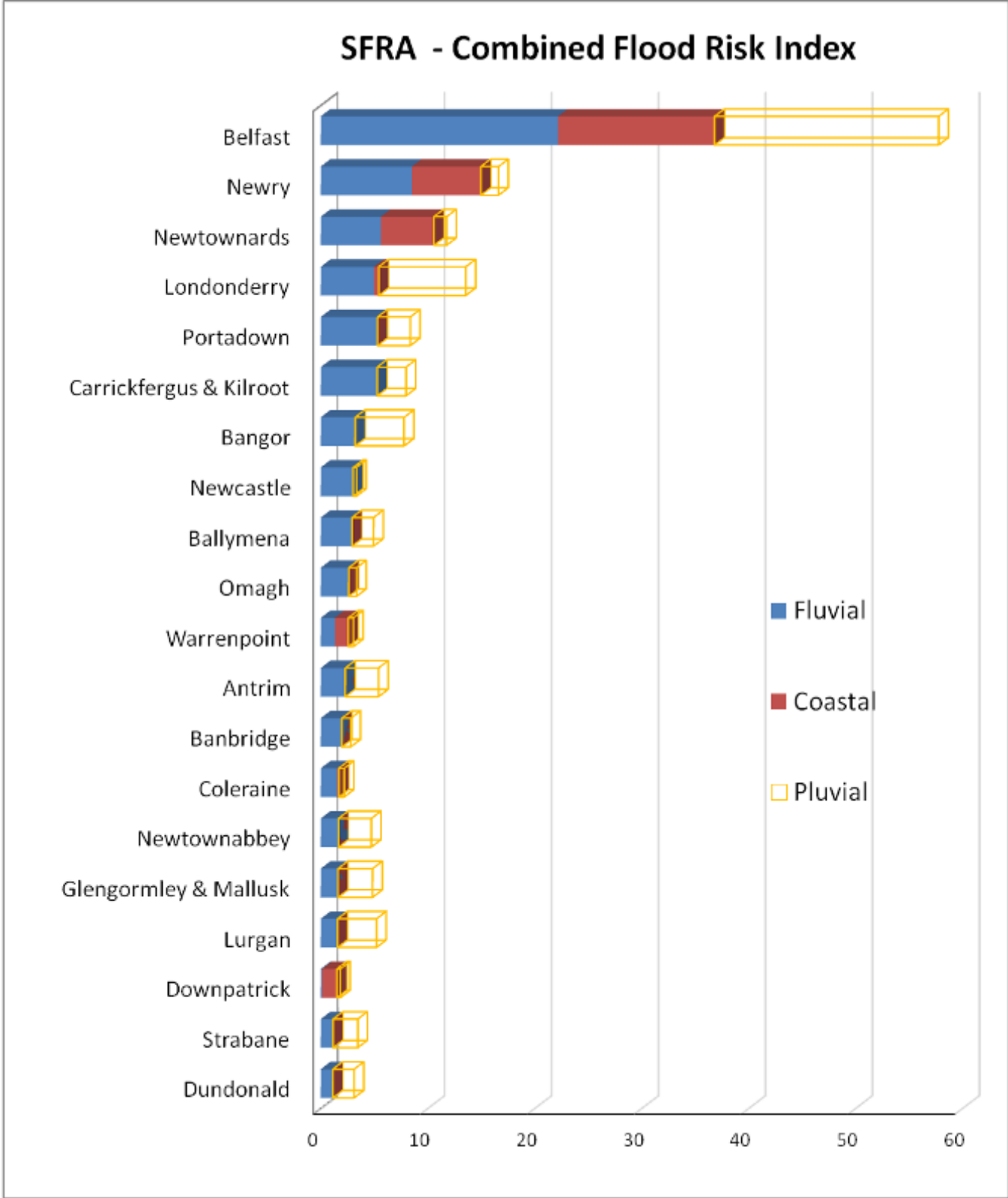


Figure 4.1 - Northern Ireland's 20 Significant Flood Risk Areas

4.1.4 Flooding in New Areas

Every effort has been made to ensure that the Flood Risk Management Plans (FRMPs) have been based on the best available up to date information at the time of publication. The FRMPs focus on the 20 most significant flood risk areas in Northern Ireland and also mention 49 areas for further investigation. While flood mapping and assessment methodologies provide a high degree of certainty that the areas identified to be at significant risk have been assessed correctly, there is still the chance that future incidences of serious flooding could possibly occur in areas outside those 69 areas. Therefore, it must be recognised that should major flooding occur elsewhere in Northern Ireland outside of those 69 areas, new objectives and measures to address such flooding may be developed and prioritised ahead of those currently included within the FRMPs. Any necessary re-prioritisation of objectives and measures will be included within progress reports on implementing the FRMPs.

4.2 Flood Maps

Rivers Agency in conjunction with Planning NI, published the online **Strategic Flood Maps** for NI in October 2008. This first generation of indicative maps was developed to provide a general indication of the areas that may be at risk of flooding from rivers and the sea and used mainly to inform the development planning process. A strategic surface water flood map was added subsequently published in December 2011. Due to the onerous requirement to produce flood maps that cover the whole of the province, it was necessary to develop the strategic flood models using a broad-scale modeling methodology and techniques that had clear limitations. These limitations meant that the estimated floodplain outlines and inundation areas were not considered sufficiently accurate to determine the flood risk to particular properties or point locations.

This strategic level mapping was used for the PFRA and the identification of SFRA. To facilitate a more robust assessment of the flood risk within the SFRA and inform the development of the development of the FRMPs the Floods Directive requires the preparation of more detailed flood mapping for each of the SFRA. As stated above in section 4.1.3 – Areas of Further Study, the Department has identified an additional 49 AFS and has prepared similarly detailed maps for these areas.

The Floods Directive's requires the preparation of Flood Hazard Maps and Flood Risk Maps, to cover the geographical areas within each of the SFRA that could flood i low, medium and extreme event scenarios. Within Northern Ireland the following flood return periods have been used for preparing the maps for this range of probability scenarios.

Flood Source	Event Scenario			Model Type Strategic or Detailed
	High	Medium*	Low	
Rivers	1 in 10 year 10% AEP	1 in 100 year 1.0% AEP	1 in 1000 year 0.1% AEP	Detailed
Sea	1 in 10 yr 10% AEP	1 in 200 year 0.5% AEP	1 in 1000 year 0.1% AEP	Detailed
Surface Water	1 in 30 year	1 in 200 year	1 in 1000 year	Detailed
* Flood Hazard Maps are also available for the Climate Change 2030 epoch. These illustrate the estimated floodplains for the year 2030 and are based on the best available predictions for the meteorological conditions and sea levels for that time.				

Table 4.2 – Flood Hazard & Risk Map Scenarios

By comparison with the strategic flood maps the accuracy and scope of the information provided by the Flood Hazard and Flood Risk Maps is greatly improved. Most importantly, this mapping is now considered suitable for identifying the level of risk to individual properties and specific point locations.

It should be noted that the surface water mapping for the SFRA continues to be strategic in nature. The surface water maps simply highlight the low spots and depressions in the landscape that may fill with water if the local natural and engineered drainage systems are overwhelmed. These maps are suitable for the purposes of emergency planning and are used by the planning authority to advise applicants of potential water surface flood risk to proposed developments that must be considered and mitigated where appropriate. Importantly, the surface water maps within Flood Maps (NI) are not suitable for decision making in regard to capital investment on infrastructure for the purposes of flood alleviation. Areas that are at high risk of flooding from surface water will continue to be identified through historical flood records and not through broad-scale predictive flood models.

4.2.1 Flood Hazard Maps

Flood Hazard Maps essentially describe the characteristics of the predicted flood for each of the flood event scenarios and include information such as the:

- Geographical extent of the estimated flood inundation areas;
- The floodwater depth and height; and
- The flow and velocity of the floodwater.

The Flood Hazard Maps for the 20 SFRA and 49 AFS are available to general public through Flood Maps (NI) which is an interactive online map-viewer that enables users to access the latest flood hazard information available from government. Flood Hazard Map coverage throughout Northern Ireland is extensive and continues to increase. Flood Maps (NI) will continue to display the strategic flood maps for the geographical areas that are not covered by the Flood Hazard Maps. The difference in the uncertainty between the 'strategic' and detailed 'hazard' maps is reflected in how they are displayed within Flood Maps (NI). The hazard maps are published at 1 in 5000 scale to enable the identification of individual properties at risk of flooding, whereas strategic maps are displayed at 1 in 10,000 scale which is more appropriate for assessing the risk at a street/community level.

The publication of the flood maps is designed to:

- Enable flooding agencies, infrastructure providers and others to manage their work to reduce flood risk.
- Encourage people living and working in areas prone to flooding to take appropriate action.
- Inform anyone applying for planning permission if flooding is likely to be a material consideration.

A sample copy of the Flood Hazard Maps available through Flood Maps NI is shown in Figures **4.2.2** and **4.2.2.1**. This map shows the 1 in 100 yr (medium probability) fluvial flood plain for the Westwood Development in Lurgan.

4.2.2 Flood Risk Maps

The Flood Risk Maps essentially describe the main adverse consequences of the predicted flood for each of the scenarios listed in Table **4.2**. The specific information that is required to be included in Flood Risk Maps is:

- The number of inhabitants that could be affected;
- The effect on economic activity;
- The areas within nationally important environmental areas that could be flooded, particularly those which could be accidentally polluted from an Industrial Pollution Prevention Control Site.

The Flood Risk Maps prepared for Northern Ireland collate and display this information on a 250m grid. A sample copy of the Flood Risk Maps available through Flood Maps NI is shown in Figure **4.2.2.2**. This map shows the 1 in 100 yr (medium probability) fluvial flood plain for Lurgan. The Department has published Flood Risk Maps for fluvial (river) and coastal flood risks on the Department's website.

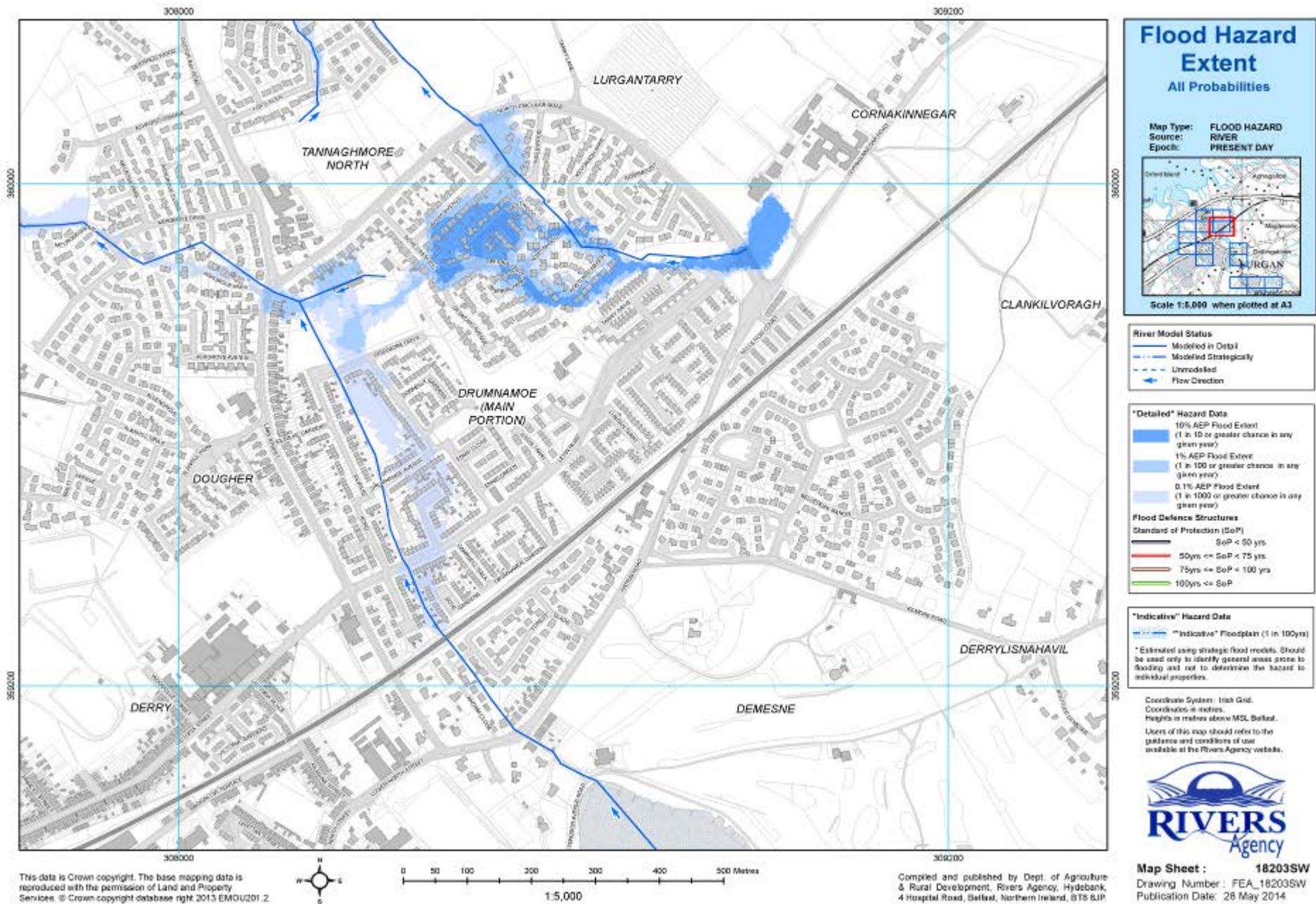


Figure 4.2.2 – Example Flood Hazard Extent Map for Lurgan



Figure 4.2.2.1 – Example Flood Hazard Depth Map for Lurgan

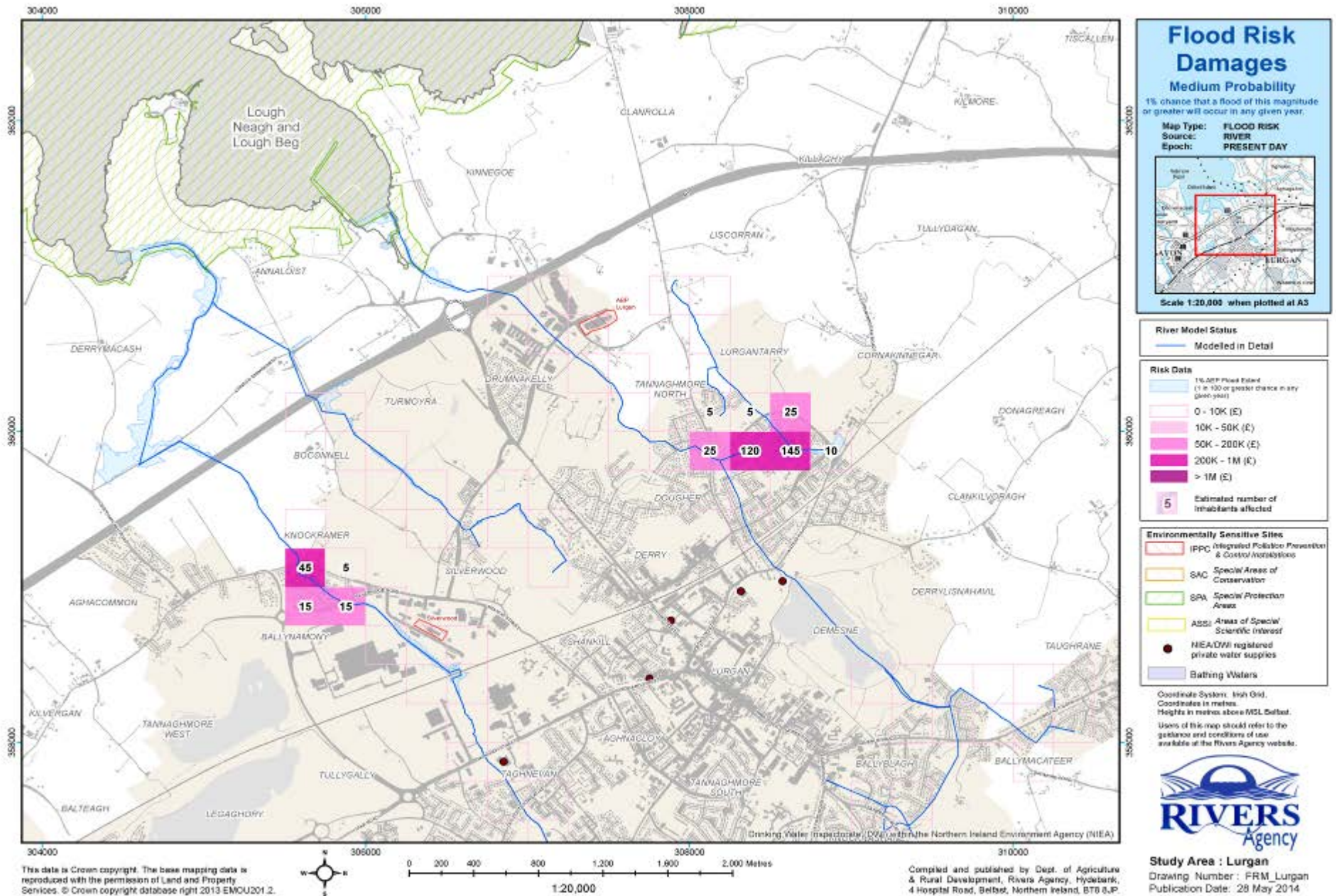


Figure 4.2.2.2 – Medium Probability Flood Risk Map for Lurgan

Mapping for Climate Change

The Floods Directive does not specifically require the preparation of flood maps that take account of climate change. However, it is widely accepted that our climate is changing and that with the passage of time, extreme rainfall events may become more frequent and intense and the sea around our coastline will rise and become stormier. The Department recognises that the long-term flood risk management decisions that are taken today, will only be sustainable if they are future proofed and take into account the potential increased flood risk from climate change. This is particularly important for decisions in relation to the provision of flood defences and development planning. Therefore, to inform these important decisions the Department has prepared a range of climate change flood hazard maps. These maps illustrate the estimated flood plains for the year 2030 and are based on the best available predictions for the meteorological conditions and sea levels for that time. The medium probability climate change (2030 year) epoch flood maps for each of the main flood sources are available through Flood Maps (NI).

Reservoir Inundation Maps

Reservoir inundation maps are not available at the time of the publication of the FRMPs. Rivers Agency is developing predictive flood models for each of the Controlled Reservoirs that have been identified. This will facilitate the implementation of the Reservoirs Act (Northern Ireland) 2015. It is anticipated that maps highlighting the potential flood inundation areas resulting from an uncontrolled release of water from these reservoirs will be available in early 2016 and will be published in Flood Maps (NI).

4.3 Communication and Engagement

The Floods Directive Regulations place a general duty on government departments and other public bodies to execute and coordinate their relevant functions *‘in a manner which secures compliance with the requirements of the Floods Directive.’* It also requires that appropriate steps are taken *‘to provide opportunities for the general public and public bodies to participate in discussion and the exchange of information or views in relation to the preparation of the plan and, in particular, shall give access to the documents and information used in such preparation.’*

4.3.1 General Arrangements for Stakeholder Involvement

The general arrangements that were established to secure compliance with the requirements of the Directive in relation to communication and engagement are outlined in the Timetable and Work Programme for the Preparation of Flood Risk Management Plans which was published for public consultation on 20 December 2012.

The consultation network that was set up to ensure that all relevant stakeholders had an opportunity to participate in discussion and the exchange of information and views in the preparation of Flood Risk Management Plans is illustrated in Figure 4.3. The roles of the main groups in this process are as follows.

Floods Directive Steering Group

The successful implementation of the Floods Directive requires effective communication, cooperation and coordination across a number of government departments, agencies, councils and a government owned company NI Water. To ensure that there is an appropriate level of engagement and commitment within government, DARD Rivers Agency, as Competent Authority for the Floods Directive, set up the cross-departmental Floods Directive Steering Group in January 2008. This group, which comprised senior representatives from all of the key government stakeholders with an interest in flood risk management, was responsible for providing the strategic direction for the implementation process and ensured that each organisation undertakes its functions and aligned its policies in a manner that supports the effective implementation of the Directive in Northern Ireland.

Floods Directive Stakeholder Group

The Floods Directive Stakeholder Group was established in June 2009 to satisfy the Directive's requirement to encourage the active involvement of interested parties in the development of the Flood Risk Management Plans. This Group includes representatives from both statutory and non-statutory organisations with a broad range of interests including the environment, fisheries, navigation, transportation networks, essential services (such as water, sewerage and telecommunications), insurance, flood emergency planning/response, business and health and social care. This Group is an effective conduit for the transfer of relevant information to and from knowledge holders and ensures that key stakeholders have an opportunity to identify and consider all issues, challenges and opportunities associated with potential flood mitigation measures within a catchment based flood risk management framework.

Flood Forum Groups

A Flood Forum Group has been established for each of the three River Basin Districts (i.e. one for each FRMP area) since March 2013. However, the North East Forum has essentially grown through an expansion of the membership of the Belfast Flood Forum which has been in existence since May 2010. The aim of the Flood Forums is to create the opportunity for local community groups, relevant NGOs and the public, through their elected representatives, to influence and contribute to the development of the Flood Risk Management Plans. The aim of the Forums is to:

- raise the general awareness of flooding at the local community level and to input into the aims and objectives of the Flood Risk Management Plans;
- create the opportunity for all groups, organisations and individuals to share their knowledge and experience of local flooding with decision makers and;
- contribute to the development of flood mitigation solutions that are affordable, appropriate for the local area and support the environmental objectives of the Water Framework Directive.



Photo 4.3 – Local Flood Forum 20th January 2015, Greenmount, Antrim

4.3.2 Public Consultation on the Draft Flood Risk Management Plan

The Directive requires that draft Flood Risk Management Plans are published not less than one year before the beginning of the period to which they relate and that the public and statutory consultees are invited to make representations on the Plans.

In accordance with this requirement, the draft Flood Risk Management Plan was published for consultation on Rivers Agency's website on 22 December 2014 with hard copies available on request. Details of the

consultation were advertised in the main local newspapers and on the Department's website and representations on the Plan were invited throughout a six month consultation period which ended on 22 June 2015. The timing of the consultation on the draft FRMPs was coordinated with the Northern Ireland Environment Agency's public consultation on its Draft River Basin Management Plans that were produced in compliance with the Water Framework Directive. The coordination of these consultations is a requirement of the Floods Directive and aims to secure efficiency in obtaining the active involvement of parties with a common interest in the objectives of both Directives. In total the Department received twenty eight responses to the public consultation on the draft FRMPs which included:

- 8 from Councils / Local Government
- 5 from Government bodies
- 5 from environmental organisations
- 4 from fishing organisations
- 2 from blue light responders
- 1 from farming Industry
- 1 from a political party
- 1 from and independent consumer organisation
- 1 from a professional engineering organisation

The Response to the Consultation on the draft Flood Risk Management Plan was published week commencing 30th November 2015 and is available on the DARDNI website via the link: <https://www.dardni.gov.uk/publications/response-consultation-draft-flood-risk-management-plan>.

The Department has taken into account all of the views and representations that it received on the draft Plans and made appropriate changes to the Plans where it has determined that this was justified. A summary of the substantive changes that were made to the FRMPs as a consequence of the representations received from the consultation exercise can be found in Appendix B.

4.3.3 Other Public Information Measures

In addition to the Directive's requirements to actively involve and consult with interested parties in the production of the FRMPs it was also necessary to make available to the public, the preliminary flood risk assessment and the flood hazard maps and flood risk maps.

The Preliminary Flood Risk Assessment for Northern Ireland was published and made available for public inspection through the Department's website on 22 December 2011 with hard copies available on request.

The flood hazard and flood risk maps for each of the 20 Significant Flood Risk Areas were prepared and made available to the public on 22 December 2013. Initially maps were available only for specific locations on request and supplied on paper or as digital PDFs. Public accessibility to the flood hazard maps was significantly improved on 2 June 2014 when Rivers Agency launched its web-based interactive flood map service for Northern Ireland, Flood Maps (NI). Through Flood Maps (NI) the public have direct access to the detailed flood hazard maps for each of the 20 SFRA and the 49 Areas for Further Study. Public awareness of the flood maps was generated through a publicity campaign which involved local television, radio and newspapers and was supported by the DARD Minister.

4.3.4 Cross-Border Coordination in International River Basin Districts

In recognition of the fact that many river catchments throughout Europe cross national boundaries, the Floods Directive requires that Member States coordinate their flood risk management practices in shared river basins and shall in solidarity not undertake measures that would increase the flood risk in neighbouring countries. Northern Ireland shares 3 (International) River Basin Districts (RBD) with the Republic of Ireland; the North Western IRBD, Neagh Bann IRBD and Shannon IRBD. In the case of the Shannon IRBD, only 3.5km² of its 18,000km² is located within Northern Ireland and therefore for practical purposes the responsibility for the preparation of the FRMP for this RBD rests solely with the RoI.

To ensure that a coordinated approach is adopted for the two substantive IRBDs, and building upon a long-standing history of cooperation between the two organisations, working groups on the implementation of the Directive have been established between the OPW and the Rivers Agency. These groups have taken into account the catchment areas, their flood history, topography and the significant flood risk areas within them, in order to assign and plan work between the two jurisdictions.

It was been decided that Rivers Agency and the Office of Public Works will develop their FRMPs separately within their own jurisdictions but will closely coordinate on all technical matters and proposed flood mitigation measures. There is no likelihood that any measures will be taken in one jurisdiction that will increase the flood risk in the other.

The two main cross- border groups set up to coordinate the activities and share information are the Cross Border – Floods Directive Implementation Group and the Cross Border – Floods Directive Technical Coordination Group. The specific aims of these groups are described in the Figure 4.3.

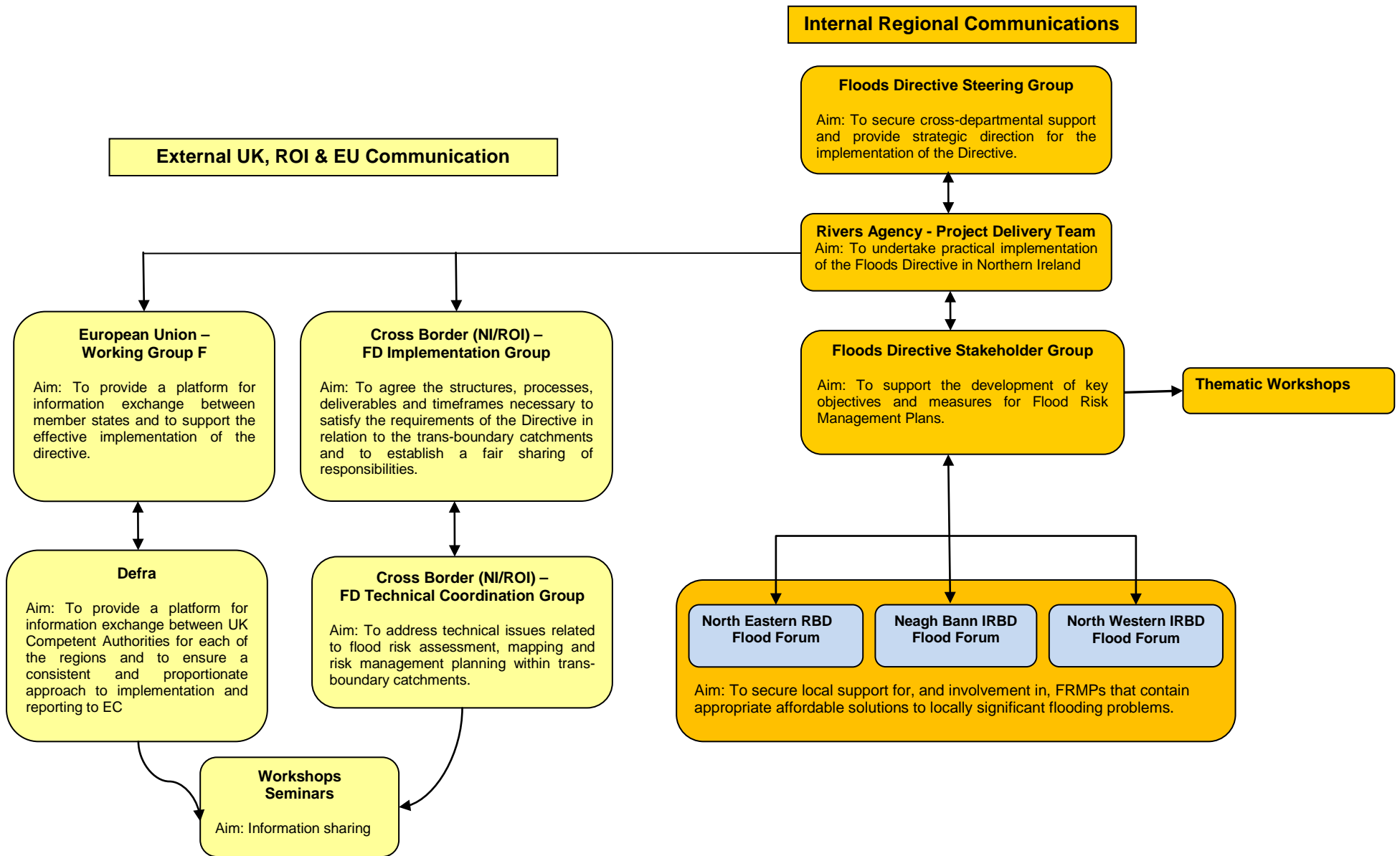


Figure 4.3 – Floods Directive Communication/Engagement Network

4.4 Flood Risk Management Organisations

The management of flood risk is the responsibility of a number of organisations, mainly Rivers Agency, Transport NI, NI Water, Planning NI and Local Councils. Their respective roles and functions in relation to flood risk management are described below.

River Agency

The Department of Agriculture and Rural Development (DARD) is the statutory drainage and flood defence authority for Northern Ireland. The Department is also the competent authority in Northern Ireland for the implementation of the EU Floods Directive, which reinforces the legislative basis for the Agency's flood risk management role.

Under the terms of the Drainage (Northern Ireland) Order 1973, the Department has permissive powers to:

- Maintain watercourses and sea defences which have been designated by the Drainage Council for Northern Ireland.
- Construct and maintain drainage and sea defence structures.
- Administer advisory and enforcement procedures to protect the drainage function of all watercourses.

In addition to its role under the Drainage Order and Floods Directive, the Agency is also has a responsibility for:

- Taking forward legislation on reservoirs safety;
- Maintaining flood defence and drainage infrastructure assets;
- Constructing new flood infrastructure to provide enhanced flood protection to people and property;
- Providing a flood emergency response service during flooding events;
- Fulfilling the role of Lead Government Department for the Co-ordination of Flooding Emergencies;
- Providing advice on flood risk;
- Providing advice to business, developers and the public on drainage and flood related issues;
- Providing advice to Planning NI on the flood related aspects planning policy and to Local Councils on Local Development Plans and planning applications.

Further information on Rivers Agency can be found on the NI Direct web site, [Rivers and flooding](#).

Northern Ireland Water (NIW)

NI Water is a Government Owned Company, set up in April 2007 to provide Northern Ireland's water and sewerage services including the collection of surface water. As owner of the key urban drainage infrastructure, NI Water has a major role to play in cooperation with the other drainage agencies, Rivers Agency and Transport NI, to manage the risk from surface water flooding. NI Water is committed to:

- Work with Rivers Agency, Transport NI, Councils and other relevant stakeholders to develop and contribute to the implementation of integrated solutions to manage surface water flood risk in urban areas (for example, the Living with Water Programme);
- Contribute to the development and implementation of sewerage recommendations and policies arising from the Stormwater Management Group in relation to future sustainable drainage planning;
- Implement drainage and sewerage related measures set out in FRMPs;
- Contribute to the delivery of an efficient and effective coordinated response from Government during flooding incidents; and
- Implement the inspection and maintenance requirements of the Reservoir Bill to reduce the flood risk from Controlled Reservoirs.

NI Water also maintains a register of properties at risk of sewer flooding (DG5 Register) and delivers a prioritised programme of works to remove properties from this register in accordance with targets agreed with the Utility Regulator.

The Department for Regional Development has responsibility for the policy on water and sewerage services in Northern Ireland under the Water and Sewerage Services (Northern Ireland) Order 2006. This responsibility will pass to the Department for Infrastructure when established in May 2016.

Transport NI

Transport NI is the sole Roads Authority in Northern Ireland. It has responsibility for over 25,000 km of public roads, together with 9,000 km of footpaths and a substantial number of bridges, street lights and public car parks.

Transport NI deals with the impacts of roads-related flooding. They maintain road drainage systems, organise road closures and traffic diversions, clear blockages during flooding and remove debris once the flood has receded. They will also take action to protect property that may be affected by road flooding.

Transport NI applies Sustainable Drainage Systems (SuDS) solutions to schemes costing in excess of than £1 million.

Planning NI

From 1 April 2015 the Northern Ireland planning system was reformed and restructured from a unitary system, where all powers rested with the Department of the Environment, to a new two-tier model of delivery whereby local councils have primary responsibility for the implementation of the following key planning functions:

- preparation of local development plans;
- development management (excluding regionally significant applications); and
- planning enforcement.

DOE, Planning NI retains responsibility for planning legislation, regional planning policy and the determination of regionally significant and called-in applications. It also provides oversight, guidance for councils, governance and performance management functions.

The DOE's Strategic Planning Policy Statement for Northern Ireland (SPPS), published in September 2015, sets out the regional planning policies for securing the orderly and consistent development of land under the reformed two-tier planning system. The SPPS is consistent with the Executive's Regional Development Strategy 2035 (RDS 235) which sets out the framework for the spatial development of Northern Ireland.

The SSPPS produced by Planning NI must be taken into account by councils in the preparation of their Local Development Plans and are material to all of their decisions on individual applications and appeals. Included within the SSPPS are the policies that describe how potential flood risks must be taken into account and in essence these are designed to prevent inappropriate new development that will be at risk of flooding or which may increase the flood risk elsewhere.

Planning NI's strategic policy functions will transfer from DOE to the new Department for Infrastructure which is to be formed in May 2016.

Further information on Planning NI can be found on the website [Planning NI](#).

Local Government

As mentioned earlier, from 1 April 2015, the responsibility for planning is shared between the 11 local councils and the Department of Environment. Within this two-tier system, councils have a responsibility for the preparation of Local Development Plans for their areas, taking decisions on the majority of planning applications and planning enforcement. Consequently, councils have a key role to play in preventing inappropriate development in areas known to be at risk of flooding or that may increase the risk of flooding elsewhere.

Local Government also has a key role in undertaking co-ordination and support activities to facilitate the emergency response to flooding in conjunction with the statutory authorities. Emergency Planning Coordination Officers (EPCOs), and a Regional Local Government Coordinator continue to have a key role in facilitating emergency response activities in relation to flooding both at a local and regional level.

The interaction between the key organisations, including Local Government, in relation to the co-ordination of the emergency response to flooding is detailed in the OFMDFM [‘Framework for the Co-ordination of Flooding Emergencies’](#).

In addition, Emergency Planning Groups (EPGs) have recently been set up and these provide a forum to focus on flood emergency response action. Councils also have a leading role in the ‘recovery phase’ after a flooding event has occurred.

In the immediate aftermath of significant flooding within their areas, Councils have a responsibility for the administration of the ‘Scheme of Emergency Financial Assistance to Councils (SEFA). SEFA offers individual householders, who have suffered severe inconvenience due to flooding, immediate practical assistance in the form of a monetary payment, to ensure homes are made habitable as quickly as possible.

Impacts of Organisational Changes within government on Flood Risk Management Plans

In producing these Flood Risk Management Plans (FRMPs), it should be recognised that major changes in both local and central government in Northern Ireland are underway. These changes may impact on organisations and people responsible for implementing the FRMPs.

In relation to the ‘Prevention’ aspects of Flood Risk Management there is a need to ensure that flood risk continues to be given full consideration within the new development planning processes by both DoE and the

11 new council planning departments. Rivers Agency will work with council planning departments to ensure that they have the necessary information to appropriately consider flood risk as part of the planning process.

During the early period of the forthcoming Flood Risk Management Planning cycle, there will be significant changes made to government departments in Northern Ireland. Fundamentally the number of departments will reduce from twelve to nine. In relation to Flood Risk Management, the Department's Rivers Agency is to join up with the DRD infrastructure agencies of Transport NI and NI Water in the formation of a new Department for Infrastructure (DfI). This is recognised as a positive step for managing flood risk as the 3 main providers of drainage infrastructure will be located within the one department from May 2016.

In taking forward the proposed measures, in these Flood Risk Management Plans it should be recognised that the achievement of the objectives within the Plans will depend on resource and capital funding being available.

Office of Public Works, Republic of Ireland

The Office of Public Works (OPW) is the lead State body for the coordination and implementation of Government policy on the management of flood risk in the Republic of Ireland. The OPW has a long history of working closely with colleagues in Rivers Agency on areas of common interest and, as both organisations are the competent authority for the implementation of the Floods Directive in their respective territories, are sharing information and coordinating activities on the development of FRMPs for shared International River Basin Districts. Further information on the OPW can be found at the following website [The Office of Public Works](#).

4.5 Flood Risk Management Groups

A number of groups have been established in recent years to take forward various initiatives, both at strategic and operational level.

Flood Strategy Steering Group

The Flood Strategy Steering Group (FSSG) was established in 2003 to provide oversight and direction to ensure the co-ordinated multi-agency response to flooding emergencies. The role of the group is to:

- Develop strategies to improve flood response;
- Provide a steer to the Flood Working Groups linked to the Emergency Planning Groups (EPGs) which deal with issues at an operational level;

- Monitor and review the effectiveness of flood response during and following major events; and
- Ensure that there are effective communication channels and processes in place at strategic level among the flood response organizations.

Membership

The FSSG comprises membership from the following organisations:-

- Rivers Agency (Chair)
- Transport NI
- NI Water
- Department of Agriculture & Rural Development (DARD) Core
- Department of Regional Development (DRD) Core
- Local Government Emergency Planning
- Police Service Northern Ireland (PSNI)
- Northern Ireland Fire & Rescue Service
- NI Direct

Multi-agency Civil Emergencies Preparedness Groups (EPGs)

Four additional multi-agency Civil Emergencies Preparedness Groups (EPGs) (North, South, East and West) have now been formally established alongside the existing Belfast Resilience Group.

Each EPG is responsible for:

- agreeing a joint approach to emergency preparedness and response and co-ordinate the multi-agency planning effort;
- conducting local risk assessments to provide a robust basis for planning;
- ensuring that relevant multi-agency plans, procedures, training and exercising are in place to address all local area risks; and
- addressing the implications of regional initiatives and the work/ decisions of the Civil Contingencies Group (NI) for the local area.

Flood Investment and Planning Group (FIPG)

The FIPG was established in the aftermath of the severe flooding which occurred in June 2012 and in response to concerns that greater collaboration between government departments was required to effectively manage the risks from flooding when there is no obvious infrastructure "owner". The causes of flooding are often complex due to hydraulic inter-dependencies between our sewerage and drainage networks, rivers and the sea. The Group comprises members from DRD Water Policy and the three agencies with a drainage responsibility; NI Water, Transport NI and Rivers Agency. FIPG will not be involved in flooding issues which are considered to be the sole responsibility of one of the drainage agencies.

The role of the FIPG is to ensure that there is a coordinated approach to the investigation flood of flooding, agree responsibilities, propose potential solutions, prioritise investment and ensure joint responses including making the case for investment.

Living with Water Programme Board

It is acknowledged that Belfast's drainage infrastructure requires significant future capital investment in order to, enhance the water environment, reduce the risk of flooding and allow for the continued economic growth of the city. To facilitate the development of optimum solutions to address the flooding and environmental risks arising from the drainage network, it was agreed by the NI Executive in July 2014 that the Department of Regional Development (DRD) should set up an inter-departmental group to produce a Strategic Drainage Infrastructure Plan for the city. This plan will be developed through the Living with Water Programme which is being progressed through a series of interlinked work package. The Programme Board includes representatives from DRD water Policy, NI Water, Rivers Agency, Transport NI, Belfast City Council, Department of Environment, NI Environment Agency , Department of Finance and Personnel and the Strategic Investment Board. All of these organisations will contribute to the development of the resulting Strategic Drainage Infrastructure Plan. Further details of the Living with Water Programme can be found in section **7.1.7**.

DRD Water Policy Division

Department for Regional Development's Water Policy and Shareholder Division is responsible for advising Northern Ireland Assembly Ministers on policy in relation to the water and sewerage industry and for discharging the DRD's statutory and other duties under the Water & Sewerage Services (NI) Order 2006.

They are responsible for contributing to the health and well being of the community and the protection of the environment by developing and maintaining the policy and regulatory environment to provide a modern, high quality water and sewerage service, at the lowest possible cost.

The main areas of responsibility are:

- legislative framework for the water and sewerage industry
- strategic planning on water and sewerage service related environmental and social matters
- policy advice on water and sewerage issues
- regulatory governance of the water industry
- DRD's regulatory role on water and sewerage services
- coordination of flood investment planning by NI Water, Rivers Agency and Transport NI
- NI Water subsidy and charging policy
- Communication and Co-ordination with NI Water's Stakeholders
- Development of the Long Term Water Strategy and it's delivery Action Plan
- Programme Management for Strategic Drainage Investment Planning

Stormwater Management Group (SMG)

The Stormwater Management Group (SMG) is an inter-departmental policy coordination and implementation group that was established in 2011 to facilitate the implementation of the NIEA's Strategy for Promoting the Use of Sustainable Drainage Systems within Northern Ireland. It is jointly chaired by NIEA's Water Management Unit (WMU) and DRD's Water Policy Division and has cross-departmental support with representatives from Rivers Agency, NI Water and the Utility Regulator. The fundamental aim of the SMG group is to examine a range of approaches to develop a more integrated, catchment based approach to stormwater management in reducing flood risk.

Section 5

Neagh Bann RBD - SFRAs

Flood Risk Assessment & Measures

5.1 River Basin Overview

This Flood Risk Management Plan is based on the **Neagh Bann River Basin District (RBD)**. The Neagh-Bann International River Basin District lies in the centre of Northern Ireland and includes Lough Neagh, the largest lake in Ireland, and the Bann River, which runs into and out of Lough Neagh. The Neagh Bann RBD has total area of 8,085 km² including the marine elements. It drains parts of counties Louth, Meath, Cavan, Monaghan, Armagh, Tyrone, Derry / Londonderry, Antrim and Down. (See Figure 5.1 below)

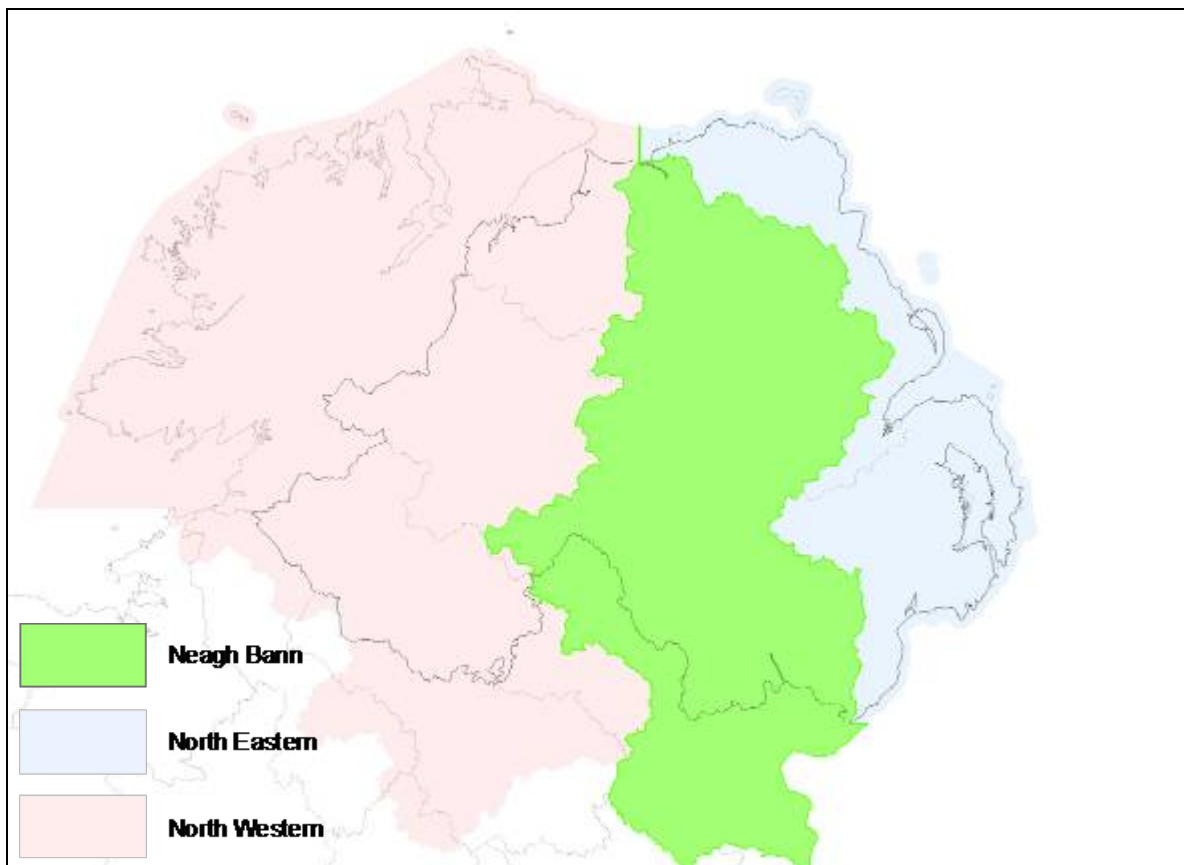


Figure 5.1 – Neagh Bann River Basin District (Green)

5.2 Areas of Significant Flood Risk

Following the Preliminary Flood Risk Assessment (PFRA) in 2009, twenty areas of potential significant flood risk were identified within Northern Ireland. Nine of the Significant Flood Risk Areas (SFRA) are located in the Neagh Bann River Basin District and named as follows:

- Lurgan
- Antrim
- Ballymena
- Newry
- Banbridge
- Portadown
- Glengormley and Mallusk
- Warrenpoint
- Coleraine

The location and geographical extents of the SFRAs are illustrated in Figure 5.2.

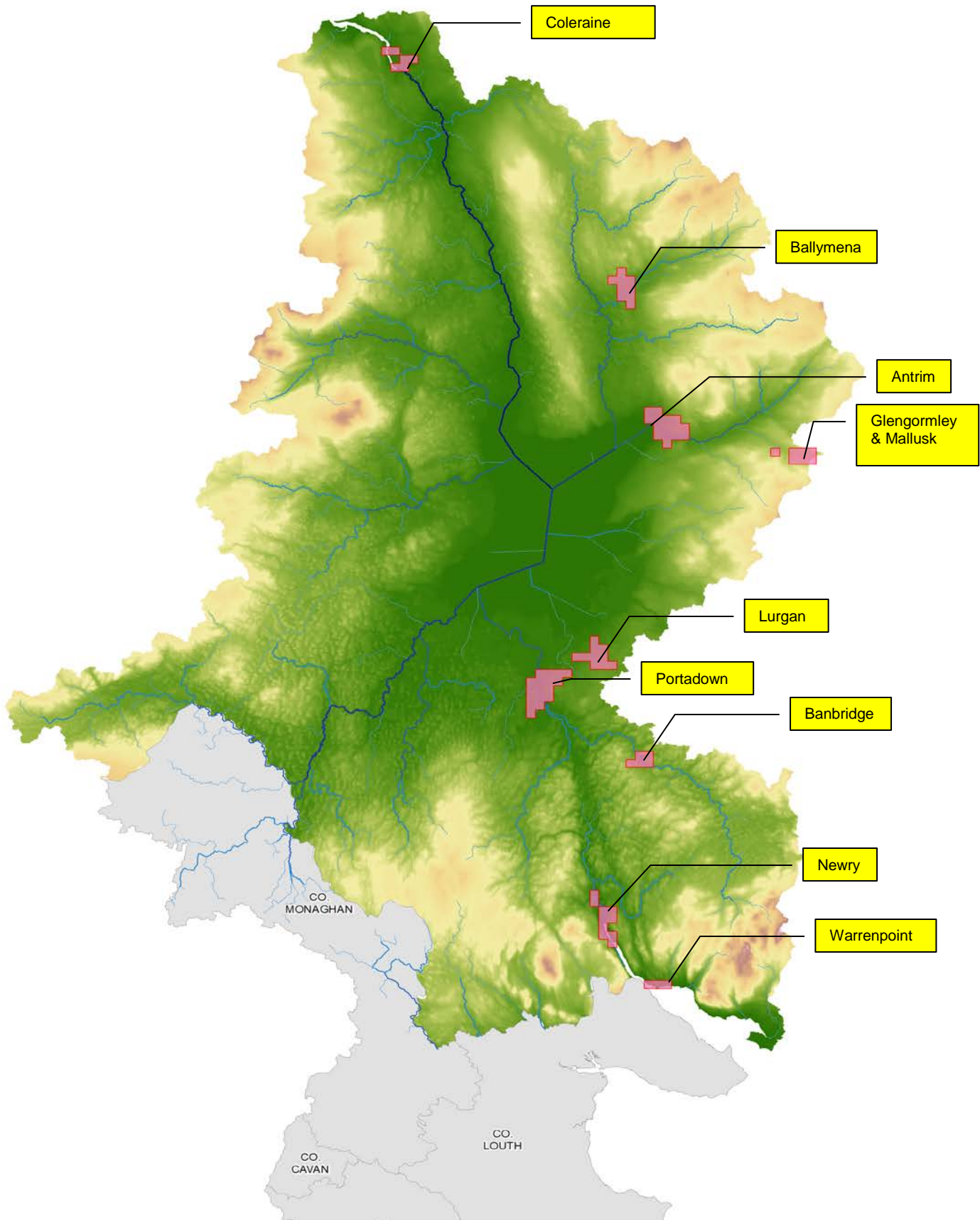


Figure 5.2 - Neagh Bann Significant Flood Risk Areas

5.3 Lurgan SFRA – Lough Neagh

The core boundary of the Lurgan SFRA, which has been determined through the PFRA, is located within the Lough Neagh Local Management Area and illustrated in Figure 5.3 below.

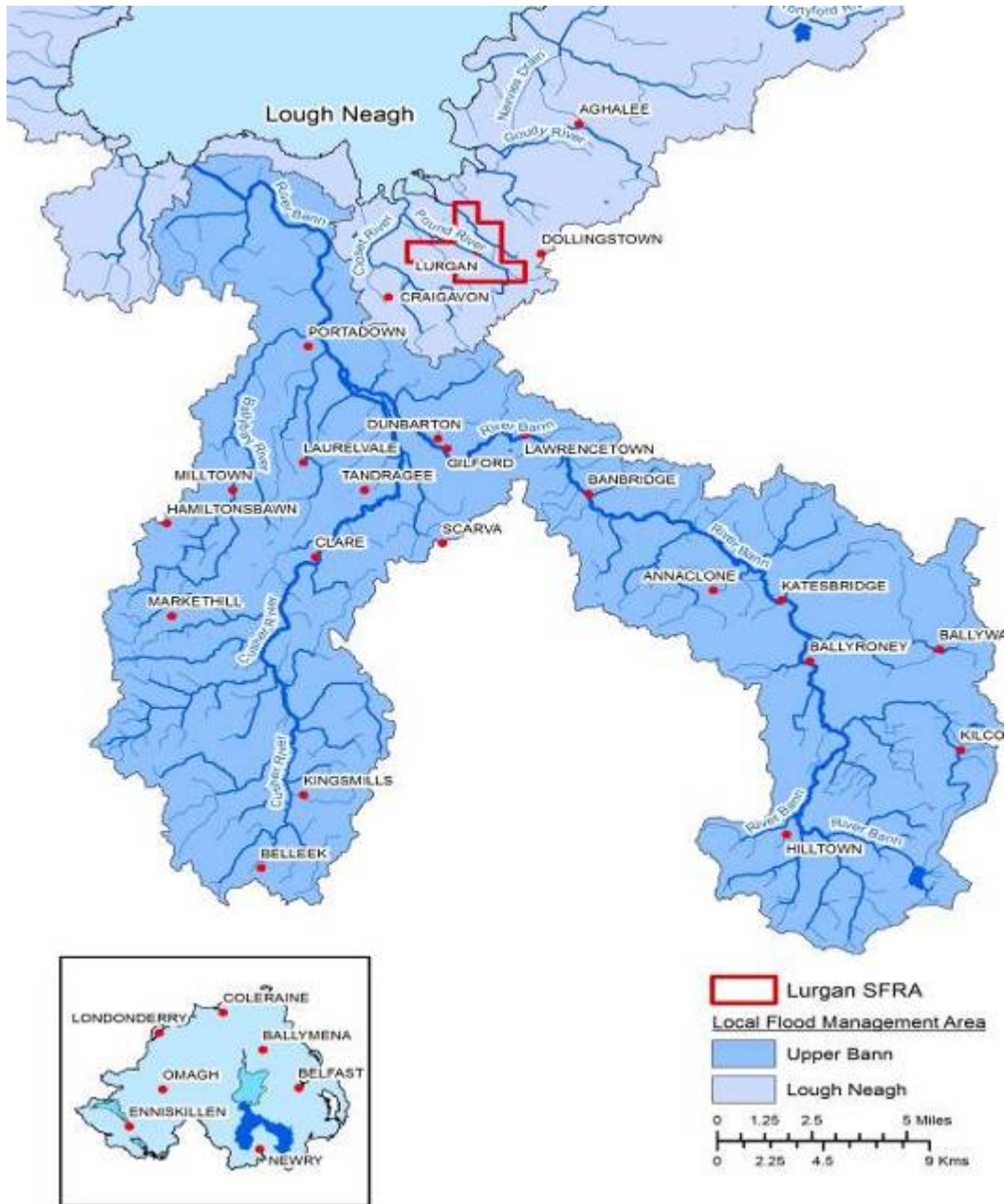


Figure 5.3 - Neagh Bann LFMA and Lurgan SFRA



5.3.1 Flooding History

A review of the entire available flood data, including the local and regional newspapers, would suggest that Lurgan is not prone to frequent flooding. It has not been possible to identify any major flood events prior to 2008. However, Rivers Agency records show there is a small number of areas in Lurgan which have flooded in the past. These areas include:

- Shane Park (Aug 2008)
- Knockramer Meadows (Aug 2008)
- Melrose Grove (Aug 2008)

Photo 5.3.1.1 - Halfpenny River in flood August 2008 at the Knockramer Meadows Development

After the flooding on 16th August 2008, which affected a number of locations in Lurgan, Rivers Agency carried out a post flood investigation to determine the flooding source.

One of the outcomes of this investigation to alleviate flooding in Lurgan was to replace the accommodation bridge located downstream of the Knockramer Meadows Development on the Halfpenny River. The existing bridge was found to be undersized and causing a restriction to the flow in a flood event.

Rivers Agency replaced the existing accommodation bridge on the Halfpenny River with a 2.8m x 1.5m precast concrete box culvert in 2010 at a cost of £48,000. (See Photo 5.3.1.2)



Photo 5.3.1.2 - Rivers Agency upgraded accommodation bridge on the Halfpenny River downstream of the Knockramer Meadows Development.

From the post flood investigation it was clear that there was also a problem with an accommodation bridge in the Shanes Park area of Lurgan on the Tirsogue Drain. The investigation found the existing accommodation bridge to be under capacity and required upgrading to a sufficient size.

The new scheme involved the construction of a new 2m X 1.5m precast concrete box culvert (See Photo 5.3.1.3) to replace an existing inadequate 1350mm diameter culvert which was prone to blockage. The scheme was developed to alleviate flood risk to 24 houses that had flooded in the past in the Shanes Park area of Lurgan. The scheme was appraised, designed and supervised by Rivers Agency engineering staff, and constructed by the Rivers Agency Direct Labour. The works were carried out at a cost of £43,000.



Photo 5.3.1.3 - Rivers Agency upgraded accommodation bridge on the Tirsogue Drain in Shanes Park, Lurgan

5.3.2 PRFA - Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the town of Lurgan, in terms of the potential adverse consequences of flooding, is ranked 17th of the twenty SFRA within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Lurgan because this national assessment is based on strategic 'undefended' flood models which ignore the presence of

existing flood defence systems. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach has been taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection offered by these defences.

To facilitate a more robust assessment of the level of flood risk to Lurgan from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.3.3 Catchment Description

The Tirsogue Drain and Flush River catchments are classified as being largely rural watercourses, whereas the Halfpenny River is considered to be moderately urbanised as it flows through Craigavon.

5.3.4 Fluvial Flood Risk Assessment

Flood Model

The Lurgan flood model was constructed using InfoWorks RS 1D/ 2D (Version 13) and InfoWorks ICM 1D/ 2D (Version 3.5) modelling software. InfoWorks RS is an integrated hydrological and hydraulic modelling package developed by Innowyze. It includes full solution modelling of open channels, floodplains, embankments and hydraulic structures. InfoWorks ICM (Integrated Catchment Modelling) is an integrated modelling platform which incorporates both urban and river catchments. It provides the ability to model the complete drainage system, both natural and engineered, above and below-ground drainage systems including sewers, surface water, river and floodplains.

Fluvial Flooding Mechanisms

Clanrolla Tributary

Figure 5.3.4.1 illustrates the predicted extents of the potential fluvial flooding from the Clanrolla Tributary in Lurgan and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.3.4.1.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the culverted Clanrolla Tributary watercourse within the Westwood Development and that the resulting surface water flow will pond to shallow depths up to 300mm in the low lying areas of the development. It is estimated that **76** residential properties could be internally flooded at this event at a cost of around **£414,000**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the vicinity of the Westwood Development. Flooding from the 1% AEP (Q100) event is estimated to affect **130** residential properties and **1** non residential property at a cost of around **£1,188,000**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£3.8 million**.

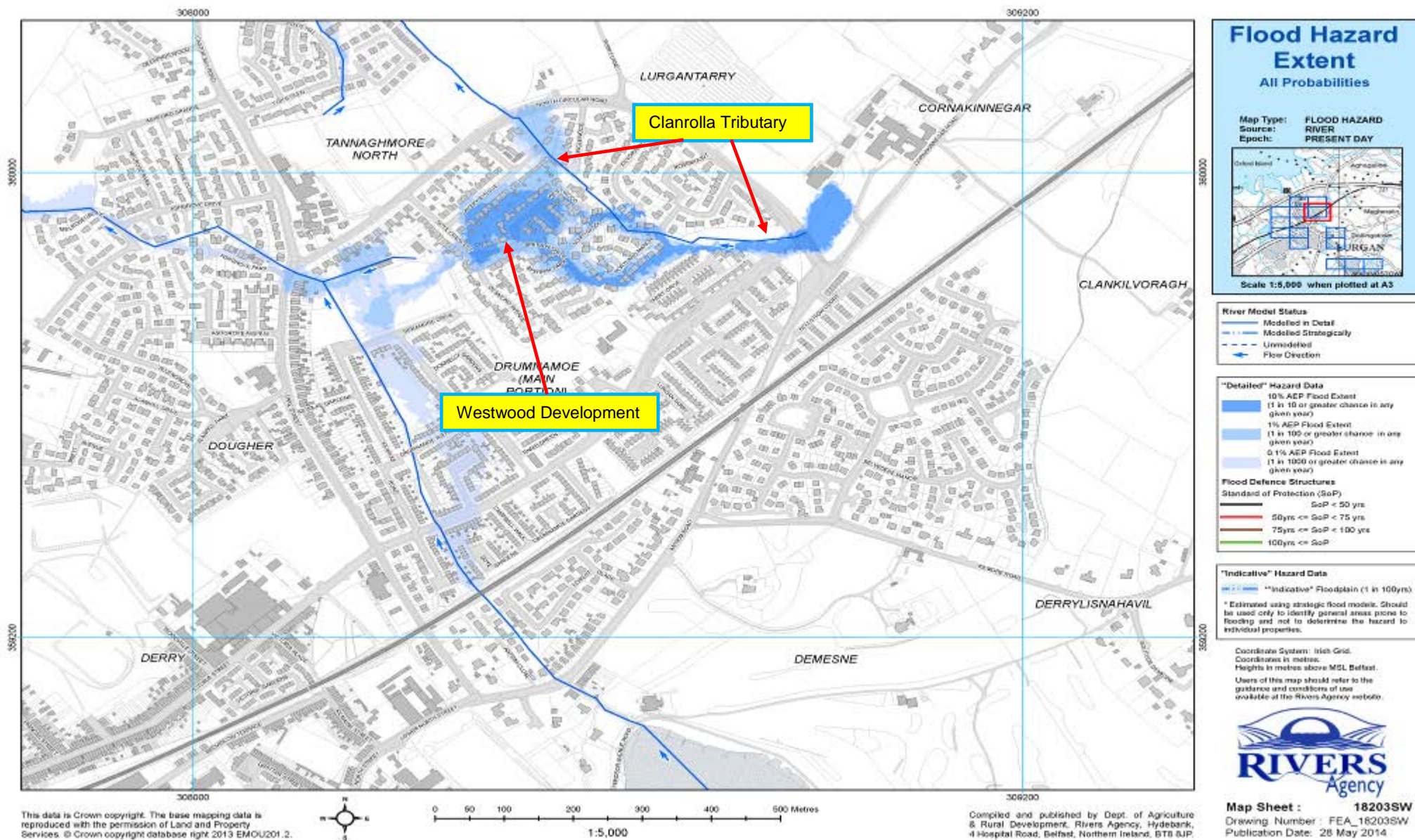


Figure 5.3.4.1 - Flood extent map for Clanrolla Tributary in Lurgan

Table 5.3.4.1 - Lurgan SFRA – Clanrolla Tributary			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	76	90	130
Non Residential (Nr)	0	0	1
Economic Damage (£)	£414,572	£824,513	£1,188,274
Annual Average Damage (£)	£126,725		
Present Value (£)	£3,801,750		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Halfpenny River

Figure 5.3.4.2 illustrates the predicted extents of the potential fluvial flooding from the Halfpenny River in Lurgan and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.3.4.2.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the culverted watercourse known as Halfpenny River within the Knockramer Development and that the resulting surface water flow will pond to shallow depths up to 300mm in the low lying areas most notably at Knockramer Meadows. It is estimated that **13** residential properties could be internally flooded at this event causing damages in excess of **£172,000**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations, although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the vicinity of the Knockramer Meadows. Flooding from the 1% AEP (Q100) event is estimated to affect **30** residential properties at a cost of around **£448,000**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£3.1 million**.

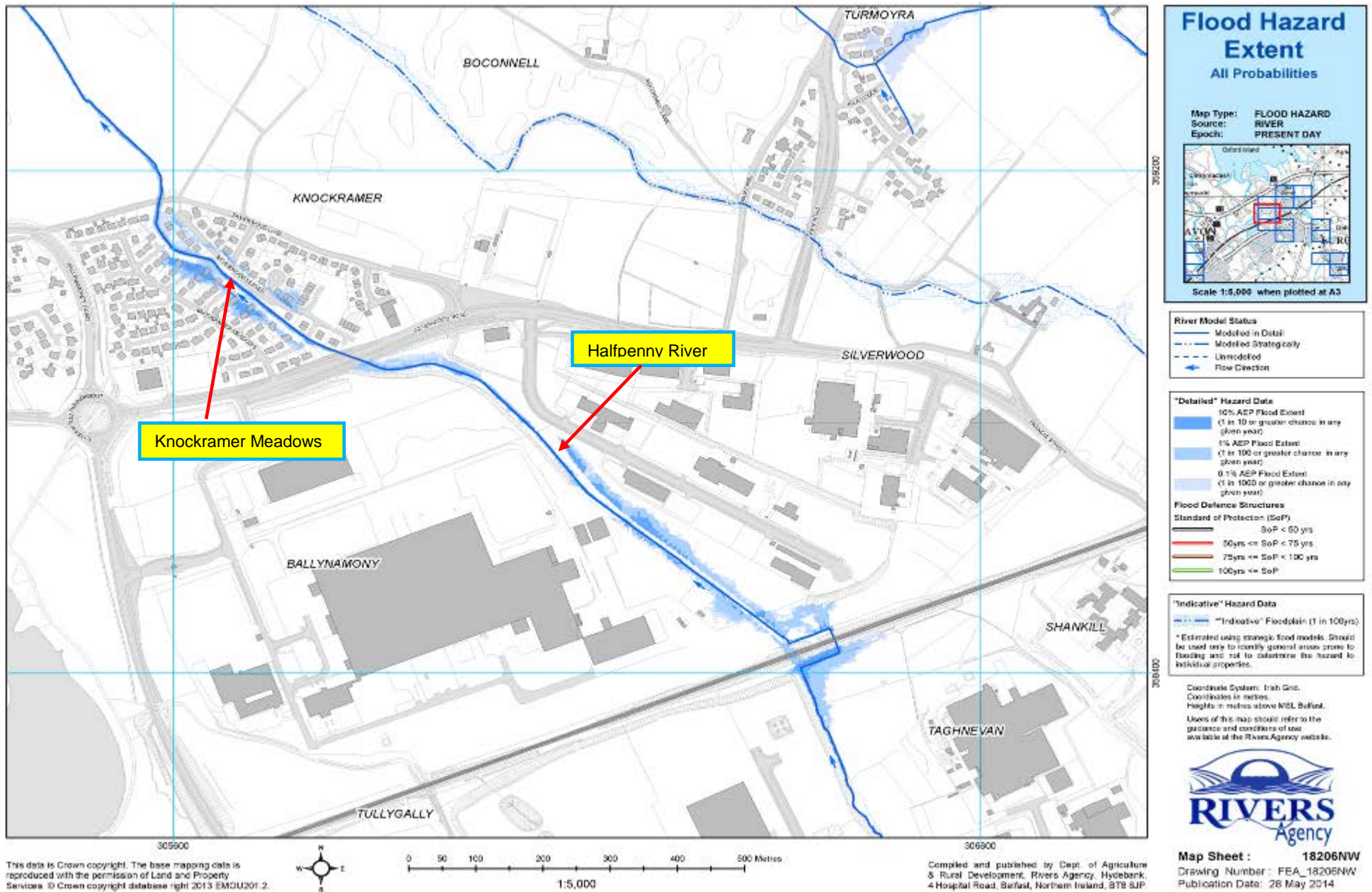


Figure 5.3.4.2 - Flood extent map for Halfpenny River in Lurgan

Table 5.3.4.2 - Lurgan SFRA – Halfpenny River			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	13	15	30
Non Residential (Nr)	0	0	0
Economic Damage (£)	£172,440	£218,517	£448,873
Annual Average Damage (£)	£103,459		
Present Value (£)	£3,103,770		
IPPC sites (Nr)			
	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0
	0	0	0

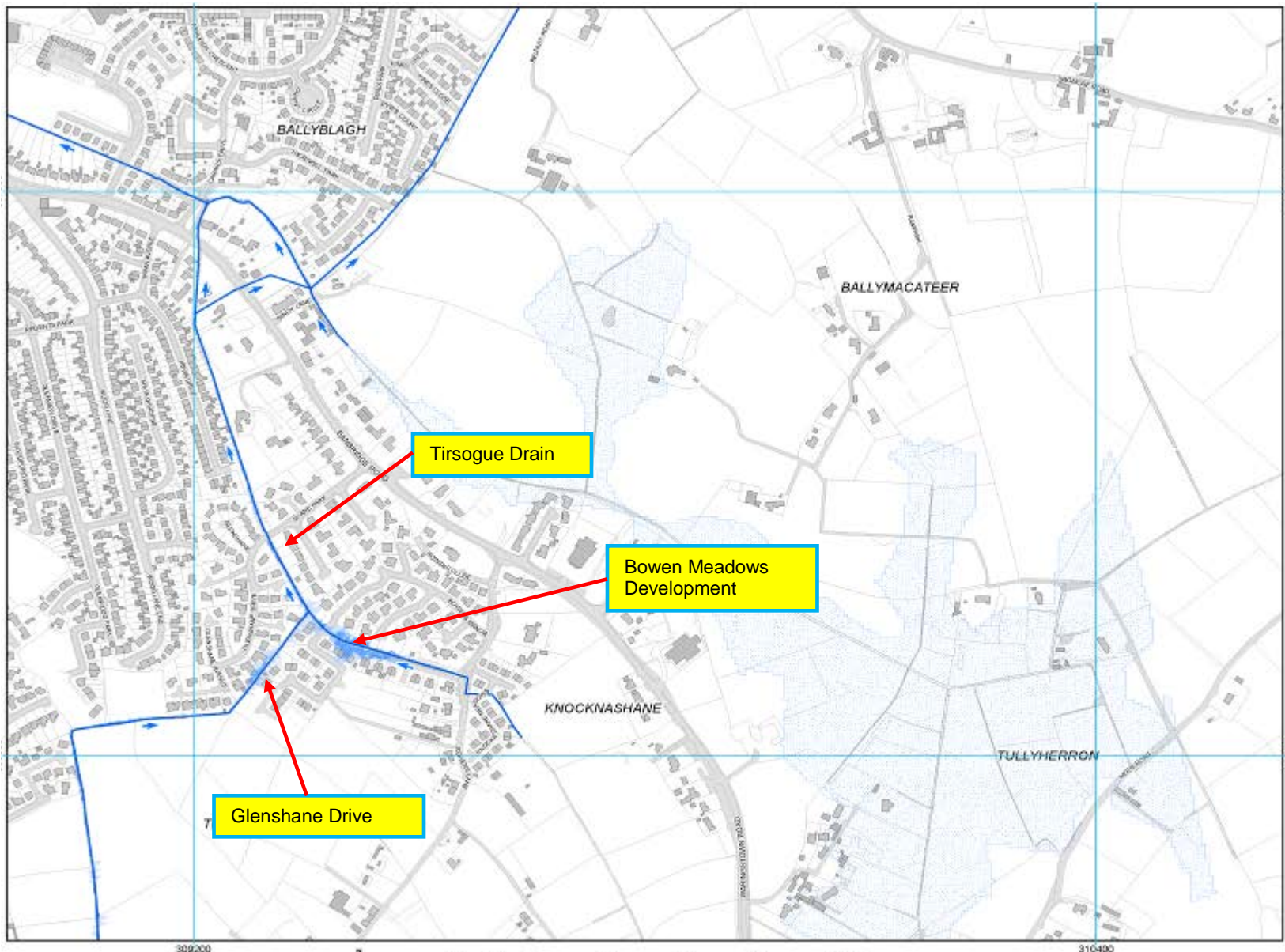
Tirsogue Drain/Tirsogue Drain Tributary

Figure 5.3.4.3 illustrates the predicted extents of the potential fluvial flooding from the Tirsogue Drain Tributary in Lurgan and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.3.4.3.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the open watercourse known as the Tirsogue Drain Tributary in the Bowens Meadows Development and that the resulting flood water ponds to a depth of up to 300mm in the low lying areas of the development. It is estimated that **4** residential properties could be internally flooded at this event causing damages in excess of **£1,217**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same location in Bowens Meadows and in Glenshane Drive, although the flood inundation areas are more extensive and deeper (up to 1m deep), particularly in the vicinity of the Bowens Meadows Development. Flooding from the 1% AEP (Q100) event is estimated to affect **10** residential properties at a cost of around **£21,351**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£30,000**.



Flood Hazard Extent

All Probabilities

Map Type: FLOOD HAZARD
Source: RIVER
Epoch: PRESENT DAY

Scale 1:5,000 when plotted at A3

River Model Status

- Modelled in Detail (solid blue line)
- Modelled Strategically (dashed blue line)
- Unmodelled (dotted blue line)
- Flow Direction (blue arrow)

"Detailed" Hazard Data

- 10% AEP Flood Extent (1 in 10 or greater chance in any given year) - Dark Blue
- 1% AEP Flood Extent (1 in 100 or greater chance in any given year) - Medium Blue
- 0.1% AEP Flood Extent (1 in 1000 or greater chance in any given year) - Light Blue

Flood Defence Structures

Standard of Protection (SoP)

- SoP < 50 yrs (Black line)
- 50yrs <= SoP < 75 yrs (Red line)
- 75yrs <= SoP = 100 yrs (Orange line)
- 100yrs <= SoP (Green line)

"Indicative" Hazard Data

- "Indicative" Floodplain (1 in 100yrs) - Dotted blue line

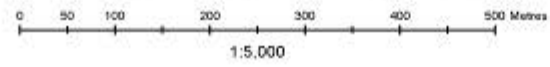
* Estimated using strategic flood models. Should be used only to identify general areas prone to flooding and not to determine the hazard to individual properties.

Coordinate System: Irish Grid.
Coordinates in metres.
Heights in metres above MSL, Belfast.
Users of this map should refer to the guidance and conditions of use available at the Rivers Agency website.



Map Sheet : 18211NE
Drawing Number : FEA_18211NE
Publication Date: 28 May 2014

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Compiled and published by Dept. of Agriculture & Rural Development, Rivers Agency, Hydebank, 4 Hoapital Road, Belfast, Northern Ireland, BT8 8JF.

Figure 5.3.4.3 - Flood extent map for Tirsoque Drain/Tirsoque Drain Tributary in Lurgan

Table 5.3.4.3 - Lurgan SFRA – Tirsogue Drain			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	4	7	10
Non Residential (Nr)	0	0	0
Economic Damage (£)	£1,217	£3,172	£21,351
Annual Average Damage (£)	£994		
Present Value (£)	£29,820		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.3.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Lurgan it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Lurgan, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency will also review the existing Development Plan for Lurgan (Craigavon Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Lurgan area are:

- The playing fields north of Deramore Drive
- The south east corner of St Michaels Grammar School

Planning Applications

Fluvial Areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Lurgan where re-development may be likely to take place are:

- The area south of the North Circular Road
- The Knockramer Development
- Bowen Meadows Development

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a historic surface water flooding Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Controlled Reservoirs identified in the Lurgan area are as follows:

- The Park Lake

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Within the Lurgan area the following potential schemes have been identified and will be referred to the appropriate bodies for further investigation or detailed feasibility study.

List of possible schemes in Lurgan SFRA.

Westwood Development, Clanrolla River

- Fluvial flooding from the Clanrolla River
- Flood damage avoidance figure of £3.8 million

Knockramer Development, Halfpenny River

- Fluvial flooding from the Halfpenny River
- Flood damage avoidance figure of £3.1 million

Bowens Meadows Development, Tirsogue Drain

- Fluvial flooding from the Tirsogue Drain
- Flood damage avoidance figure of £30k

Preparedness

In Lurgan it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Lurgan which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring the following areas could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Westwood / Sperrin Drive area.
- Knockramer Meadows / Silverwood Leaves area.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience
- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRAs in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.4 Antrim SFRA – Sixmilewater

The core boundary of the Antrim SFRA, which has been determined through the PFRA, is located within the Sixmilewater Local Management Area and illustrated in Figure 5.4 below.

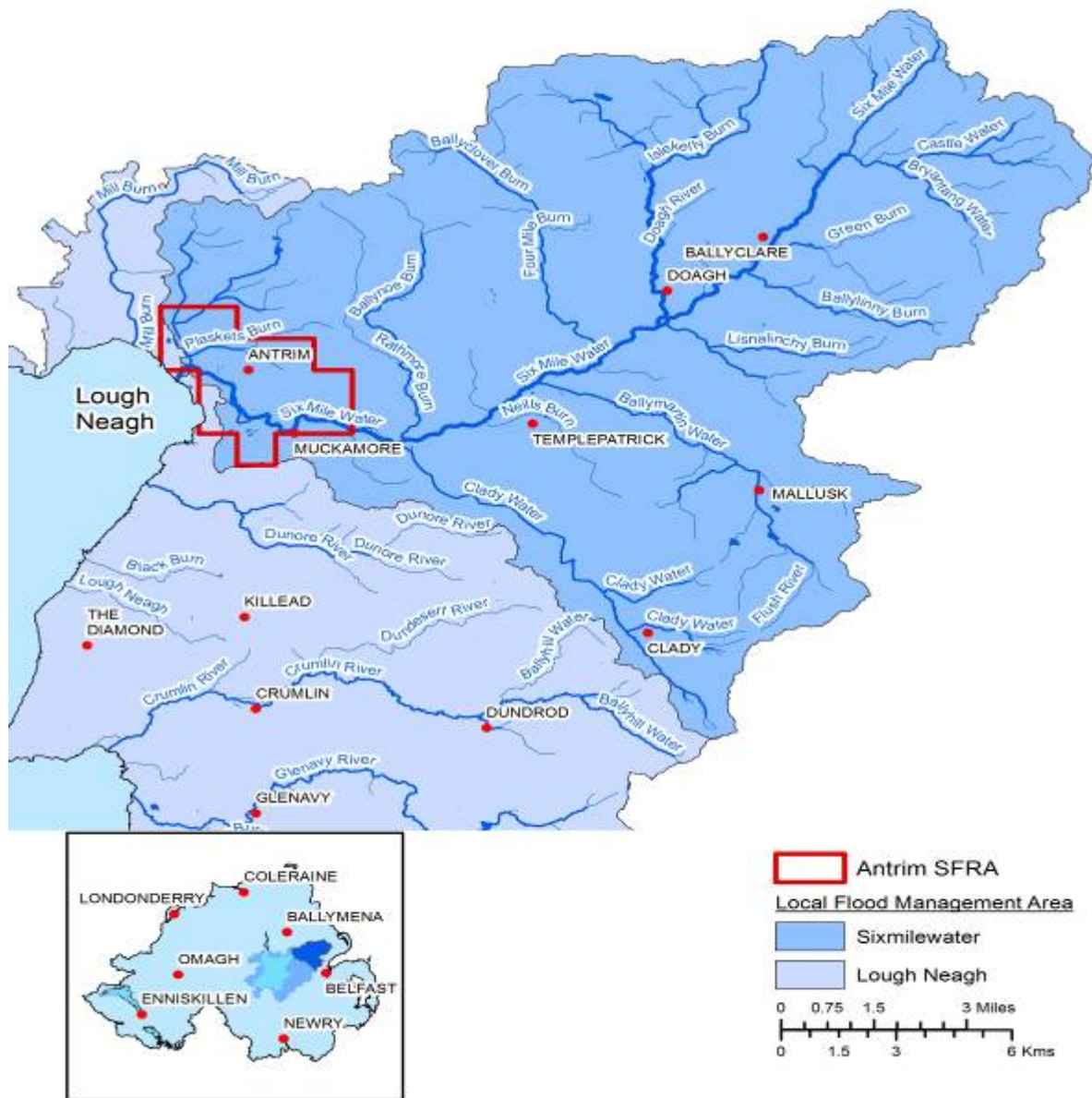


Figure 5.4 – Sixmilewater LFMA and Antrim SFRA

5.4.1 Flooding history

A search of flood records in the Antrim area has revealed very limited information on historic flooding along the Sixmilewater either in Antrim or elsewhere, with only very brief accounts for 1890 and 1949. There are two possible reasons for the lack of reporting:

1. **Properties flooded in 2008 event were built after the historic flood events.** Many of the properties flooded in 2008 were recently built. This includes properties at Greenmill in Muckamore and Riverside in Antrim. However, many affected properties in Antrim are more than 100 years old and most houses at Abbeyview, Muckamore date from late nineteenth or early twentieth century. A flood of the magnitude of that in 2008 would have affected fewer properties had it occurred in 1968, 1952 or 1949. However, in these years and even in the nineteenth century, a sufficient number of properties would have been affected which one might have expected to have attracted regional journalistic attention.
2. **Flooding has occurred but not been reported.** Historic flood reporting is limited by the absence of a local newspaper until the 1970s. It is known that some flooding has occurred in Muckamore in the past which has not been reported in regional or local news papers based outside Antrim. A respondent resident in Abbeyview Muckamore indicated that a small number of houses, which were also flooded in 2008, had been affected by another flood in 1987.

It is, therefore concluded that the August 2008 flood in Antrim is not only the greatest in the river gauged record from 1971 but very likely is the greatest in the historic period reviewed from 1883.

Since the introduction of the flooding hardship payment scheme in 2007 there have been 152 payments issued to homeowners in the Antrim SFRA. The majority of these payments (129) relate to the extreme flooding on 16th August 2008 which affected large parts of the central and to a lesser extent, eastern parts of the province. Most of the flooding which occurred on that day was estimated to have a return period in excess of the 1%AEP (Q100) event. The properties affected during this particular event were mainly clustered in the vicinity of Meadowside, Riverside and Muckamore.



Photo 5.4.1.1 – Flooding at the entrance to Abbeyview 16th August 2008.



Photo 5.4.1.2 – Flooding at Greenmill, Muckamore 16th August 2008

Existing Flood Defences

Muckamore

The defence is located on the left bank of the river and has a total length of 800m between Alexandra Park and Abbeyview. The flood defence consists of a sheet pile wall with a concrete capping beam and short sections of reinforced concrete wall at the intersection with bridge the abutments. This defence was designed by Gault Cambers Bullen now (AECOM) and was constructed in November 2000. The flood defence was designed to provide a 1:100 year standard of protection, for which the flow estimate was 168.8m³/s. A previous level survey completed on the top of the flood defence was found to vary between 30.08 and 31.55m AOD.

Meadowside

The area of Meadowside is protected by a flood defence consisting of a 43m section of reinforced concrete wall and a 200m section of clay cored embankment. Design drawings indicate that the levels of the defences are:

- Flood Wall – 19.50m AOD
- Flood Embankment – 20.00m AOD

From the topographic survey completed as part of Meadowside Post Flood Review it was found that the defence height varied as follows:

- Flood Wall – 19.45 to 19.54m AOD
- Flood Embankment – 19.14 to 19.64m AOD

Following the flood event in August 2008, which almost over topped the defence in Meadowside, a decision was made by Rivers Agency to raise certain sections of the flood embankment, which had subsided over a period of time, to its original design level. Interim works to the flood wall were also carried out at the same time. These works consisted of increasing the level of the flood wall by adding concrete to the upstand.

Antrim, Riverside

A number of residential and commercial properties are protected in this area by a 100m long hard concrete retaining wall on the right bank approximately 120m downstream of the Belmont Road Bridge. As part of the Riverside and Masserene Street post August 2008 Flood Investigation by Rivers Agency, a comprehensive topographic survey of the defence and surrounding area was undertaken. It was found that the top of the concrete wall varied between 18.29m to 18.41m AOD. It was also found that ground levels behind the defence were higher than the defence, following redevelopment of the mill site.

5.4.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the town of Antrim, in terms of the potential adverse consequences of flooding, is ranked 12th of the twenty SFRA within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Antrim. This is because this national assessment is based on strategic 'undefended' flood models which ignore the presence of existing flood defence systems such as the Millside Flood Wall and Meadowside flood bank. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach was taken because at the time of the assessment there was

a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection offered by these defences.

To facilitate a more robust assessment of the level of flood risk to Antrim from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.4.3 Catchment Description

The Sixmilewater rises at an elevation of approximately 330m AOD in an area of coniferous forest at Headwood 7km south of Larne and drains a catchment of approximately 301km² to its ultimate discharge to Lough Neagh at Antrim Boat Club just south of Shane's Castle. The study reach and associated catchment is shown in Figure 5.4.3.1 Approximately 7km downstream of the source, Sixmilewater is joined by Ballynure Water on its left bank, west of Ballynure village.

The catchment land use for both watercourses appears to be predominantly grass and agricultural with a few sporadic urbanised areas particularly in the upper (north eastern) reaches and some isolated areas of forestry.

Further downstream the catchment noticeably flattens and there is a small increase in the prevalence of urban areas, including Ballynure, Ballyclare and Antrim close to the Sixmilewater's ultimate discharge into Lough Neagh at an elevation of approximately 15m AOD.

The average annual rainfall for the Sixmilewater catchment is approximately 1000mm - 1200mm. Antrim town centre is a very heavily urbanised area with a lot of hard standing areas with some large green areas such as Antrim Castle Gardens. Approximately 90% of Antrim town is urbanised.

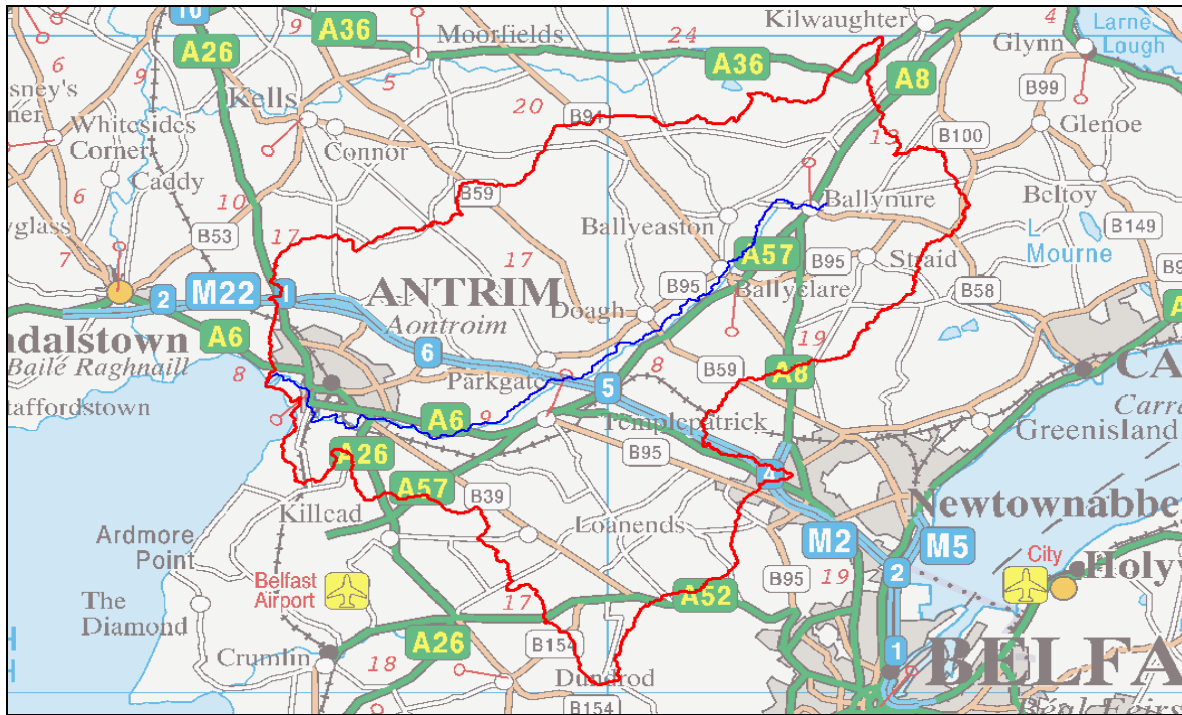


Figure 5.4.3.1 – Sixmilewater Catchment

5.4.4 Fluvial Flood Risk Assessment

Flood Model

The model constructed for the Antrim SFRA was an InfoWorks-RS model which was largely based on the existing steady state 1-dimensional HEC-RAS model. The existing geometry data within the HEC-RAS model was updated through the main urban areas via a commissioned channel survey undertaken during February and March 2009. All pre-existing hydraulic structure information within the HEC-RAS model was accepted as correct, although validation was undertaken via the surveying of soffit levels.

The existing cross sections were geo-referenced based on their approximate position obtained from the supplied archive drawings. The newly surveyed channel data was then imported directly in to the model geometry data. Cross-sections were extended across the full width of the floodplain using the supplied LiDAR data. The final model contained 264 cross-sections, 31 bridges and 10 weirs. The entire geometry file was then exported from HEC-RAS and imported into InfoWorks-RS, although this process did not transfer the hydraulic structures which required manual entry.

Fluvial Flooding Mechanisms

Muckamore

Rivers Agency's new hazard map indicates the Sixmilewater River begins to flood out of channel at Abbeyview, Muckamore between a 4%AEP (Q25) event and 2% AEP (Q50) event. (See Figures 5.4.4.1 and 5.4.4.2)

The model shows that at the relatively high frequency 10% AEP (Q100) flood event, floodwater is predicted to spill from the Sixmilewater to the south of the Greenmill Development and that the resulting surface water ponds to shallow depths. It is estimated that **1** residential property could be internally flooded at this event resulting in minimal damages.

At the more extreme 1% AEP (Q100) event, the predicted flooding is generally confined to the same location in Greenmill and also to the Abbeyview Developments. The flood inundation areas are more extensive and have a depth of 300mm to 1m. Flooding from the 1% AEP (Q100) event is estimated to affect **51** residential properties at a cost of around **£514,380**. The present value of the total property damages from potential future floods is calculated to be in excess of **£770,000**.

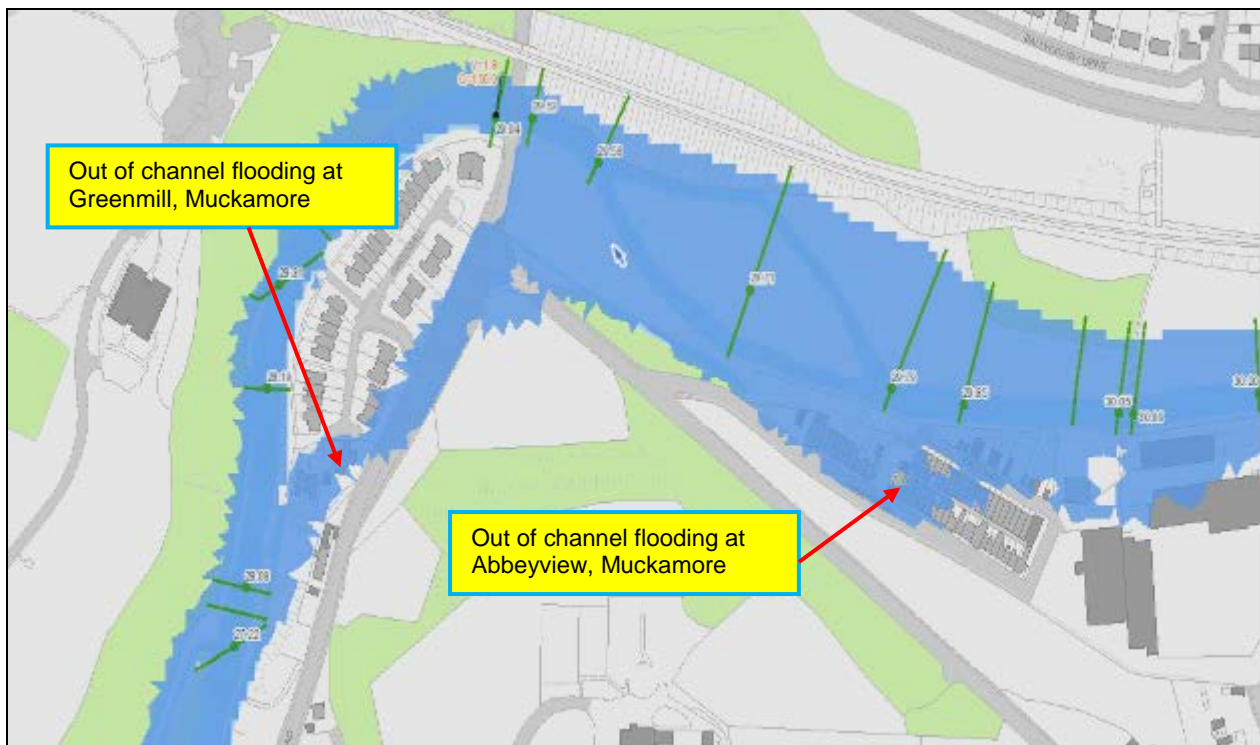
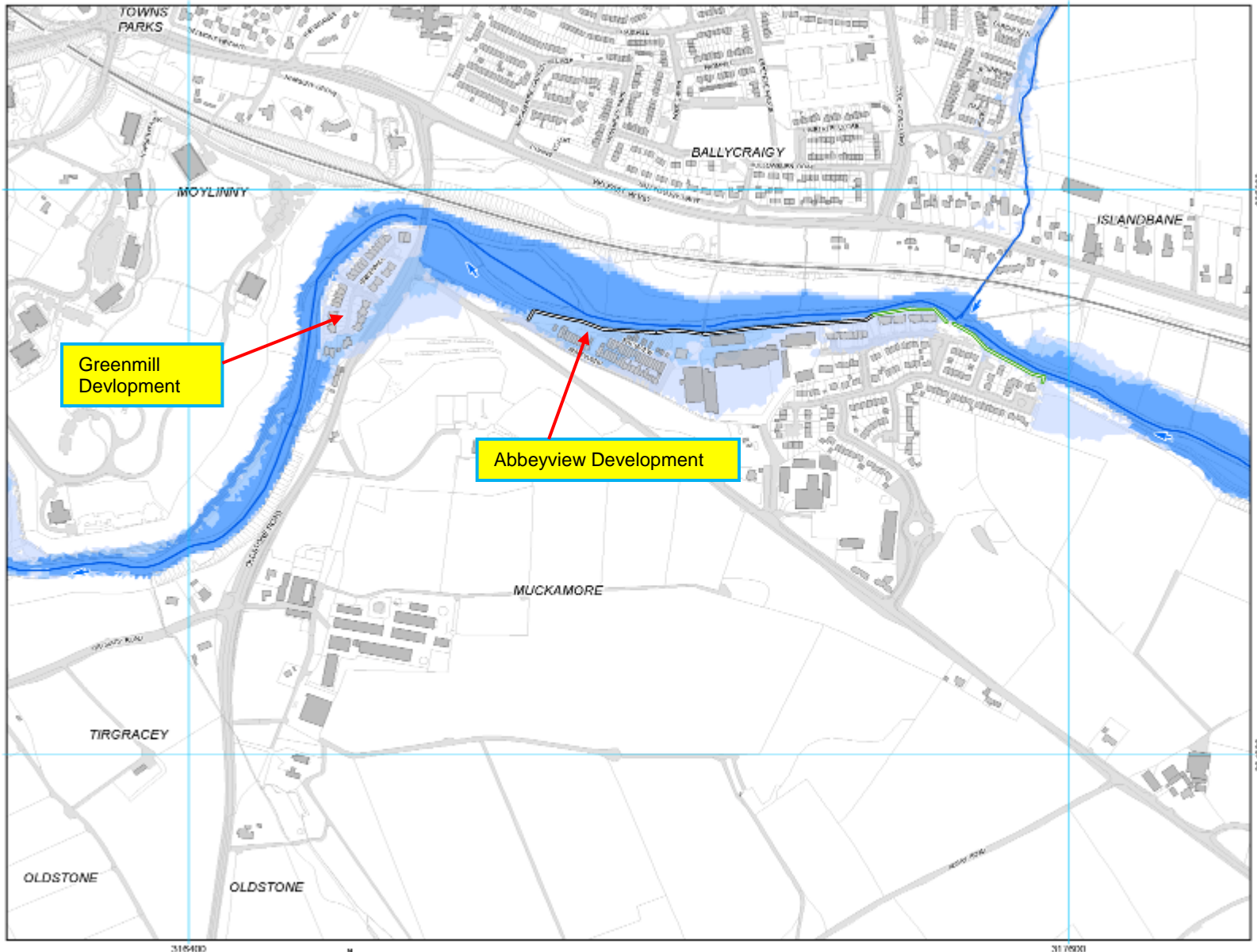


Figure 5.4.4.1 – Sixmilewater River out of bank at Muckamore 1% AEP (Q100)



Flood Hazard Extent

All Probabilities

Map Type: FLOOD HAZARD
 Source: RIVER
 Epoch: PRESENT DAY

Scale 1:6,000 when plotted at A3

River Model Status

- Modelled in Detail
- - - Modelled Strategically
- - - Unmodified
- ← Flow Direction

"Detailed" Hazard Data

- 10% AEP Flood Extent (1 in 10 or greater chance in any given year)
- 1% AEP Flood Extent (1 in 100 or greater chance in any given year)
- 0.1% AEP Flood Extent (1 in 1000 or greater chance in any given year)

Flood Defence Structures

Standard of Protection (SoP)

- 50yrs < SoP < 75 yrs
- 75yrs < SoP < 100 yrs
- 100yrs < SoP

"Indicative" Hazard Data

- "Indicative" Floodplain (1 in 100yrs)

* Estimated using strategic flood models. Should be used only to identify general areas prone to flooding and not to determine the hazard to individual properties.

Coordinate System: Irish Grid.
 Coordinates in metres.
 Heights in metres above MSL Belfast.
 Users of this map should refer to the guidance and conditions of use available at the Rivers Agency website.

Map Sheet : 11202SE
Drawing Number : FEA 11202SE
Publication Date: 10 June 2014

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0 50 100 200 300 400 500 Metres
1:5,000

Compiled and published by Dept. of Agriculture & Rural Development, Rivers Agency, Hydabank, 41 Hospital Road, Belfast, Northern Ireland, BT5 1UP

Figure 5.4.4.2 – Flood Hazard extent map for Muckamore, Antrim

Table 5.4.4.1 - Antrim SFRA – Muckamore			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	1	3	51
Non Residential (Nr)	0	0	0
Economic Damage (£)	£500	£1500	£514,380
Annual Average Damage (£)	£25,703		
Present Value (£)	£771,090		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	1	1	2
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	1	1	3
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	2	4
Listed Buildings	9	0	1
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Meadowside

Rivers Agency's new hazard maps show no flooding to the Meadowside Development in Antrim. Meadowside previously flooded in 2008. Since then Rivers Agency has carried out essential maintenance works to the existing flood defence surrounding Meadowside by returning the crest, which had subsided over time, to its original design level. (See Figures 5.4.4. and 5.4.4.4)

Rivers Agency commissioned a feasibility study on the Sixmilewater after the 2008 flood event. This was completed in 2013. The report highlighted that this development was at risk of flooding from the back up of surface water and not from fluvial flooding. The Meadowside defence now has a 1:100 year standard of protection.

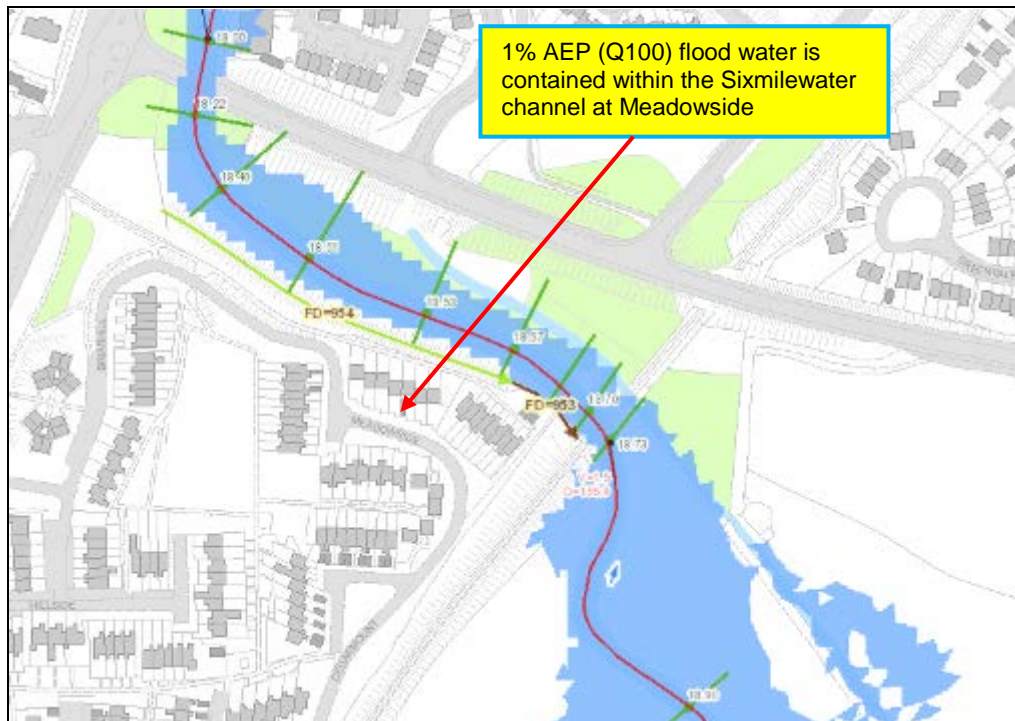


Figure 5.4.4.3 – Sixmilewater River at Meadowside, Antrim 1% AEP (Q100)

Therefore there is no potential scheme at this location as the Meadowside Development has a standard of protection greater than 100 years against fluvial flooding

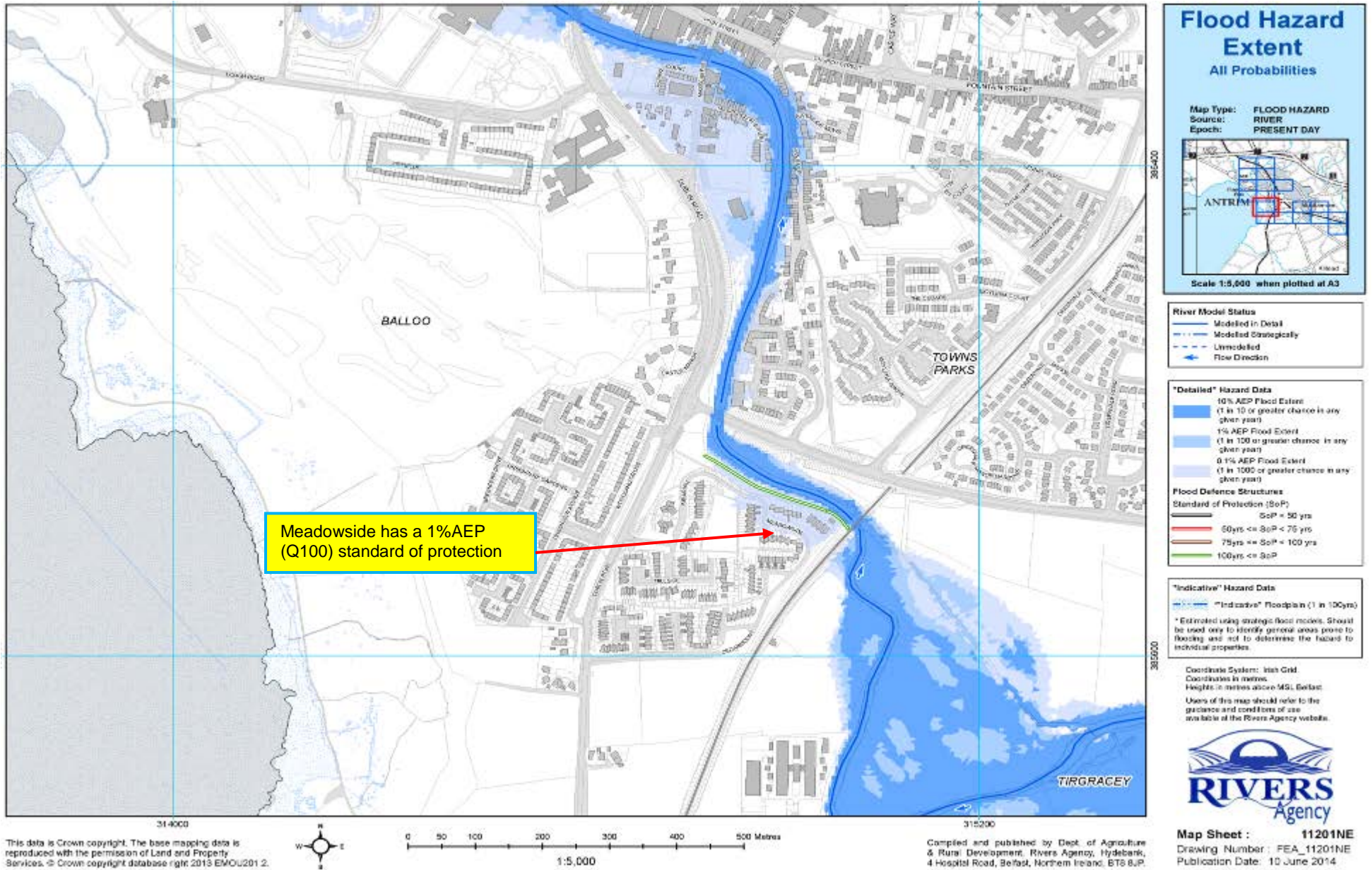


Figure 5.4.4.4 – Flood Hazard extent map for Meadowside, Antrim

Riverside & Masserene Street

Figures 5.4.4.5 and 5.4.4.6 illustrate the predicted extents of the potential fluvial flooding from the Sixmilewater in Antrim town and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.4.4.2.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from Sixmilewater channel within the Riverside Development and Masserene Street and that the flood water will pond to shallow depths up to 300mm. It is estimated that **27** residential and **19** non residential properties could be flooded at this event causing damages in excess of **£398,829**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the vicinity of the Masserene Street. Flooding from the 1% AEP (Q100) event is estimated to affect **58** residential and **46** non residential properties at a cost of around **£1,409,582**. The present value of the total property damages from potential future floods is calculated to be in excess of **£7.2 million**.

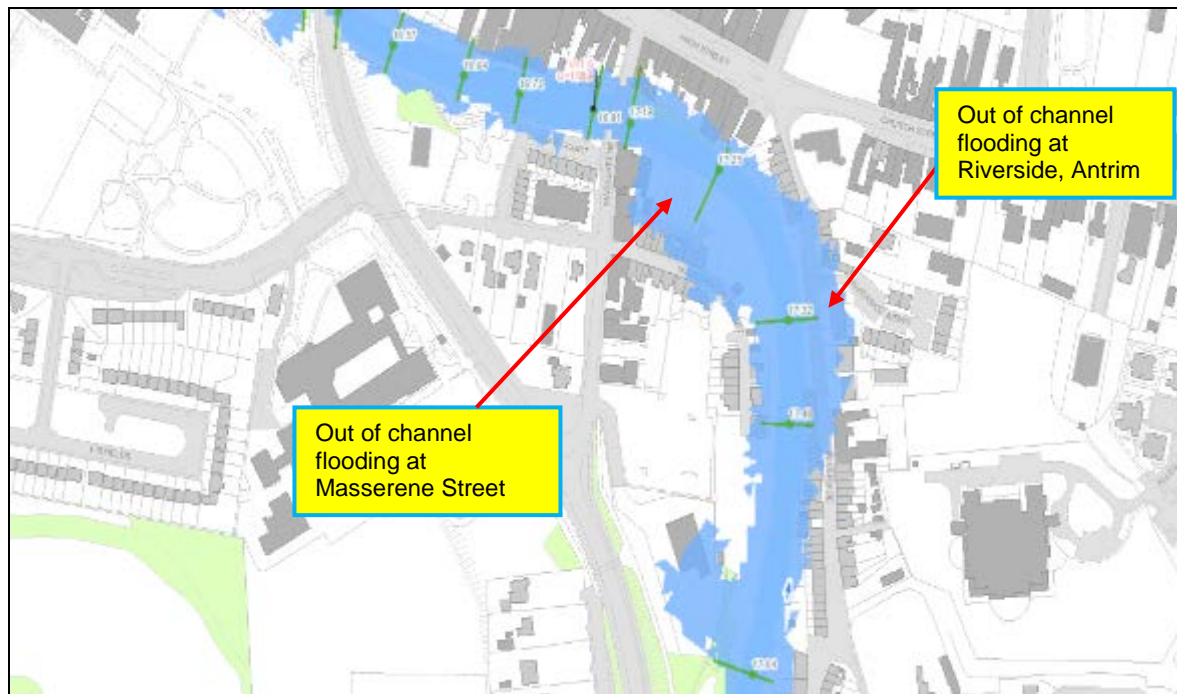


Figure 5.4.4.5 – Sixmilewater out of bank at Riverside, Antrim 1% AEP (Q100)

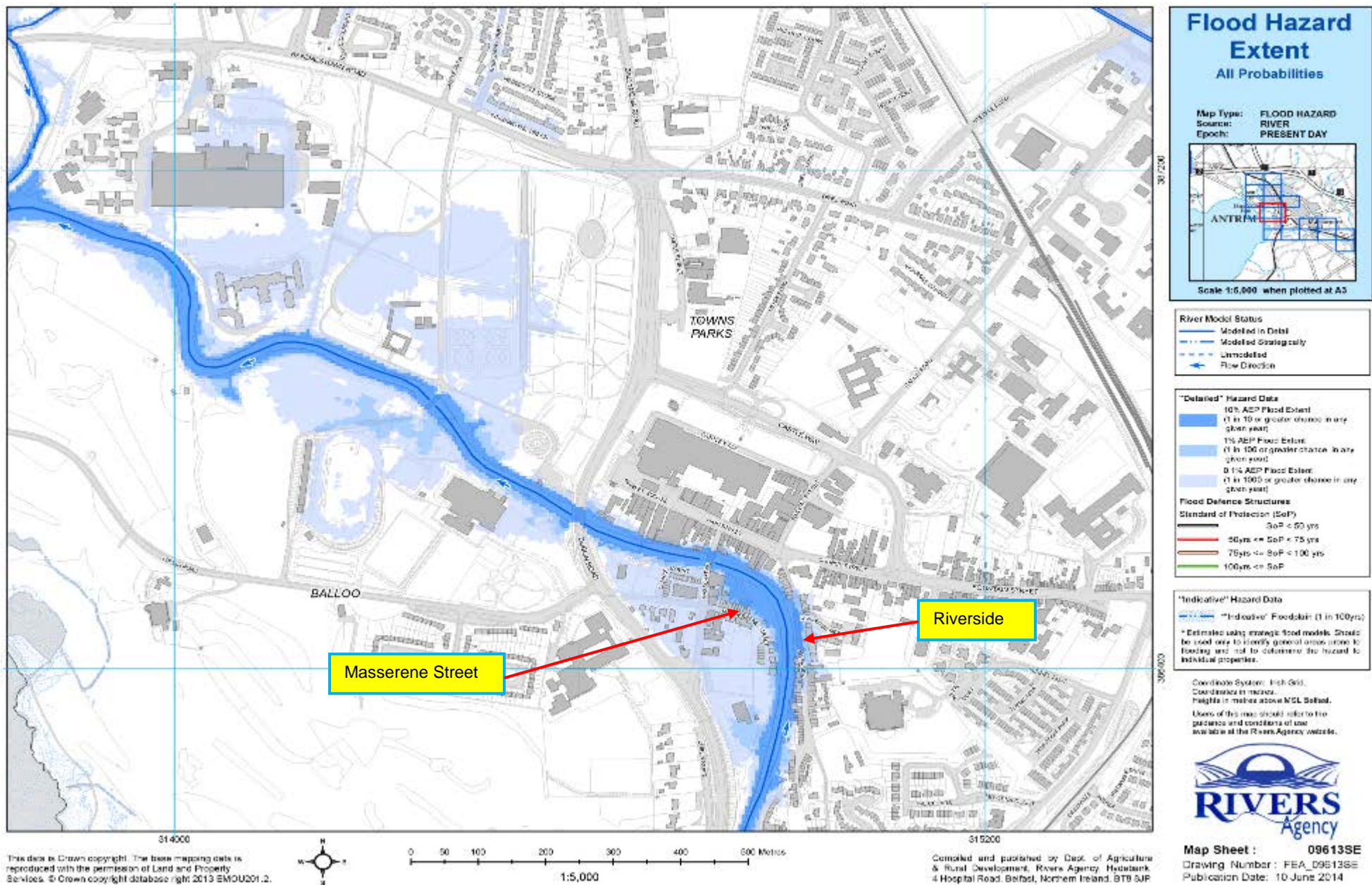


Figure 5.4.4.6 – Flood Hazard extent map for Riverside and Masserene Street, Antrim

Table 5.4.4.2 - Antrim SFRA – Riverside & Masserene St			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	27	35	58
Non Residential (Nr)	19	25	46
Economic Damage (£)	£398,829	£666,660	£1,409,582
Annual Average Damage (£)	£242,215		
Present Value (£)	£7,266,450		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	2
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	3	3
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	2	2
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	1	1	1
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	1	1	1
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	1	1	1
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	9	8	8
Listed Buildings	2	2	3
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	3	3	3

Kilbegs Industrial Estate

A hydraulic analysis of the Hollywell Burn and Plaskets Burn identified that 18 commercial properties, could potentially be affected during a 1 in 100 year flood event. The areas identified as being at risk from flooding are listed below:

- Tesco Distribution Centre,
- 17 Commercial units within Kilbegs Industrial Estate.

Figure 5.4.4.7 illustrates the predicted extents of the potential fluvial flooding from the Hollywell Burn in Antrim town and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.4.4.7.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the Hollywell Burn within the Kilbegs Industrial Estate and that the flood water will pond to shallow depths up to 300mm. It is estimated that **7** commercial properties could be flooded at this event causing damages in excess of **£61,596**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the vicinity of Fergusons Way. Flooding from the 1% AEP (Q100) event is estimated to affect **18** commercial properties at a cost of around **£562,033**. The present value of the total property damages from potential future floods is calculated to be in excess of **£1.5 million**.



Figure 5.4.1.3 – Hollywell Burn Downstream, Antrim



Figure 5.4.1.4 – Hollywell Burn Upstream, Antrim

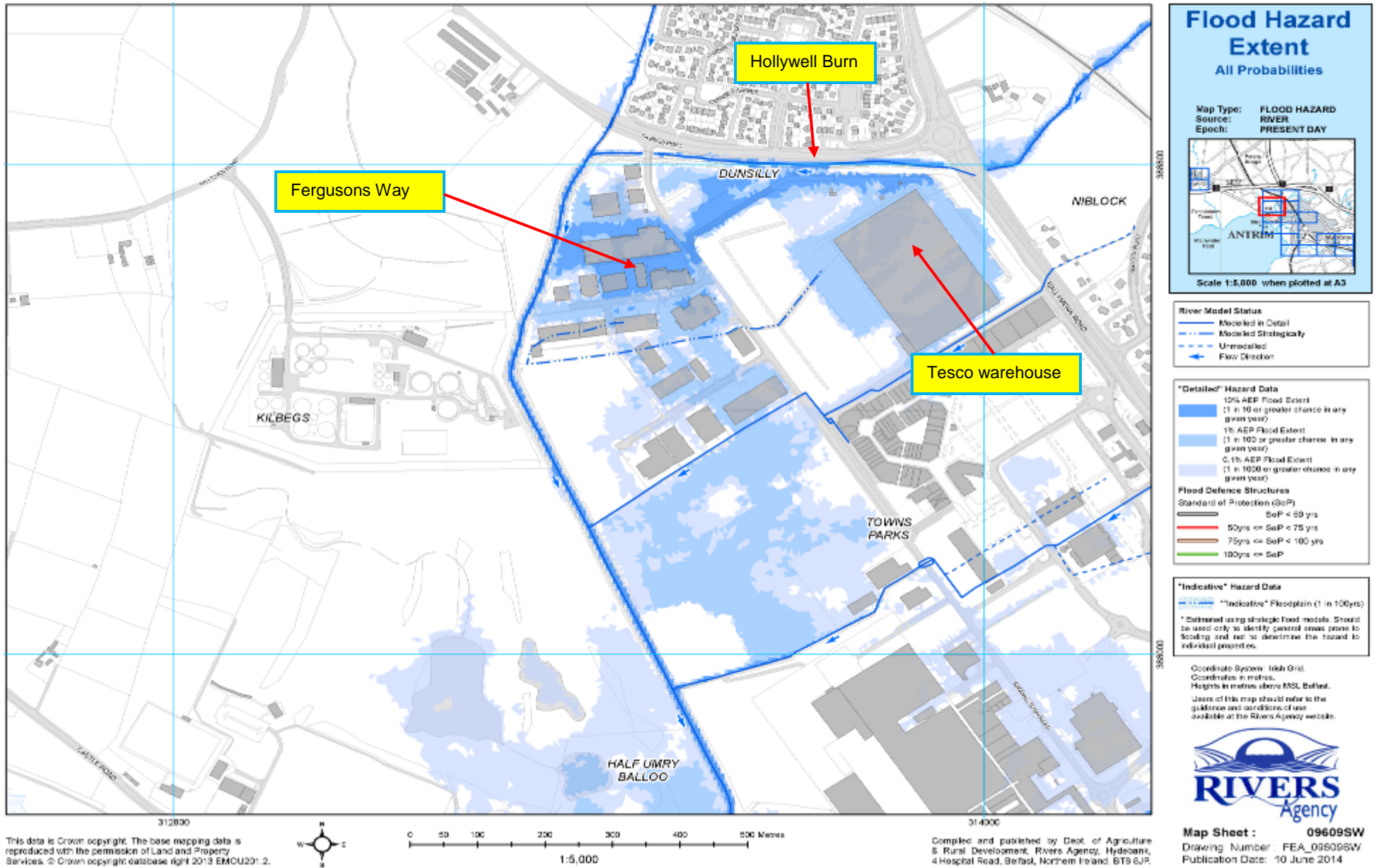


Figure 5.4.4.7 – Flood Hazard extent map for Hollywell Burn, Kilbeas Industrial Estate, Antrim

Table 5.4.4.3 - Antrim SFRA – Hollywell Burn, Kilbegs Ind Estate			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	0	0
Non Residential (Nr)	7	12	21
Economic Damage (£)	£61,596	£193,600	£562,033
Annual Average Damage (£)	£50,774		
Present Value (£)	£1,523,220		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.4.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Antrim it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Antrim, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency shall also review the existing Development Plan for Antrim (Antrim, Ballymena, Larne) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Antrim area are:

- To the north west of the town and to the west of the Sixmilewater River at Baloo.
- To the north west of the town, to the west of the Sixmilewater River and north of the Randalstown Road.
- To the south of the Tully Road, to the south of the town and on both sides of the Sixmilewater River.
- Localised sites at Muckamore, Meadowside and in the centre of the town at Riverside and Masserene Street.

Planning Applications

Fluvial Areas at Risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Antrim where re-development may be likely to take place are:

- Greenmill and Abbeyview in Muckamore,
- Meadowside
- Riverside and Masserene Street in the town centre.

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flood hardship payments. Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

The main areas identified in Antrim as being at surface water flood risk are:

- Meadowside Housing Development
- Riverside and Masserene Street, Antrim Town Centre
- Muckamore Gardens

A wastewater pumping station upgrade with increased forward flow is required at the Muckamore Garden area of Antrim.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development

proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Controlled Reservoirs identified in the Antrim area are as follows:

- Upper Potterswall Reservoir
- Lower Potterswall Reservoir

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool”, (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take anything from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Having conducted a detailed assessment of the fluvial flood risk to Antrim, Rivers Agency has determined that potential flood alleviation schemes may be justified for the Muckamore area, Riverside area and the Kilbegs Industrial Estate area in Antrim.

A feasibility study for the Sixmilewater River and was completed in 2014 and this identified that flood alleviation schemes may be cost beneficial. A subsequent feasibility study was completed in August 2015 for the Kilbegs Industrial Estate area of Antrim and this study also identified that a flood alleviation scheme may be cost beneficial for this area.

If flood alleviation schemes are confirmed to be economically viable then the schemes will be prioritised and placed on the Rivers Agency's Capital Works Programme.

Preparedness

In Antrim it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions including flood warning and informing activities planned from a regional perspective, are provided in Appendix E

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Antrim which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and

informing actions. Based on this scoring the following areas could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Abbeyview and Alexandra Park, Muckamore.
- Riverside and Masserene Street, Antrim.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience
- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRAs in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.5 Ballymena SFRA – Braid Water

The core boundary of the Ballymena SFRA, which has been determined through the PFRA, is located within the Braid Water Local Management Area and illustrated in Figure 5.5. below.

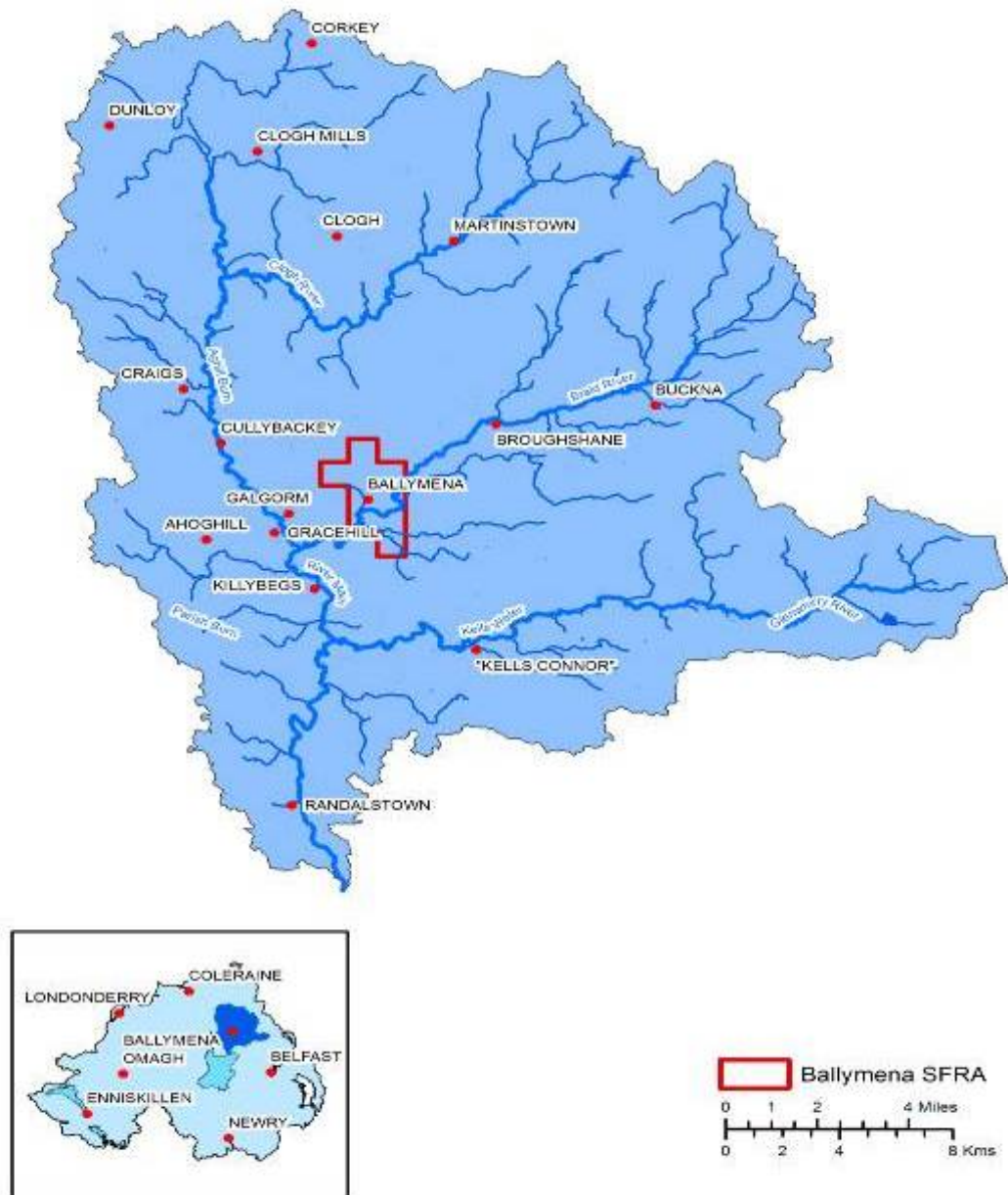


Figure 5.5 - Braid Water LFMA and Ballymena SFRA

5.5.1 Flooding History

The severity of past flooding on both the River Maine and River Braid, in both urban and rural environments, has provided impetus to protect the most vulnerable reaches. A newspaper report at the time of a severe flood on 1 November 1968 stated that ‘flooding had occurred in spite of the extensive river drainage scheme undertaken some years ago by the Ministry of Agriculture on river reaches below the town. This was the first time the Braidwater Mill was flooded since the scheme was completed. Previously identified occasions when the Braidwater flooded was in 1949 and 1952.

A further scheme was carried out on the Braid in 1994/95 to construct new flood walls and flood banks to alleviate the flooding problem on Toome Road. The gauging station at Ballee is downstream from these works and peak flows could be influenced by alteration of storage and conveyance in the catchment. Certainly, urban areas in Ballymena that were severely flooded in historical events are no longer subject to the same risk. Direct comparison of levels and flood extent achieved in 2008 and historical floods does not seem feasible.

Below is a list of all occurrences of significant flooding on the River Maine and River Braid catchments and on neighboring catchments from 1880 to present sourced from local newspapers:

Date and Source	Weather and general flood background	Neighbouring catchment flooding	Maine and Braid flooding
8 Dec 1886 Belfast N’letter Ballymena Observer	The main newspaper reference is to the impact of a severe gale which caused severe shipping losses in the Irish Sea and on the north coast of Antrim and damage on land mainly in Northern Ireland.	High river level was reported in the Bann at Coleraine. Ballymoney – land flooded but little damage done.	The Braid and Maine were reported to be swollen to an unusual height and large areas of low-lying land submerged in the townlands of Glarryford and Kellswater. Severe property flooding occurred in Ballymena from the river Braid Many houses in the vicinity of Galgorm Road, Galgorm Street, Railway Street, James Street and parts of Harryville and Ballymoney Road were flooded to as much as 6 feet .
8 Nov 1890 Belfast N’letter Ballymena Observer	Rainfall 2.35 inches in 24 hours at Ballymena Gale with heavy rain over the greater part of Britain including Wales, Scotland and Ireland, SW England with shipping losses.	Flooding reported on the River Bush, lower Bann at Coleraine, River Strule in Omagh, the Coagh River at Stewartstown.	Braid and Maine in high flood with houses in Harryville and Ballymoney Road flooded to a depth of 6 feet. Braidwater Spinning Mill and Lisnafillan Bleaching Works flooded and work temporarily stopped.

Date and Source	Weather and general flood background	Neighbouring catchment flooding	Maine and Braid flooding
<p>5 Dec 1948 Ballymena Weekly Telegraph</p>	<p>Single NI heavy rainfall listed in British Rainfall at Foffany (Mournes) of 3.02 inches (76.7 mm). No information on weather or broad extent of flooding</p>	<p>Houses also flooded in the Milltown area Ballymoney. (Balnamore Road to a depth of 3 feet), with a dozen houses affected. At Roddenfoot where houses had been previously flooded (no date stated) the water reached the doors but did not enter.</p>	<p>Ballymena flooding said to be the worst for the last 20 years with many houses and businesses flooded from the Ballee Burn at Kinhilt and Glengorm Street and Ballymoney Road. Severe flooding occurred in the Queen Street- Toome Road area with neighbouring grassland covered to a depth of six feet in places. Fifteen families on Toome Road were affected. About 200-300 yards of Queen Street were under water.</p>
<p>25 Oct 1949 Ballymena Weekly Telegraph Belfast N'letter Larne Times</p>	<p>Widespread easterly gales and flooding in eastern counties of Northern Ireland. Belfast rainfall 2 inches in 18 hours. Aldergrove 1.4 inches daily rainfall. Daily rainfall at Ballymena 1.29 inches (32.8 mm) Shipping losses and damage to boats in harbours on the Irish Sea.</p>	<p>Sixmilewater damaged Ballyclare Paper Mill. The water burst through heavy steel doors causing flooding to a depth of 3 feet.</p>	<p>Said to be the worst flooding in Ballymena for a quarter century. At Ballymena the River Braid overflowed and flooded Braidwater Spinning Mill to a depth of 3 to 4 feet; 1000 employees paid off and not expected to return for a few weeks. Water level in the Phoenix Factory at its highest in 35 years. 50 houses flooded in Ballymena. The 6 foot high wall adjoining Harryville Bridge was swept away. Houses in the Clonavon and Galgorm Street were flooded to 2-3 feet. The opinion was expressed that flooding in Toome Road was caused by the Ballee Burn rather than the River Braid.</p>
<p>9 Aug 1952 Belfast N'letter Larne Times</p>	<p>Daily rainfall second highest for Braidwater Mill with 2.08 inches (52.8) mm compared with 2.35 inches (59.7) mm in Nov 1890</p>	<p>Severe flooding in Belfast from surface runoff and overflow from Blackstaff River – 2000 houses affected. Strabane Main Street flooded for the first time in 40 years; flooding also at Glenarm and from the River Bush Flooding on the Tow River at Ballycastle.</p>	<p>Braidwater Spinning Mill under 1 foot of water from River Braid. Ballymena houses and shops flooded mainly from surface runoff. Wellington Street in the town centre was flooded for the first time in many years and residents in the Ballymoney road were seriously threatened when a three foot breach was made in a flood bank. Also affected were Galgorm Road, Queen Street and Toome Road.</p>

Date and Source	Weather and general flood background	Neighbouring catchment flooding	Maine and Braid flooding
1 Nov 1968 Belfast N'letter Ballymena Observer East Antrim Times Irish News	Strong winds and heavy rainfall were reported throughout NI. Record daily rainfall for NI at Tollmore Park Newcastle with 6.36 inches: 161.5 mm. Ballymena daily rainfall was 1.67 inches: 42.4 mm	Flooding reported in Derry from the River Foyle and in Fermanagh. Randalstown – the bridge from Neilsbrook to Old Bleach Works as badly damaged.	Severe flooding from the River Braid was reported in Ballymena. The Braidwater Spinning Mill was flooded and shift work was interrupted. A new gas plant with a retaining wall built to contain previously known floods with 18 inch freeboard was overtopped. Gallagher's tobacco factory at Lisnafillan had water in the boiler room but the rest of the factory was unaffected.
21 Oct 1987 Ballymena Times Belfast Newsletter	Slow moving depression moving up to Ireland from the bay of Biscay. Aldergrove rainfall 2 inches (50.8 mm recorded in 15 hours.	The Newsletter gives comprehensive coverage of flood hit areas throughout the province.	Flooding of roads reported in Ballymena but no homes. Residents at Toome Road Ballymena were not flooded and stated an ongoing drainage scheme aimed at easing the burden of Ballee Burn may have helped. A resident stated that he had been flooded 10 times in 40 years.
16-18 Aug 2008 Climatological Observers Link Antrim Guardian Ballymena Times	In Northern Ireland it was the wettest August since 1985 and many stations had their wettest August on record (250% of normal in mid Antrim). More than two inches (55-65 mm) of rain fell widely across many central and eastern parts of Northern Ireland. Highest official rainfall total was 74.8 mm (at Portglenone (12 km W from Ballymena) in 12 hours — a one-in-90-year event. An unofficial rain gauge in Ballyclare recorded a 24-hour total of 88.9 mm, a one-in-150-year event	Flooding was reported from across Northern Ireland, especially Belfast where a landslide caused a train to derail. Two bridges collapsed and 37 major roads were shut down, including part of the M1 motorway. Extensive flooding on the Sixmilewater at Antrim, Muckamore and Templepartick	In Ballymena Ballee Burn, on the Antrim Road side, overflowed. Queen Street had water knee deep in houses on one side but the houses on the other side escaped. Toome Road had water up to waist deep.

Table 5.5.1.1 - Accounts of flooding in Ballymena

Existing Flood Defences

The severity of past flooding on both the River Maine and River Braid, in both urban and rural environments has provided impetus to protect the most vulnerable reaches. The earliest work appears to have been carried out on the River Braid. A newspaper report at the time of a severe flood on 1 November 1968 stated that 'flooding had occurred in spite of the extensive river drainage scheme undertaken some years ago by the Ministry of Agriculture on river reaches below the town. This was the first time the Braidwater Mill was flooded since the scheme was completed'. Previous identified occasions when the Braidwater Mill was

flooded were in 1949 and 1952 so the work was done between 1952 and 1968 and presumably some years before 1968 given the uncertain reference to 'some years ago'. A further scheme was carried out on the Braid in 1994/95 to construct new flood walls and length of flood bank to alleviate the flooding problem on Toome Road. The gauging station at Ballee is downstream from these works and peak flows could be influenced by alteration of storage and conveyance in the catchment. Certainly, urban areas in Ballymena that were severely flooded in historical events are no longer subject to the same risk. Direct comparison of levels and flood extent achieved in 2008 and historical floods does not seem feasible.

Reference in newspapers was also made in 1968 to the extensive flooding of 2500 acres (1012 ha) of land in the Glaryford area of the Upper Maine with lobbying from affected farmers. The River Maine arterial drainage scheme was proposed in 1969 and was subject to a Public Inquiry in 1971 (Hutton, 1972, Wilcock, 1982). The scheme was started in the mid 1970s but the main channelisation occurred upstream from Dunminning in April 1984 and the scheme was completed in 1987. It involved channel widening, deepening and straightening over 26 km of river between Dunloy and the confluence with the River Braid. At Dunminning where the early gauging station was located, an old weir was removed and the channel deepened by about 3 m. Between Dunminning and Dunloy channel deepening was progressively reduced until at Dunloy it was about 1 metre. As described in Wilcock and Essery (1991) the scheme aimed to provide drainage benefit to 4300 ha and to reduce flooding on 730 ha of agricultural land.

A before and after study of the channelisation scheme on the catchment to Dunminning (a short distance upstream from the present Dromona gauging station) commenced in 1978 and Wilcock and Essery reported on the results of the effects on components of the water balance in several papers though not specifically on flood flows.

Channelisation occurred along the River Maine downstream from Dunminning as far as the confluence with the River Braid but no information is available on changes to the Lower Maine (either as part of the same scheme or as a separate scheme). Given the fact that a significant area of overbank storage was withdrawn and channel conveyance and velocity was increased, a significant impact on flood peaks downstream from the affected reach is to be expected. The impact of upstream channelisation is likely to persist to the mouth of the Maine at Lough Neagh.

A flood storage area is present on the Deerfin Burn which attenuates flood water from the Deerfin Burn in park land adjacent to the watercourse which has been lowered to provide additional flood storage.

There have been several schemes put in place along the watercourses in the River Maine catchment. These range from river channelisation and realignment with raised defences, to formal storage areas.

<u>Watercourse</u>	<u>Defences</u>	<u>Included in model</u>
River Maine	Flood storage area at Dunminning	Yes
River Maine	Concrete defence walls at Cullybackey. Right bank upstream and downstream of bridge	Yes
River Maine	Piled defences on both banks between Corbally Road Bridge and Gracehill Bridge (known as Galgorm Defences)	Yes
River Maine	Downstream of Gracehill Bridge	Yes
River Maine	Randalstown left bank concrete wall.	Yes
River Braid (Left Bank)	Concrete flood walls through town from Sainsburys to Harryville Bridge	Yes
River Braid (Right Bank)	Concrete flood walls through town from Sainsburys (upstream) to fire station (downstream). Tied into railway viaduct.	Yes
Deerfin Burn	Concrete flood walls, sheet piled embankments and flood storage area.	Yes

Table 5.5.1.2 - Existing flood defences in the Ballymena Model

5.5.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the town of Ballymena, in terms of the potential adverse consequences of flooding, is ranked 9th of the twenty SFRA within Northern Ireland (see figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Ballymena because the national assessment is based on strategic 'undefended' flood models which ignore the presence of existing flood defence systems such as the Ballee Burn Flood Walls. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach was taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection offered by these defences.

To facilitate a more robust assessment of the level of flood risk to Ballymena from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.5.3 Catchment Description

The River Braid catchment is a sub catchment of the River Maine catchment and is located in County Antrim. The River Maine catchment is largely rural with Ballymena and Randalstown the largest urban areas; smaller urban areas of Broughshane, Cullybackey and Kells are also located in the catchment.

The River Maine rises on the Antrim hills to the north of the village of Dunloy, flowing in a southerly direction to its outfall in Lough Neagh at Mainwater Foot. The main tributary is the River Braid with headwaters in the hills to the east of Broughshane from where it flows in a westerly direction through Ballymena to join the River Maine west of Tullagherley Bridge.

The catchment geology is predominantly basalt, overlain by till, with alluvium and sands and gravels along valleys. The Maine catchment has an annual rainfall (SAAR) value of 1150mm.

5.5.4 Fluvial Flood Risk Assessment

Flood Model

The Preliminary Flood Risk Assessment has identified areas of potential significant flood risk within the River Maine catchment. There have been several previous studies along the tributaries of the Rivers Maine and Braid, but a new study was commissioned for the whole catchment to fully understand the nature of the flood risk in the catchment. HEC-RAS models existed for the Devenagh Burn and Conor Burn and Infoworks-RS models existed of Broughshane and a small section of the Kells Water.

All these models have been incorporated into the existing study. The HEC-RAS models have been georeferenced and converted to Infoworks-RS format and are now included in the River Maine models. The existing Infoworks-RS models have also been included in the new Infoworks-RS models.

A detailed hydrological assessment along the study reach has been carried out to derive inflows to the hydraulic model. Flow estimates have been derived for return periods between the 2 and 1,000-year events. Hydraulic models have been developed in the Infoworks suite of software, the floodplain has been represented using 2D domains in areas of complex floodplain flow routes. The models have been run for

return periods of 10, 100 and 1,000-years, additionally the effects of climate change on flood flows have been assessed by increasing the 100-year flows by 20%.

Fluvial Flooding Mechanisms

Ballee Burn

Rivers Agency flood hazard maps indicate flooding in the Pennybridge Industrial estate in Ballymena. This is illustrated on the next page, which shows the predicted extents of the potential fluvial flooding from the Ballee Burn in Ballymena. Details of the impact of the flooding on property and key infrastructure is summarised in Table 5.5.4.1.



Photo 5.5.4.1 Twin 1500mm dia foot bridge on Ballee Burn

The model shows that at the relatively high frequency 10% (Q10) AEP flood event, floodwater is predicted to spill from the open watercourse known as Ballee Burn within the Pennybridge Industrial Estate. The flood water ponds to depths of 300mm in the low lying areas, most notably in the Fyfes motor factors and Slemish College areas. This may be due to an accommodation bridge on the Ballee Burn consisting of twin 1200mm dia culverts. It is estimated that **4** non residential properties could be flooded at this event causing damages in excess of **£2,566**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive (up to 300mm deep) particularly in the vicinity of the Dale Farm Factory. Flooding from the 1% AEP (Q100) event is estimated to affect **12** residential and **26** non residential properties at a cost of around **£219,767**. The present value of the total property damages from potential future floods is calculated to be in excess of **£770k**.



Photo 5.5.4.2 Entrance to Slemish College

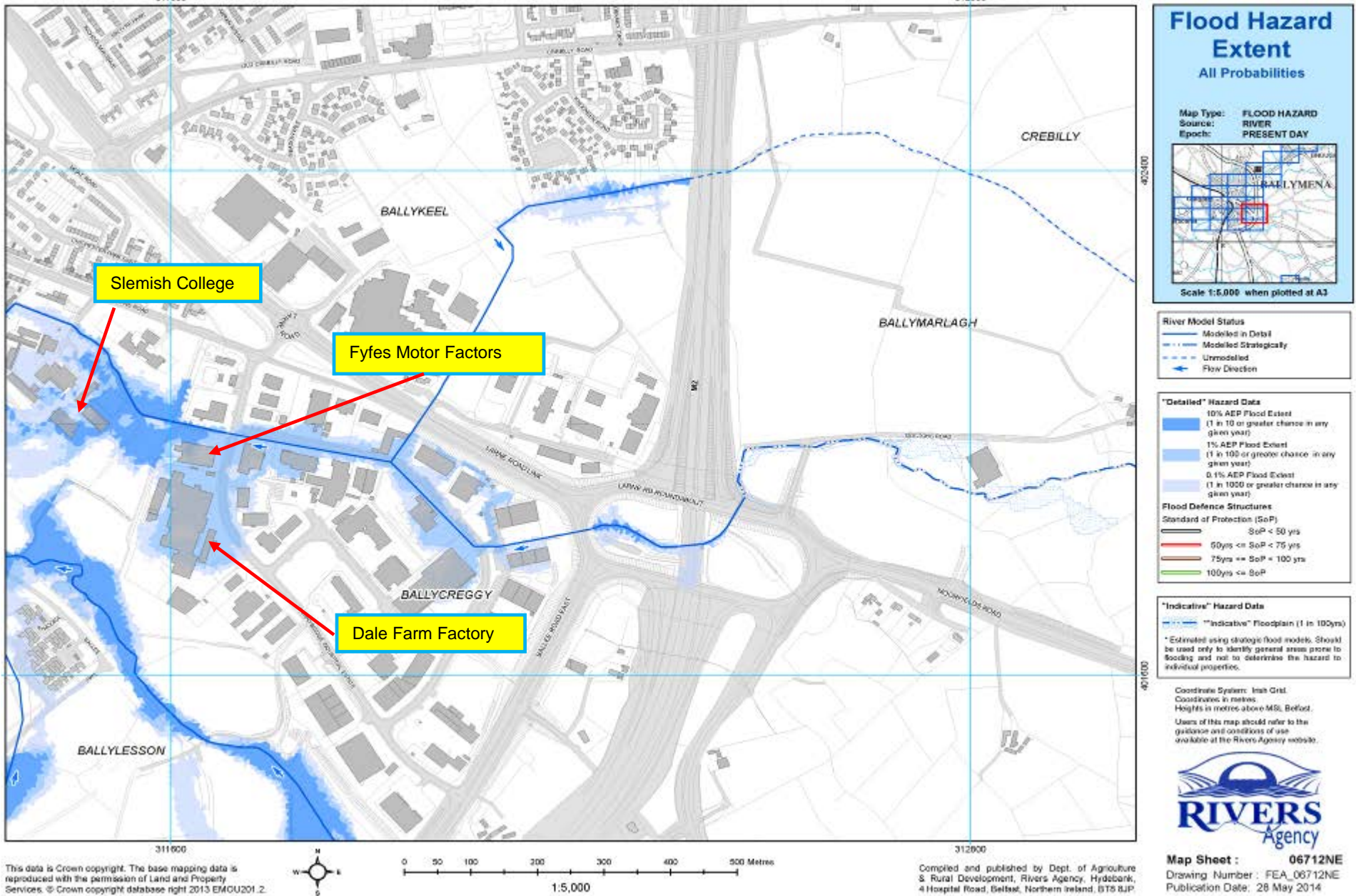


Figure 5.5.4.1 – Flood Hazard extent map for Pennvbridge Industrial Estate, Ballymena

Table 5.5.4.1 - Ballymena SFRA – Ballee Burn			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	0	12
Non Residential (Nr)	4	6	26
Economic Damage (£)	£2,566	£32,855	£219,767
Annual Average Damage (£)	£25,634		
Present Value (£)	£769,020		
IPPC sites (Nr)	0	1	1
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	2	2	2
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Ballykeel Area

The Ballykeel area is located to the south of Ballymena on the right bank of the River Braid. The flood model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the River Braid at certain locations. The flood water ponds to depths of up to 300mm in the low lying areas, most notably in the Phoenix Fields housing development (See Point B in Figure 5.5.4.2) off Railway Street and the Council Depot on Waveney Road (See point A in Figure 5.5.4.2). It is estimated that **14** residential and **12** non residential properties could be flooded at this event causing damages in excess of **£90,005**.

Further downstream the flood model shows that the old playing fields along the right bank of the River Braid, are inundated with flood water between the 2% AEP (Q50) and the 1% AEP (Q100) flood event when the existing earth embankment is overtopped. The floodwater is predicted to inundate a number of properties in the Leighinmohr Avenue and Leighinmohr Crescent housing developments. (See point C in Figure 5.5.4.2)

At the 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations as the 10%AEP (Q10) although the flood inundation areas are more extensive (300mm – 1m deep) particularly in the vicinity of Leighinmohr Crescent. Flooding from the 1% AEP (Q100) flood event is estimated to affect **30** residential and **17** non residential properties at a cost of around **£477,996** in the Ballykeel area. The present value of the total property damages from potential future floods is calculated to be in excess of **£1.9 million**.

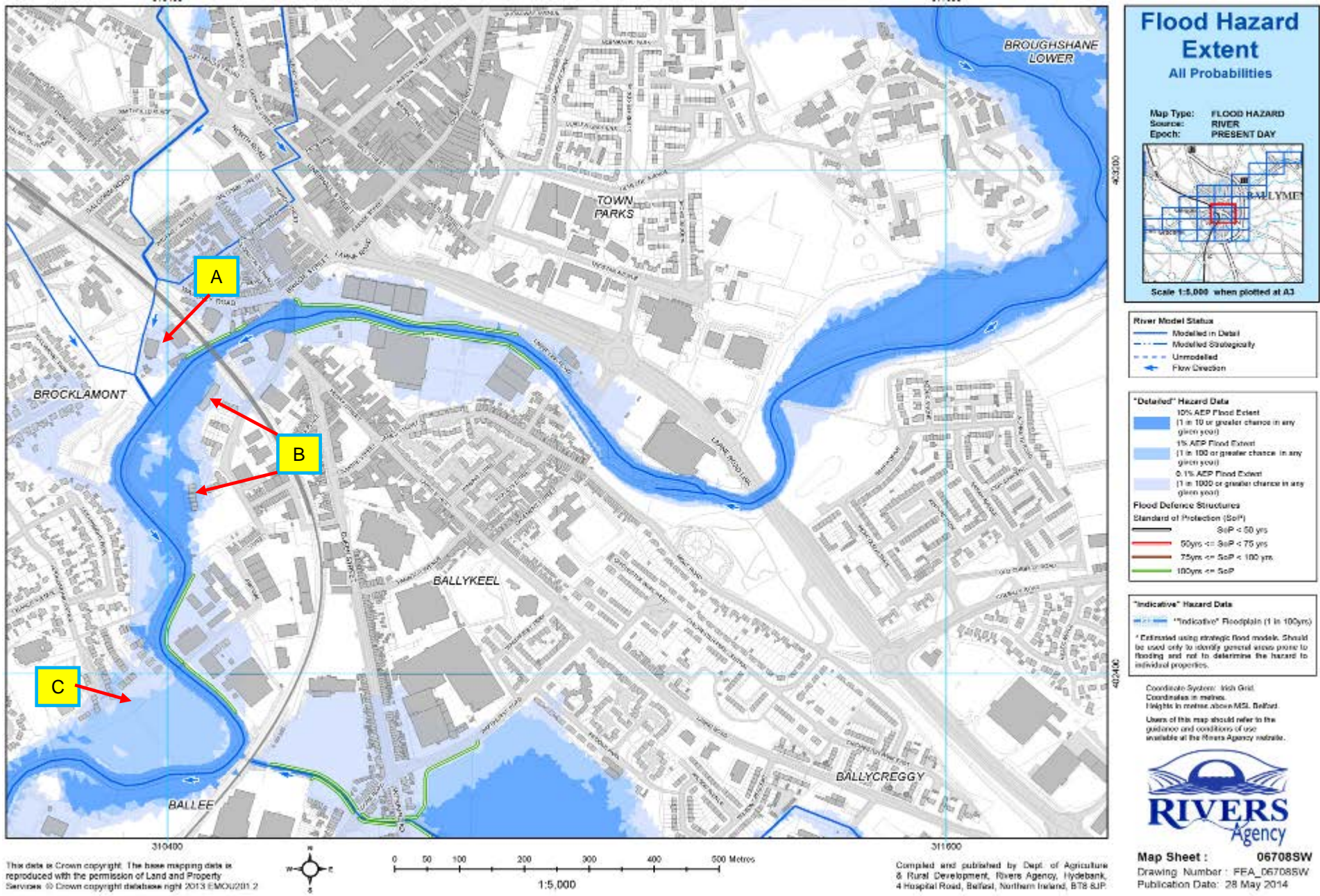
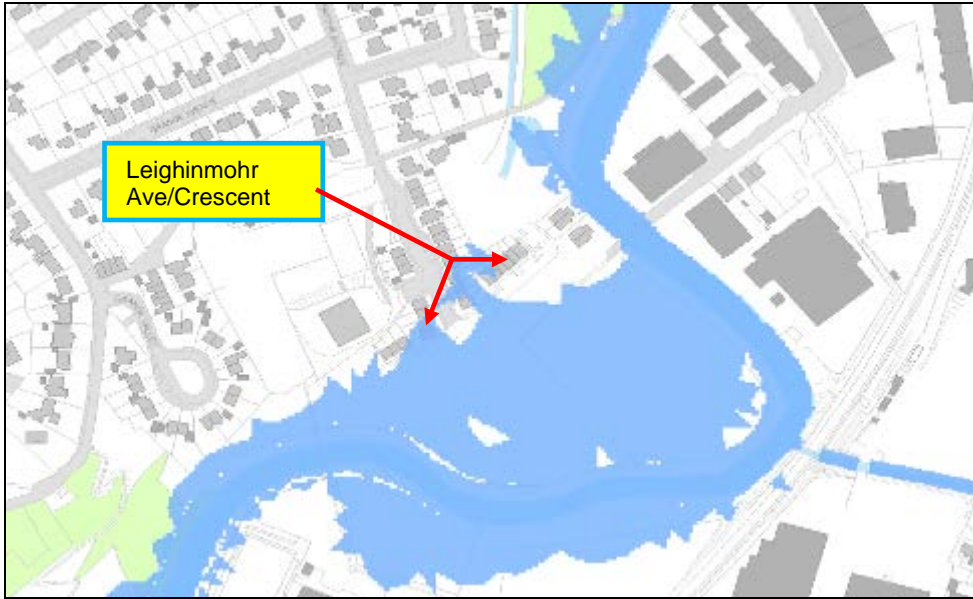
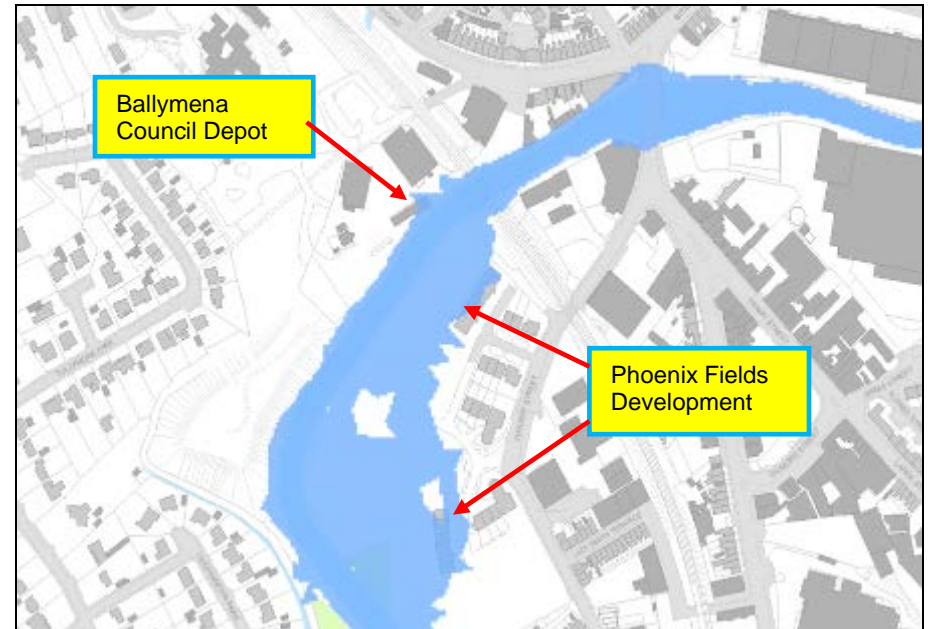


Figure 5.5.4.2 – Flood Hazard map for the Ballykeel area, Ballymena



12 Residential properties flooded at the 1% AEP (Q100) in the Leighinmohr Ave/Crescent area



14 Residential properties in Phoenix Fields and 1 non residential in Ballymena Council Depot flooded at 1% AEP (Q100) event

Table 5.5.4.2 - Ballymena SFRA – Ballykeel			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	14	16	30
Non Residential (Nr)	12	13	17
Economic Damage (£)	£91,005	£126,341	£477,996
Annual Average Damage (£)	£62,731		
Present Value (£)	£1,881,930		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	1	1	1
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	1	1	3
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	1	1	1

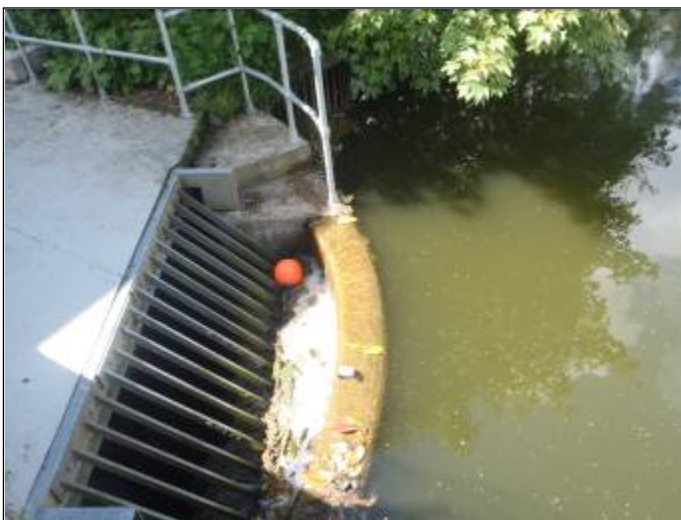
Mill Layde Lower and Mill Layde (Line 4) (Town Center)

Rivers Agency flood hazard maps indicate flooding in the Parkway Road area of Ballymena. This is illustrated in Figure 5.5.4.3, which shows the predicted extents of the potential fluvial flooding from two local watercourses known as Mill Layde Lower and Mill Layde (Line 4). Details of the impact of the flooding on property and key infrastructure is summarised in Table 5.5.4.3.

Rivers Agency current asset records indicate that there are a number of Grade 4 and 5 defects with Mill Layde (Line 4) and Mill Layde Lower in Ballymena. These defects range from broken pipes, broken joints, root intrusions to obstructions in the pipe. These defects add to the risk of flooding in this area as the main reason of flooding appears to be that both culverts are under capacity. Initial flooding takes place at manhole number U2602/26 located at No 8 Greenmount Avenue and manhole number U2602/25 located in the car park adjacent to Twickenham House at the 20% AEP (Q5) event.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the Mill Layde Lower culvert within the Parkway Road area. The flood water ponds to depths of 300mm in the low lying areas, most notably in the Ballymoney Road, Mount Street and Meadow Street areas. This is due to the under capacity of both culverts. It is estimated that **24** residential and **4** non residential properties could be flooded at this event causing damages in excess of **£20,076**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive. Flooding from the 1% AEP (Q100) event is estimated to affect **30** residential and **12** non residential properties at a cost of around **£43,503**. The present value of the total property damages from potential future floods is calculated to be in excess of **£440,000**.



Inlet grille to Mill Layde Lower

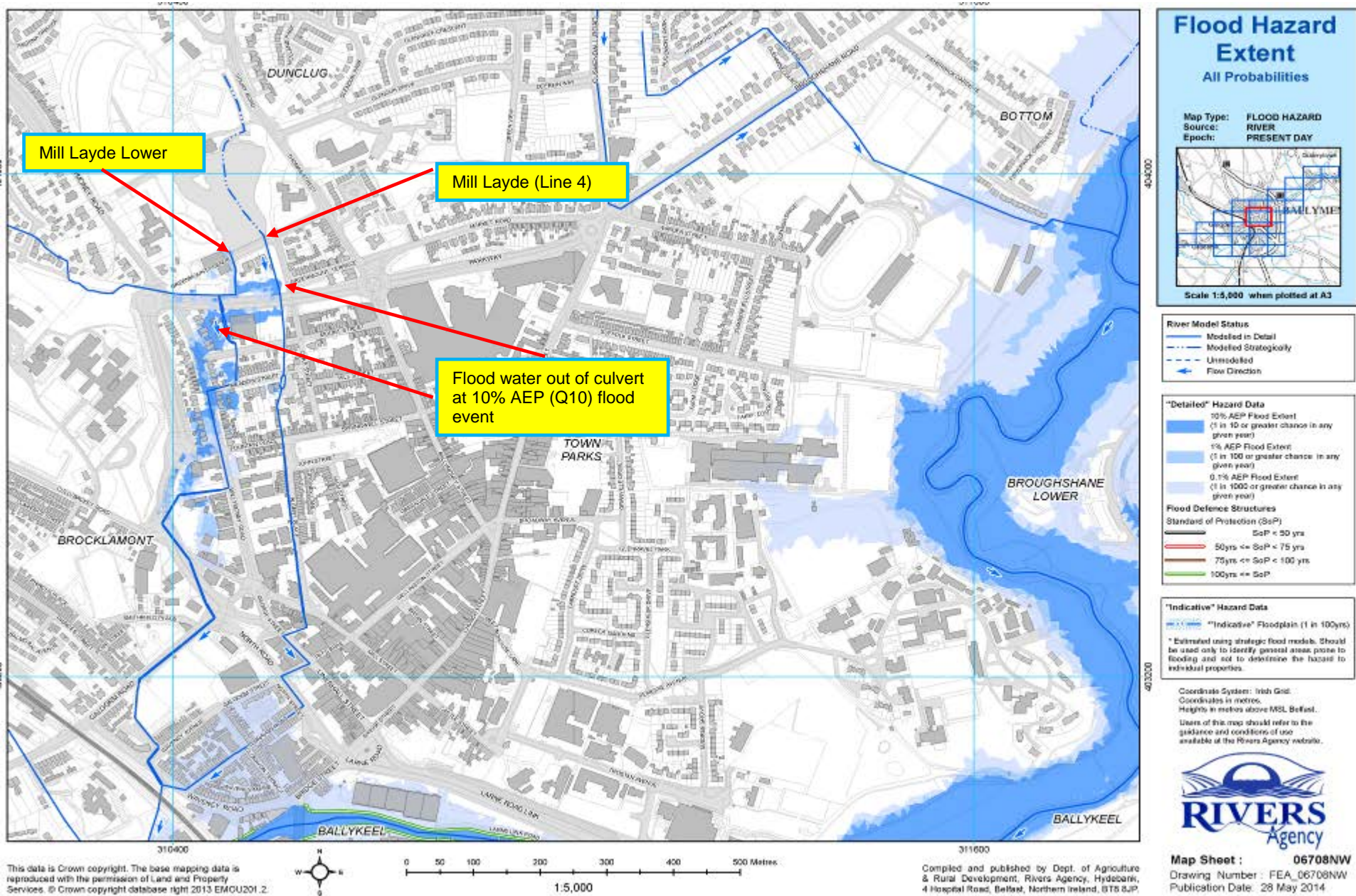


Figure 5.5.4.3 – Flood Hazard extent map for Mill Layde area, Ballymena

Table 5.5.4.3 - Ballymena SFRA – Mill Layde Lower & (Line4)			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	24	24	30
Non Residential (Nr)	4	8	12
Economic Damage (£)	£20,076	£24,766	£43,503
Annual Average Damage (£)	£14,656		
Present Value (£)	£439,680		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	1

5.5.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Ballymena it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Ballymena, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency will also review the existing Development Plan for Ballymena (Northern Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Ballymena area are:

- The John Simpson Memorial Playing Fields
- The old playing fields adjacent to Leighinmohr Crescent
- The Ballee area to the west of Toome Road
- The area to the south of Slemish College
- The area to the south of Balleeway
- Areas north and south of the Galgorm Road near junction with Dans Road
- The area on the left bank of the River Braid adjacent to Phoenix Fields

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Ballymena were re-development may be likely to take place are:

- Pennybridge Industrial Estate
- Ballykeel
- Ballymoney Road area

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments. Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

The main area identified in Ballymena as being at surface water flood risk is:

- Toome Road

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety. There are no Controlled Reservoirs identified in the Ballymena SFRA.

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Within the Ballymena area the following potential schemes have been identified and will be referred to the appropriate bodies for further investigation or detailed feasibility study.

List of possible schemes in Ballymena SFRA.

Ballykeel Area, River Braid

- Fluvial flooding from the River Braid
- Flood damage avoidance figure of £ 1.8 million

Ballymena Town Centre, Mill Layde Lower and Mill Layde Line 4

- Fluvial and surface water flooding
- Flood damage avoidance figure of £ 440k

Ballee Area, Ballee Burn

- Fluvial flooding from the Ballee Burn
- Flood damage avoidance figure of £ 770k

Preparedness

In Ballymena it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Ballymena which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring the following areas could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Ballymoney Road area.
- Leighinmohr Avenue / Phoenix Fields area.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience
- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRAs in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.6 Newry SFRA – Newry and Mourne

The core boundary of the Newry SFRA, which has been determined through the PFRA, is located within the Newry and Mourne Local Management Area and illustrated in Figure 5.6 below.

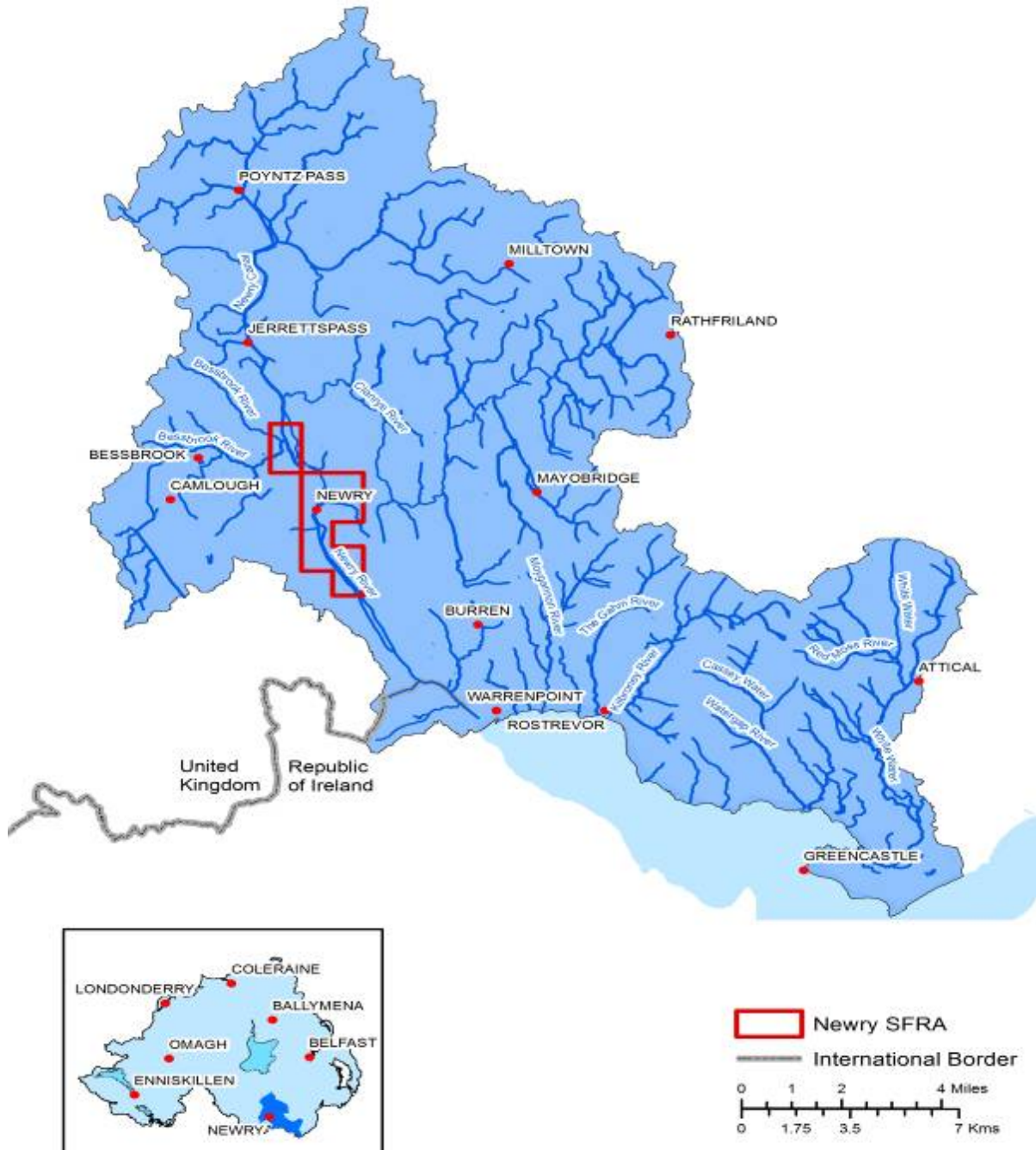


Figure 5.6 - Newry and Mourne LFMA and Newry SFRA

5.6.1 Flooding history

In the past the low-lying areas of St Mary's Street and The Mall in the city were the most vulnerable to flooding from the Newry River. Roadways were flooded on a regular basis. Buildings in The Mall were affected on average twice per decade with St Mary's Street being affected more frequently. Parts of Kilmorey Street were similarly affected but on a less frequent basis.

Flooding, caused by the Newry River rising, initially appeared as water backing up through the local storm system. This is followed, at higher river levels, by water escaping through gaps in the masonry walls and buildings, which convey the watercourse through the city centre. At St Mary's Street, where buildings are adjacent to the river, floodwater has risen through the floors on previous occasions. The footbridge opposite O'Hagan Street is lower than the adjacent river walls and its access is sandbagged in times of flood to try and contain the river. During the high flows water has also been observed seeping through joints in the one hundred-year-old walls.

This flooding problem has been since alleviated through a scheme that was carried out in the early 2000s by Rivers Agency.

Newry was also affected by the 2008 flood event and had recorded the Rank 1, 2 and 4 highest floods in the three gauging stations in the area. Interestingly, though, minimal flooding was recorded in the media, which is perhaps an indication of the actual flood risk posed to Newry. Alternatively, it could also be, or reflective of, the how serious the flooding was elsewhere in Northern Ireland on this day thus focussing attention away from Newry.

A summary of the most notable flooding incidents is indicated in Table 5.6.1.1.

Date and Source	Flooding Account
28 September 1875 The Northern Whig	The area's most affected included: Queen Street, Talbot Street, Sandy Street, Bridge Street, Kilmorey Street and Corn Market. The extensive flooding forced residents of the affected areas to seek refuge in the upper stories of their houses or vacate the houses and stay with more fortunate friends and acquaintances.
28 September 1875 The Belfast Newsletter	The article described the severe flooding experienced in Newry following three days of heavy rain and violent gales. The oldest inhabitants of the town could not recall a storm equal in " <i>severity or destructive effects</i> ".
28 August 1905 The Belfast Newsletter	The town of Newry is said to have felt the full force of the 46 hours of continuous rainfall. Although areas around the country are said to have suffered flooding, Newry was spared extensive flood damage due to the fact that the water level in the Canal was very low throughout the summer, when the rains came the surface runoff was allowed to drain away and after the rainfall the water level was once again restored to the high level mark.
19 January 1973	24 hour rainfall total of 66.1mm Flooding at Sugar Island/Basin Walk due to river overflowing into canal. Flooding at Mary Street and adjacent street.

Date and Source	Flooding Account
22 November 1981	24 hour rainfall total of 46.8 mm. Flooding at St Mary's, Kilmorey, River and Quay Streets, Home Avenue and Warrenpoint Road, cause not specified.
January/February 1990	Series of high tides. Flooding to St Mary's Street and the Mall. Back up from local drainage a factor but also river was sufficiently high to flow directly into Mary Street properties and over footbridge at O'Hagan Street. The flooding persisted for several days, as there were insufficient outlets to allow the water to drain away between tides.
9 November 2000 Newry Reporter	Despite the Clanrye River rising to alarming heights, Newry managed to escape flooding due to the fact that tides were not high and aided by the construction of the retaining wall along the river banks, the town would have suffered a fate similar to the floods of the early 1970s
18 July 2003 Belfast Telegraph	Newry suffered 70mm of rainfall the annual average for the entire month of July. Water had to be pumped away from Daisy Hill Hospital. "Monaghan Street was a no go area". The main A1 from the Mourne. Sandy Street and Talbot Street had water and raw sewage floating on them as the system failed to cope with heavy surface water
16 th Aug 2008	No Information on Aug 2008.
October 2011	Rivers Agency records indicate that approximately 10 residential properties flooded and a similar number of commercial properties flooded in Bridge Street due to a heavy rainfall event
13 th Nov 2014	Number of residential and commercial properties flooded in Bridge Street due to intense rainfall event in the Dromalane Catchment.

Table 5.6.1.1 – List of past flooding events in Newry



Photo 5.6.1.1 - Bridge Street, Newry 13th Nov 2014



Photo 5.6.1.2 - Bridge Street, Newry 13th Nov 2014



Photo 5.6.1.3 – N.I Water storm manhole surcharging, Newry 13th Nov 2014

Bridge Street

Rivers Agency records indicate that there have been a number of occasions where Bridge Street in Newry has flooded. The Flooding Hardship Payment scheme shows that 10 residential properties and a similar number of commercial properties flooded at this location in October 2011 and November 2014. (See Figure 5.6.1.1) This area of Newry flooded from the Glen River system and the Dromalane Stream on both occasions.



Figure 5.6.1.1 - Rivers Agency record of Flooding Hardship Payments for flooded properties in Bridge Street, Newry, Oct 2011

A post flood investigation was carried out by Rivers Agency after the 2008 flooding, which saw Rivers Agency and N.I Water working to alleviate the flooding problem in Bridge Street. The post flood investigation found that the flood problem arose from an un-adopted culverted watercourse known as The Railway Drain. The Railway Drain commences at an attenuation tank in a car park off Monaghan Street and discharges into a designated watercourse known as the Glen River Overflow. (See Figure 5.6.1.2 on the next page)

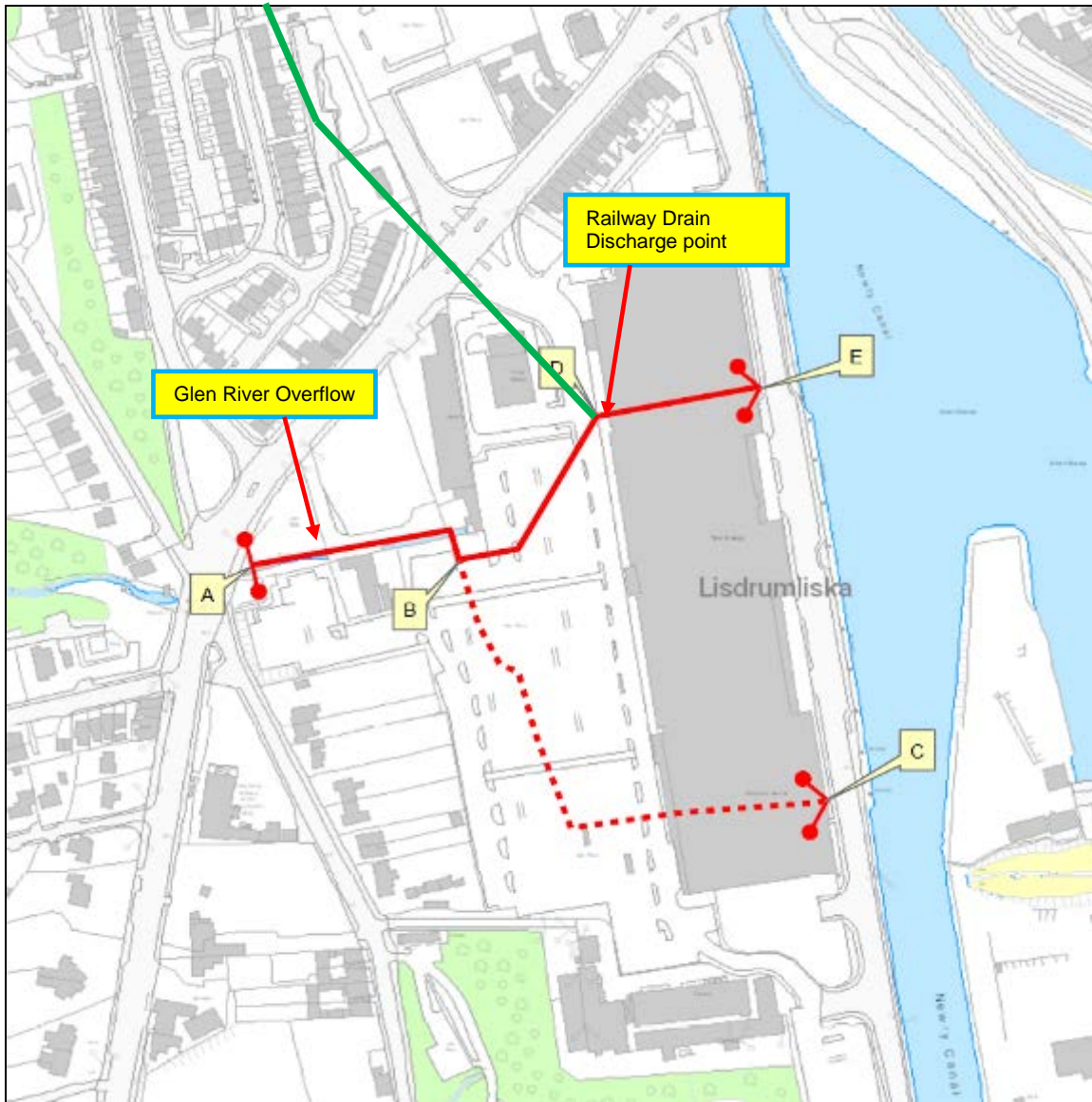


Figure 5.6.1.2 – Map showing where Railway drain discharges into the Glen River Overflow

Rivers Agency agreed to survey the undesignated section of the Glen River Overflow point D to point E in Figure 5.6.1.2 which was altered during construction stage of the Quays Shopping Centre during the late 1990s. A new culvert was laid (B-D) to the existing undesignated culvert (D-E) with the open channel and culverts (B-C) abandoned.

Since the culvert, inlet structure, silt trap and open channel (A-B-D-E) were now in the line of the watercourse it was proposed that Rivers Agency:

- de-designate the line B-C
- designate the line B-E

It was also discovered during the post flood investigation that, during construction of The Quays Shopping Centre, a new culvert was also laid from point (B-D-C) on the Lower reach of the Glen River and the existing culvert reach from point (B-C) was abandoned. Since this new culvert, inlet structure, and open channel (A-B-D-C) was in line of the watercourse it is proposed that the Rivers Agency:

- de-designate the line B-C in figure 5.6.1.3
- designate the line B-D-C in figure 5.6.1.3

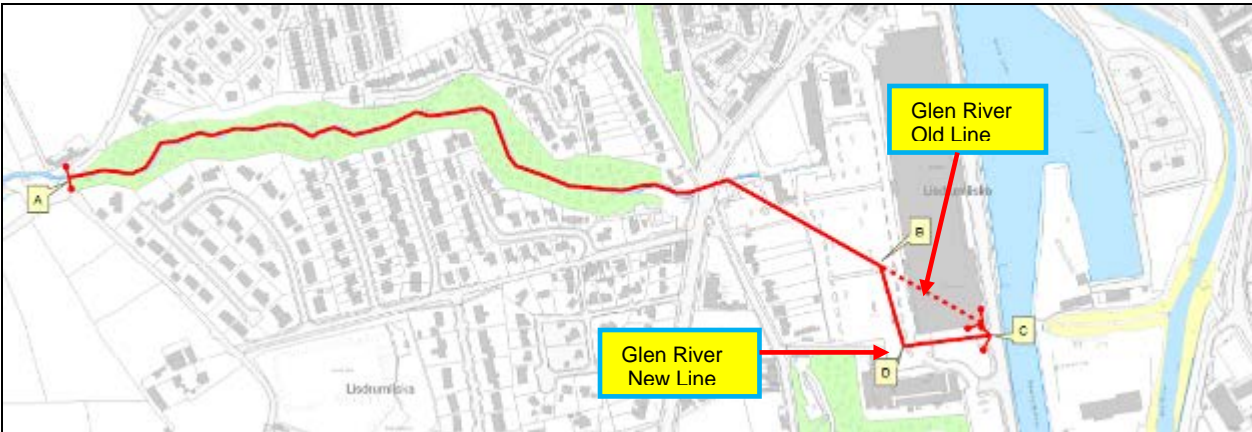


Figure 5.6.1.3 -Map showing the old and new line of the Glen River

Existing River Defences

Part of the city of Newry lies in the floodplain of the tidal Newry/Clanrye River. The area was historically protected from flooding by a masonry river wall which was over 100 years old.

Rivers Agency carried out a feasibility study which considered the hydrology of the catchment, the relationship between tidal and river flow conditions, the risk of failure of the old wall, and the benefit/cost of the works. The report recommended that the old wall should be replaced.

The construction work was carried out in 3 separate contracts in order to minimise disruption in the city centre and the main works included:

- Reinforced concrete retaining wall along the edge of the river, with the exposed faces clad with local Newry granite to retain the character of the area.
- The rising of upstream and downstream flood banks.

- New trunk sewer behind the floodwall as part of N.I Water's overall improvement of the sewerage system, which collects combined storm overflows and other outfalls to the river and conveys the flow to a new pumping station.



Photo 5.6.1.3 - Flood walls in Newry city centre after construction in 2003

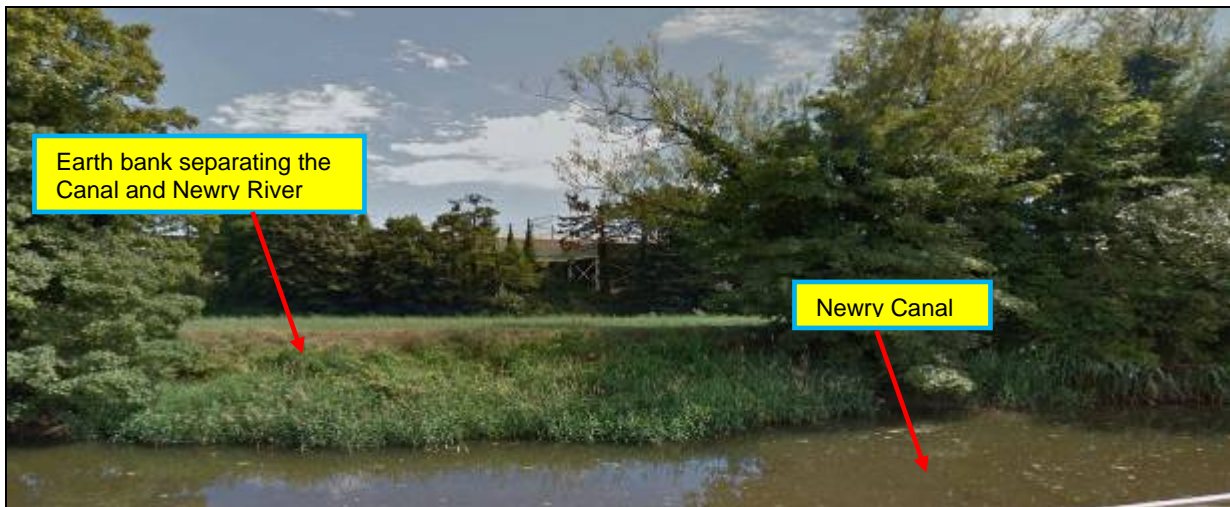


Photo 5.6.1.4 - Earth flood bank that separates the Newry Canal and the Newry River that was raised in 2001

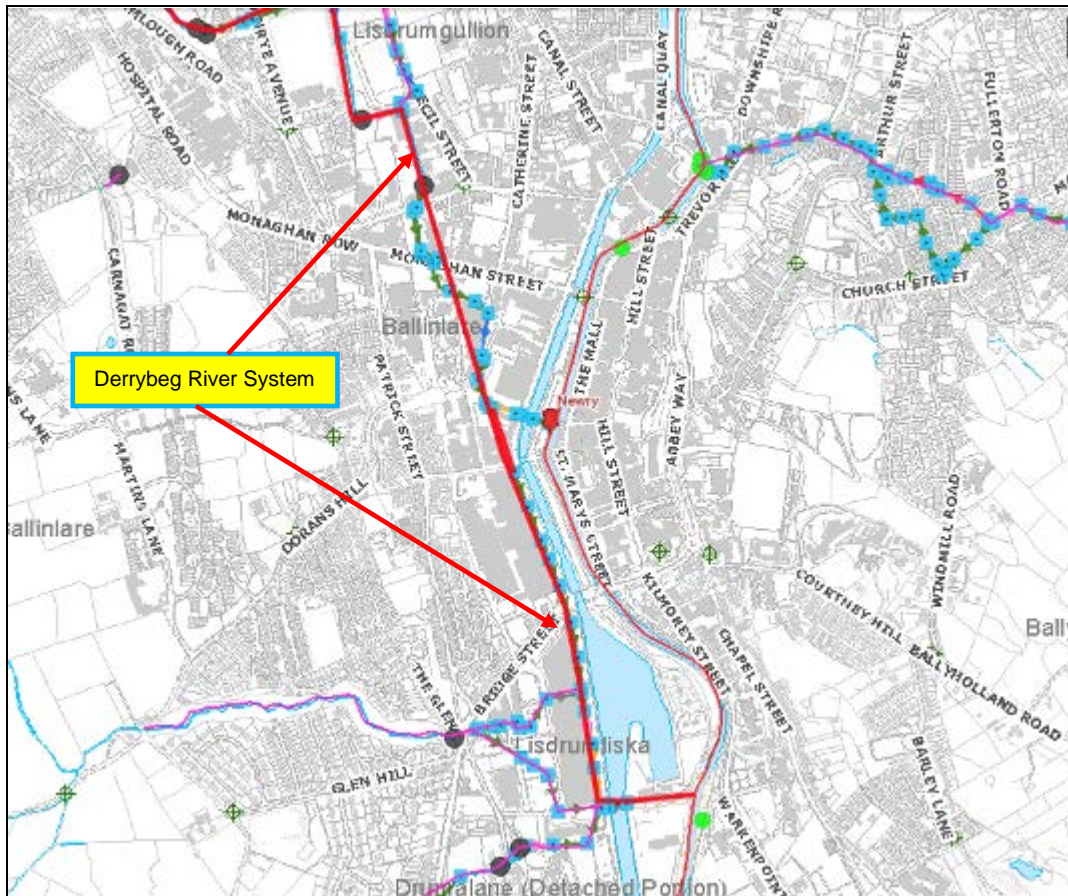


Figure 5.6.1.4 – Derrybeg River, Newry

Derrybeg System

The Derrybeg system is a designated watercourse which is culverted through a low lying area of Monaghan Street/ Upper Edward Street and Corn Market. The entire length of the culvert from Upper Edward Street/ Railway Avenue to its outfall to the Newry River received a number of improvements after a feasibility study was carried out in 1991. The feasibility study highlighted that in times of heavy rain flood water would back up through the system and spill from the manholes located in the Monaghan Street area. The recommendation from the feasibility study consisted of:

- Installing a flap valve at the outfall
- Installing a penstock
- Pressurised lids on all manholes

- Diverting storm connections to the Bridge street pumping station where possible and installed flap valves to any connections which remained.



Photo 5.6.1.5 - Inlet Structure on Derrybeg River

Existing Coastal Defences

Greenbank Earth Bank

This is a high earthen flood bank, which protects a large industrial estate from direct inundation from the adjacent Newry River. (See points A to B in figure 5.6.1.5). The embankment was found to be in reasonable condition and calculations generally yield satisfactory factors of safety for possible modes for failure such as piping (water seeping through the embankment), rotational slip, settlement, overtopping and erosion.

The Rampart

The Rampart is the seaward face of the flood defences protecting the Greenbank Industrial Estate (See point C below). Whilst the profile of the Rampart is inappropriate for wave energy dissipation, the likelihood of an extensive failure which would release sufficient water to endanger the developed part of the Estate is considered slight. Any failure is likely to be as a result of waves overtopping the crest and/or displacing pitching and causing failure by scour action.

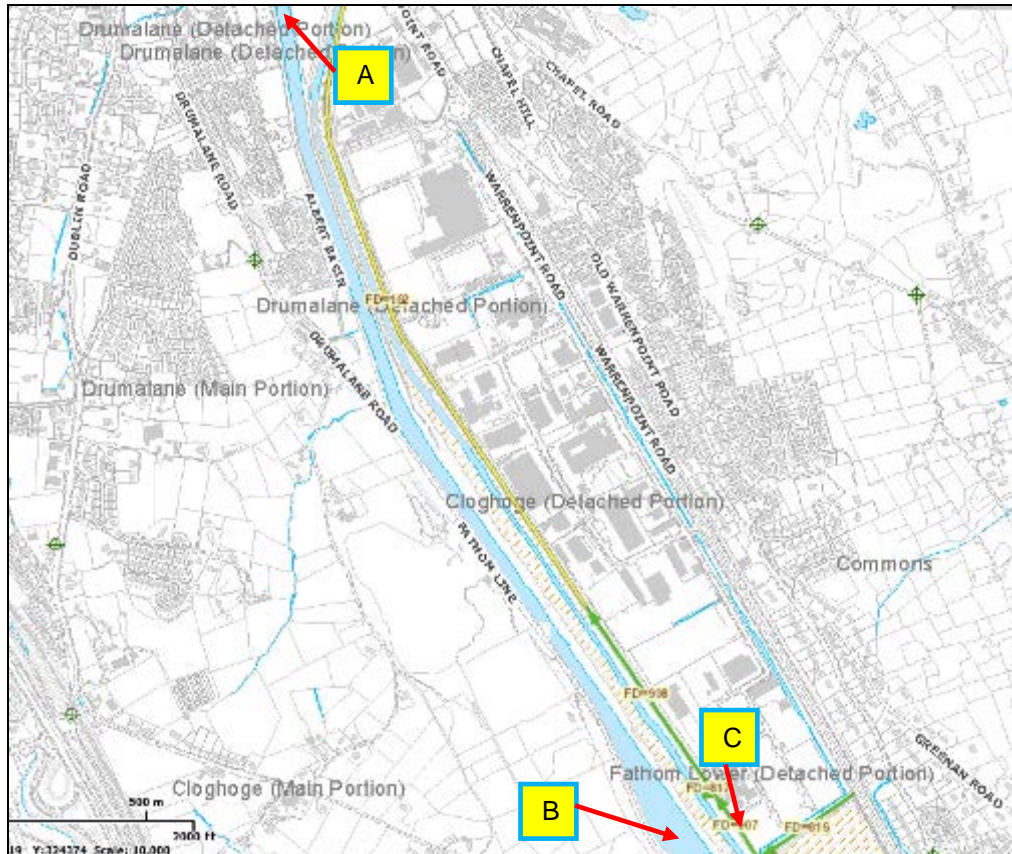


Figure 5.6.1.5 - Greenbank Industrial Estate Sea Defence

5.6.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the city of Newry, in terms of the potential adverse consequences of flooding, is ranked 2nd of the twenty SFRA within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the city was considered to arise from fluvial flooding with some risk of coastal flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Newry because this national assessment is based on strategic ‘undefended’ flood models which ignore the presence of existing flood defence systems such as Newry city flood walls and the Greenbank Sea Defence. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach has been taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to

undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection offered by these defences.

To facilitate a more robust assessment of the level of flood risk to Newry from fluvial and coastal flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.6.3 Catchment Description

Newry is a thriving commercial city straddling the Newry River/Clanrye River at the North Western limit of the narrow inlet of Carlingford Lough.

The Clanrye, Bessbrook and Jerettspass tributaries drain the Newry River catchment; the catchment size is 902 km². The Newry Canal runs adjacent to the river through the city and drains a catchment near to but separate from the river catchment. However during high flow conditions the canal can overflow into the river significantly increasing its flow.

The river is tidal from Carlingford Lough through the city to Thompson's Weir. The tide is the main influencing factor over this stretch with the river being dominant upstream of the weir. When high flows in the river coincide with high tides low-lying areas of the city, especially its centre, are vulnerable to flooding. The Greenbank Industrial Estate, to the south of the town, is protected from direct inundation from the river by a high earth floodbank. The river through the town is bounded by buildings and masonry walls, which provide varying degrees of, flood protection to adjacent low-lying areas.

Newry Canal

The Newry canal was opened in 1742 with the first lock connecting it to the Newry River being constructed at the location of the present Albert Basin. The canal has now been abandoned for commercial purposes, in stages, starting with the inland section in 1949, followed by the section through the city in 1956 and finally the section from Albert Basin to Victoria Lock, known as the ship canal in 1974. Newry & Mourne District Council assumed ownership of the canal, within its boundary, in 1986 with the intention of utilizing its recreation potential.

The Canal is a designated watercourse, upstream of Dublin Bridge and serves a drainage function in the rural area but through the main urban area a base flow is provided and limited by a 900mm diameter culvert. Sluice gates at Victoria Lock are operated by the lock keeper depending on the weather conditions. (See photo 5.6.3.1). The canal has been used in a storage capacity in previous flood events.



Photo 5.6.3.1 - Victoria Lock Gates on the Newry Canal

5.6.4 Coastal Flood Risk Assessment

Model

Rivers Agency's new detailed coastal hazard map indicates that Newry city is also at risk from coastal flooding as it is fluvial flooding. The 0.5% AEP (Q200) flood level for Newry was obtained from the Irish Surge and Tidal Model that is used to determine extreme sea levels around the non-estuarine coastline of Ireland. This coastal model indicates that there is a significant risk of flooding to Newry city in particular the old Warrenpoint Road at the entrance to Greenbank Industrial estate.

Due to the complex nature of Carlingford Lough, detailed modelling was required to establish extreme water levels at Newry. Although Newry is within Carlingford Lough, it is in the upper reaches. Therefore, Rivers Agency did not have sufficient bathymetry or calibration data to adequately model the channel that far upstream. A more reliable prediction point was chosen to represent the Newry extreme tidal boundaries. This also had the advantage of being independent of fluvial conditions and, therefore, suited to the provision of boundary conditions for further modelling. The location of this point (6.262°W, 54.099°N) can be seen in Figure 5.6.4.1.

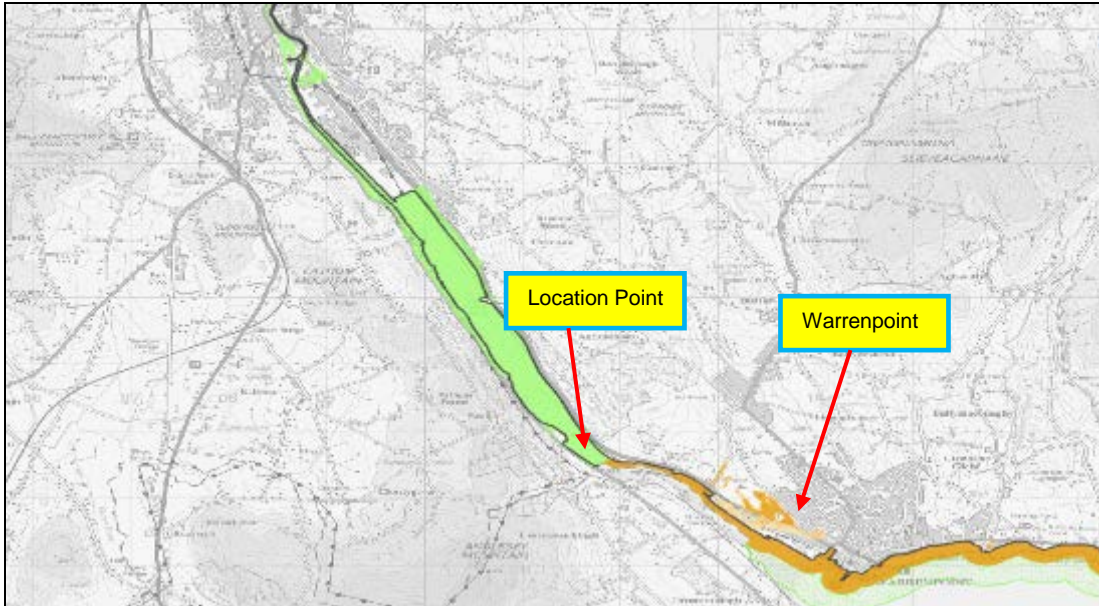


Figure 5.6.4.1 - Location point in the Newry Coastal model

Coastal Flooding Mechanisms

The model shows that, at the more extreme 0.5% AEP (Q200) flood event, floodwater is predicted to inundate the north end of Greenbank Industrial Estate and the Old Warrenpoint Road. (See Figure 5.6.4.2). The flood water will pond to depths of up to 300mm in the low lying areas, most notably in the north end of the Greenbank Industrial Estate. It is estimated that **16** non residential properties could be flooded at this event causing damages in excess of **£347,302**

Return Period	Water Level (OD)
2	2.75 m
10	3.078 m
25	3.389 m
50	3.466 m
75	3.520 m
100	3.650 m
200	3.950 m

Table 5.6.4.1 - Predicted Coastal Levels for Present Day at Newry



Photo 5.6.4.1 - Newry city came close to flooding January 2014 from a coastal event

Table 5.6.4.2 - Newry SFRA – Greenbank Industrial Estate			
Potential Adverse Consequences – Coastal Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	0.5% AEP
Residential (Nr)	0	0	0
Non Residential (Nr)	0	0	18
Economic Damage (£)	0	0	£347,328
Annual Average Damage (£)	£8,726		
Present Value (£)	£261,780		
IPPC sites (Nr)	0	0	1

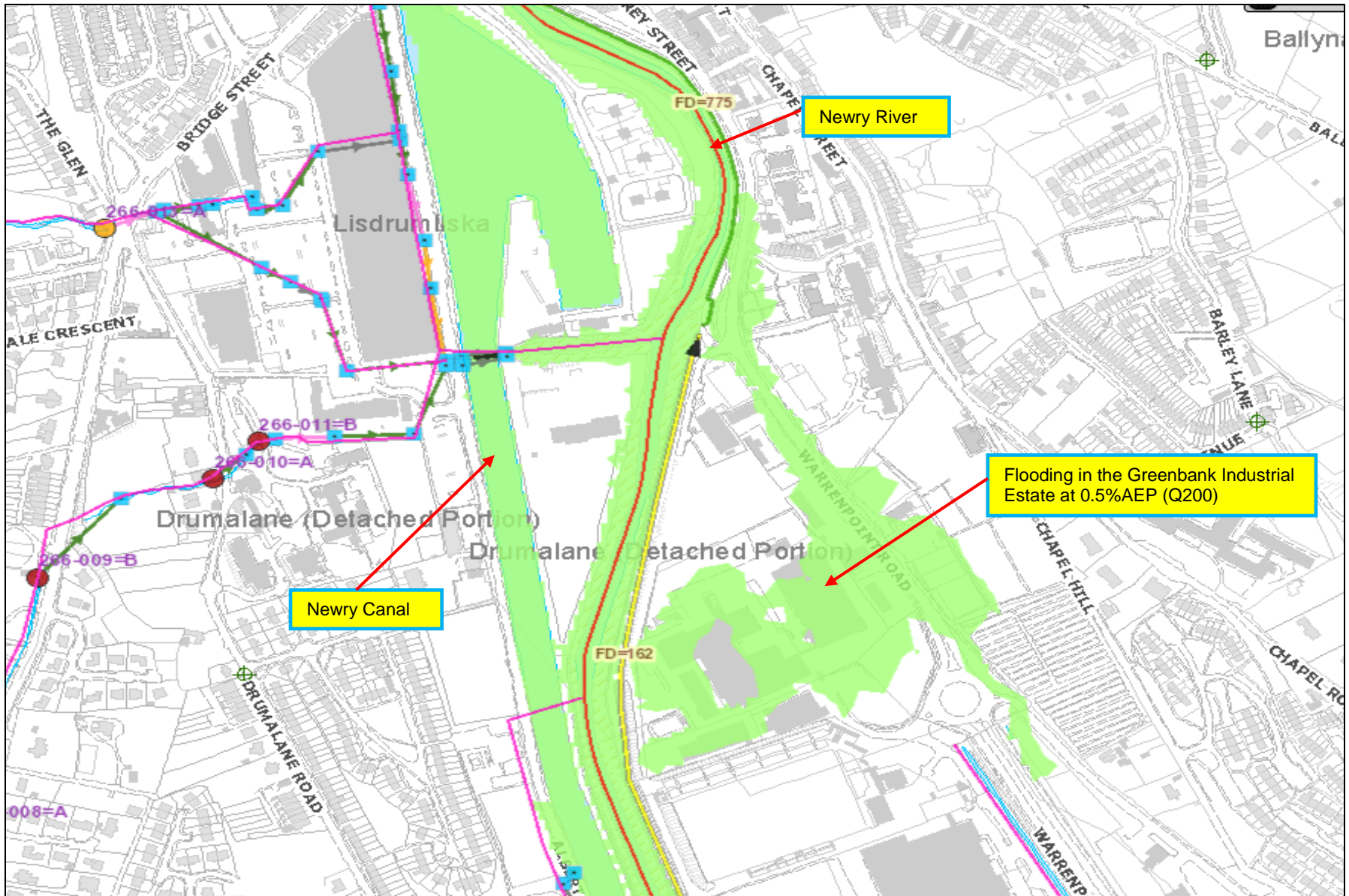


Figure 5.6.4.2 - Detailed Coastal Flood Extent map for Greenbank Industrial Estate in Newry City 0.5 %AEP (Q200)

5.6.5 Proposed Coastal Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Newry it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Newry Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 200 year coastal floodplain.

Rivers Agency will also review the existing Development Plan for Newry (Banbridge, Newry and Mourne Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

Planning Applications

Coastal areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 200 year coastal floodplain, irrespective of whether they are located within a current development plan or as a single site application outside the plan area.

For those sites within the 1 in 200 year coastal floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of an accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at coastal flood risk within Newry where re-development may be likely to take place are:

- Greenbank Industrial Estate on the old Warrenpoint Road

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely, Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

Having conducted a detailed assessment of the coastal flood risk to the Greenbank Industrial Estate in Newry, Rivers Agency has determined that potential flood alleviation schemes may be justified for this location. Rivers Agency has commissioned a feasibility study including an economic appraisal focusing on the potential for overtopping, assessing the structural condition of the Greenbank sea defence and developing options to counter overtopping of the defence. A ground investigation has been commissioned to inform the structural calculations and is likely to commence before the end of March 2016. The overall study and report should be completed by mid 2016.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works along with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from feasibility study to construction works commencing on the ground.

Preparedness

Coastal flooding has the potential to have a significant impact in terms of risk to life. This is mainly due to the rate of inundation from the sea at the height of the tidal cycle. In light of this the emergency response to significant coastal flooding with a risk to life will be led by PSNI and evacuation of potentially affected areas will be a real consideration.

To ensure a coordinated approach local, tactical Coastal Flooding Emergency Response Plans are being developed for Newry. This will link to a strategic Coastal Flooding Emergency Response Plan.

The Coastal Flood Response Plan aims to provide a pre-planned response to a warning of coastal flooding and outline the graduated incident and coordinated inter-agency response to a potential or actual coastal flooding event.

The objectives of the plan are to:

- Identify activation triggers for responding to a coastal flood warning or incident.
- Document the actions to be taken on receipt of a coastal flood warning.
- Set out the process for a coordinated response including the graduated incident management of a potential or actual coastal flooding event.
- Ensure a common understanding of the potential impacts of a coastal flooding event in each area and act as a reference document for all the agencies involved to provide a pre-planned response at various levels of coastal flood risk.

5.6.6 Fluvial Flood Risk Assessment

Flood Model

The modelled constructed for the Newry SFRA extends from Jerettspass to beyond Victoria Lock a reach of approximately 14km and includes 92 topographical survey cross-sections. There were 13 bridges along this reach that affected the hydrodynamic characteristics of the river and were included in the model along with all surveyed weirs. In order to increase the accuracy of the model, and particularly the linkage between the 1D and 2D domains of the model a number of interpolated sections were added. The Newry Canal runs

adjacent to the Newry River and was included in the same Infoworks model network so that interactions between the canal and river could be modelled.

InfoWorks ICM was used for rivers flowing through urban areas. In addition to survey data, the Rivers Agency InfoNet database provided data for the ICM models. Eight InfoWorks ICM 1D/2D hydrodynamic models were prepared for the Newry study. The downstream boundary conditions for each of the ICM models were extracted from the model of the river into which it discharges, providing a stage/time boundary to simulate backwater effects.

Fluvial Flooding Mechanisms

City Centre

Figures 5.6.6.3 and 5.6.6.4 illustrates the predicted extents of the potential fluvial flooding from the Newry River and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.6.6.1.

The model constructed for Newry city indicates the first breach point is located just downstream of Thompsons Weir on the Newry River. The model indicates that flood water begins to breach at this location around the 5% AEP (Q5) event. Once out of channel the flood water makes it way towards Downshire Road and then further onto Sandy's Street. (See Figure 5.6.6.1)

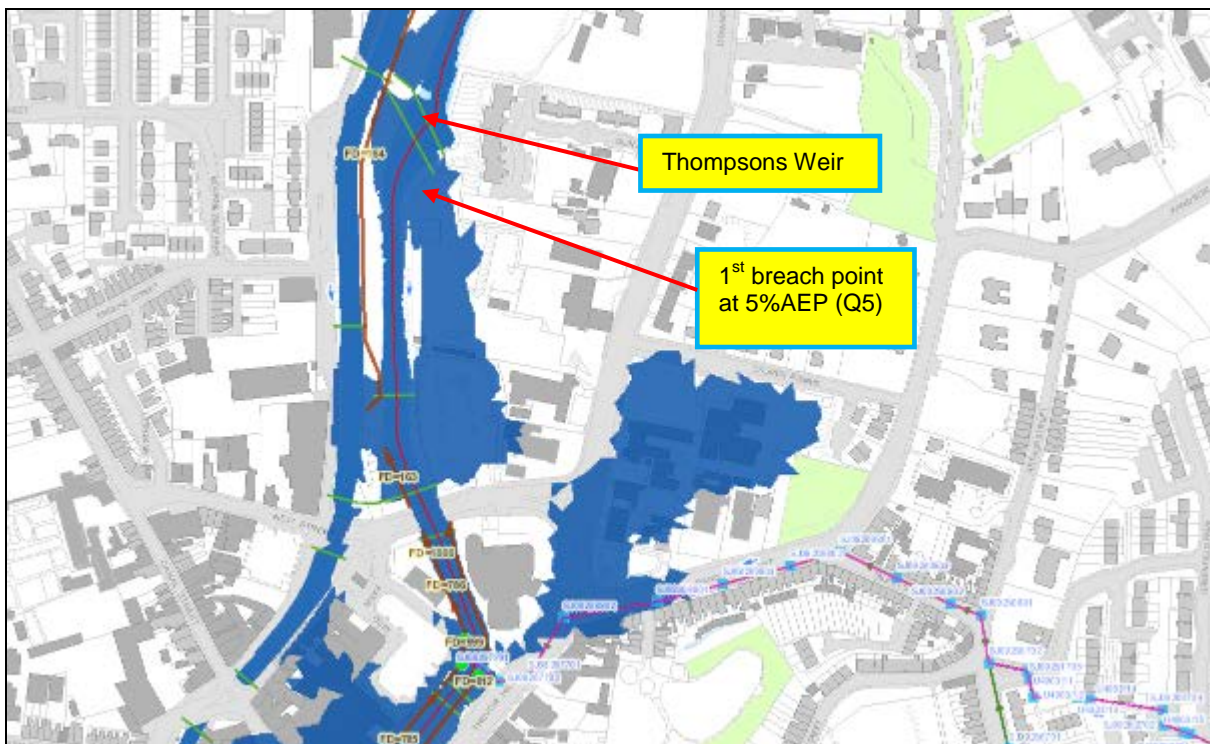


Figure 5.6.6.1 - First breach point on the Newry River

Shortly after flood water as spilled at Thompson's weir it then begins to overtop the flood wall on the right bank located in front of Newry Town Hall at the old war memorial. (See Figure 5.6.6.2 & photo 5.6.6.1). Flood water from this location then makes its way into the Newry Canal.

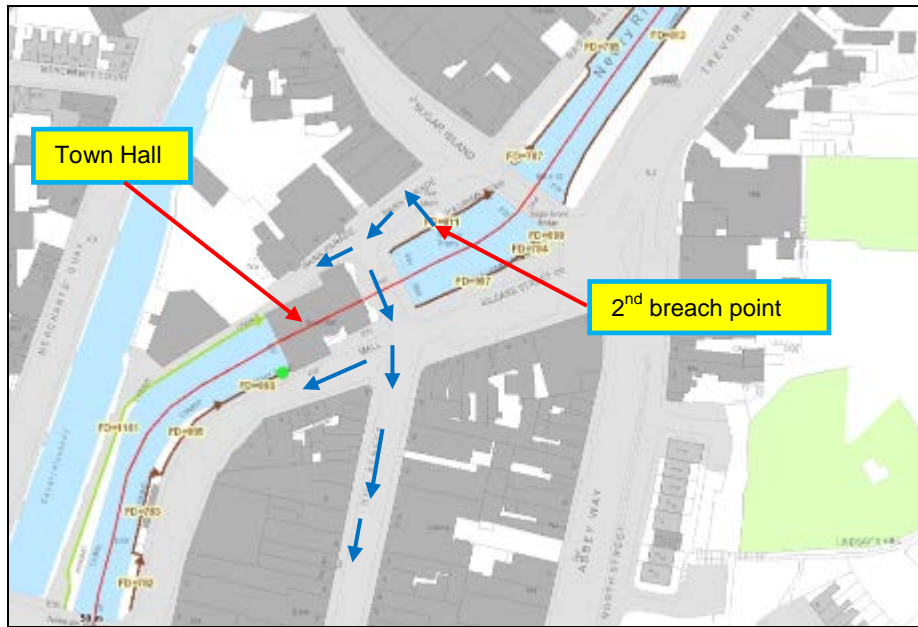


Figure 5.6.6.2 - Second breach point in Newry city - Town Hall

It is estimated that **23** residential and **148** non residential properties could be flooded at the 10% AEP (Q10) event causing damages in excess of **£2,983,391**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the Sugar Island and Monaghan Street. Flooding from the 1% AEP (Q100) event is estimated to affect **349** residential and **781** non residential properties at a cost of around **£63,255,816**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£89.9 million**.

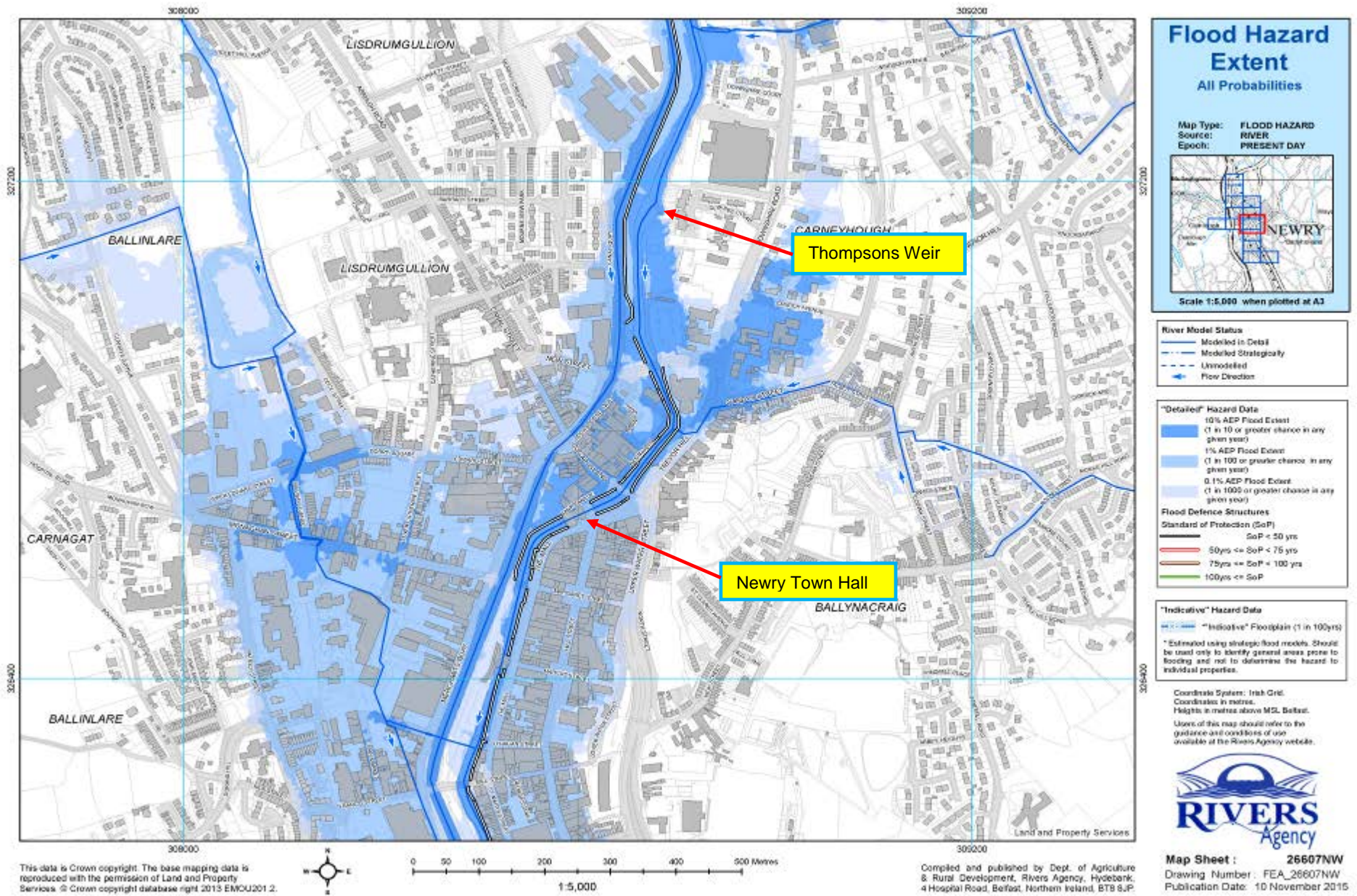


Figure 5.6.6.3 – Flood Hazard extent map for Newry Area

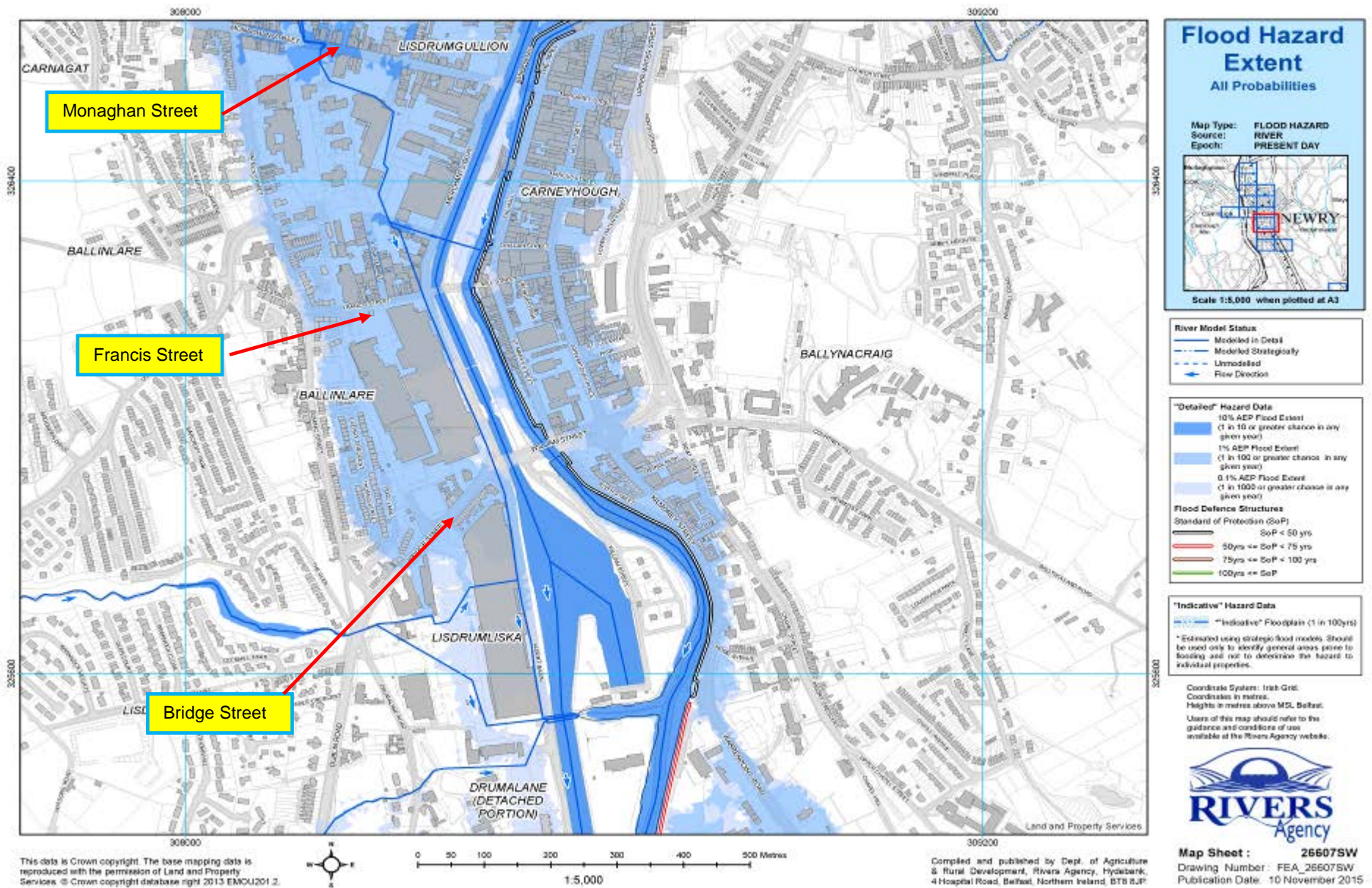


Figure 5.6.6.4 – Flood Hazard extent map for Newry Area

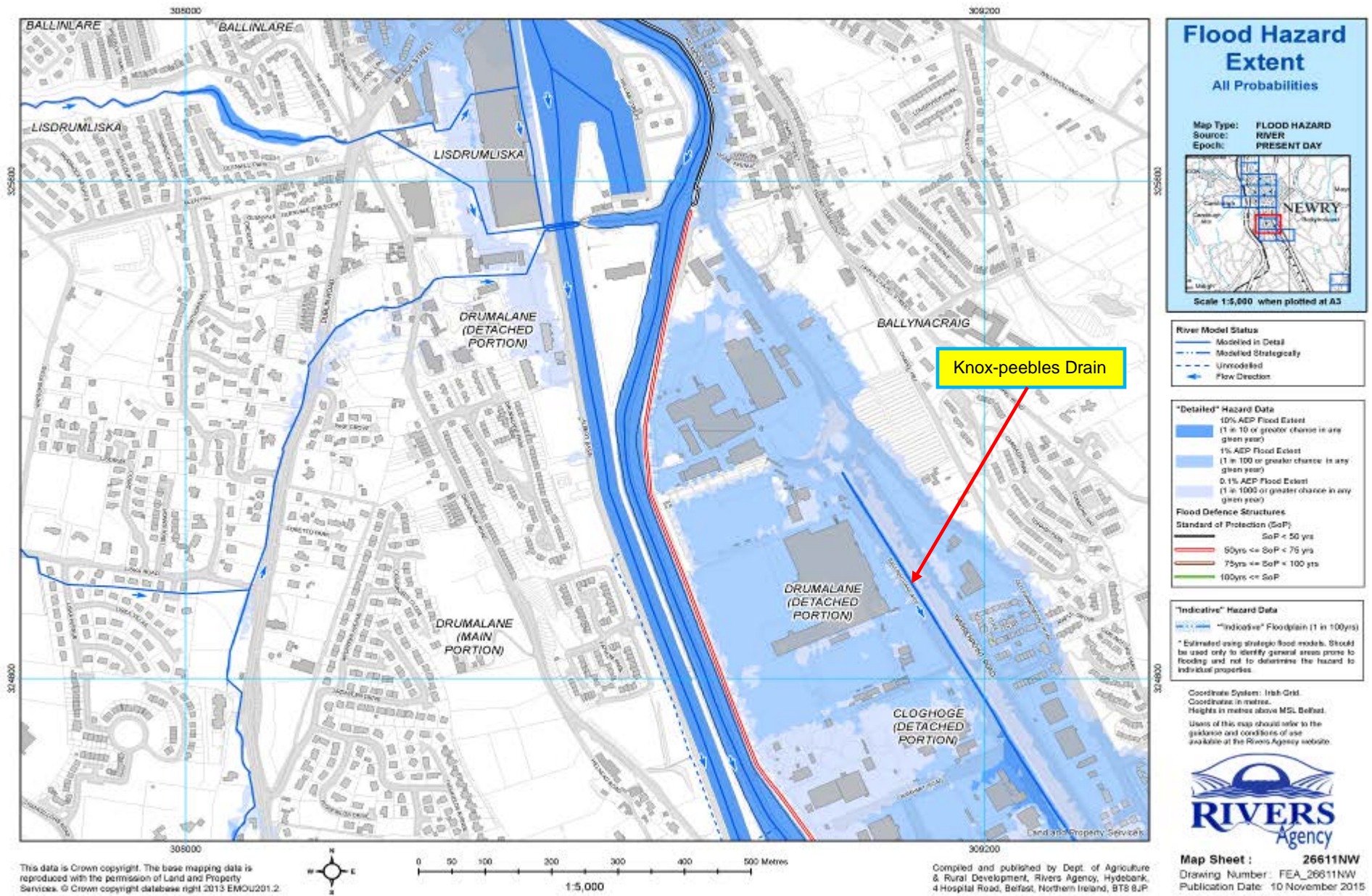


Figure 5.6.6.5 – Flood Hazard extent map for Greenbank Industrial Estate Newry

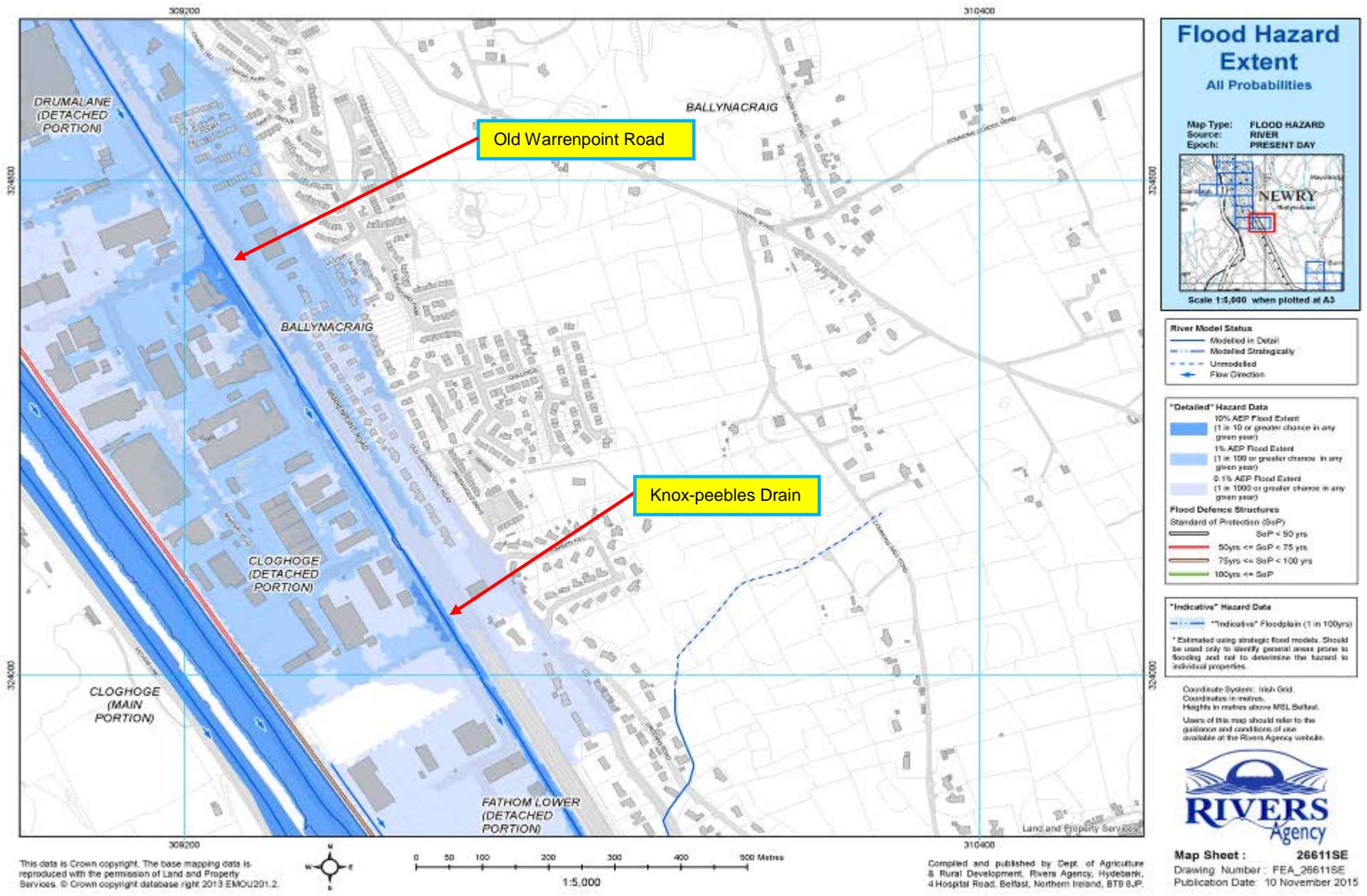


Figure 5.6.6.6 – Flood Hazard extent map for Greenbank Industrial Estate Newry



Photo 5.6.6.1 - Second breach point in Newry – Upstream of Newry Town Hall at the War Memorial

Table 5.6.6.1 - Newry SFRA			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	23	52	349
Non Residential (Nr)	148	284	781
Economic Damage (£)	£2,983,391	£6,966,228	£63,255,816
Annual Average Damage (£)	£2,995,384		
Present Value (£)	£89,875,050		
IPPC sites (Nr)	1	1	3
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	2	8
Fire stations	0	0	1
Hospitals	0	0	0
Police Stations	0	1	0
Schools	1	1	2
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	1	1
NIW Sewage Pumping Stations	0	2	6
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	4	11	39
NIE Substation 33kV	0	0	1
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	7	7	0
Environmental Designated sites (Nr)			
AONB	2	2	2
ASSI	1	1	1
Environmentally Sensitive Areas	0	0	2
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	20	31	100
Sites and Monuments Records	0	1	4
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.6.7 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Newry it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Newry, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency shall also review the existing Development Plan for Newry (Banbridge, Newry and Mourne are plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within a current development plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the

application through the appraisal of an accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Newry where re-development may be likely to take place are:

- Hill Street
- Sugar Island area
- Downshire Road
- Sandy Street

Areas at Risk of Surface Water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments. Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the 'purple' predicted areas on the surface water maps we will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in an appropriate manner.

The main areas identified in Newry as being at surface water flood risk are:

- Bridge Street

Area's at Risk of Flood Inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Controlled Reservoirs identified in the Newry area are as follows:

- Camlough

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take anything from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Having conducted a detailed assessment of the fluvial flood risk to Newry, Rivers Agency has determined that potential flood alleviation schemes may be justified for Newry city.

Rivers Agency has commissioned a feasibility study including an economic appraisal to assess the fluvial flooding problem in Newry City. This study will have proposed options and costs to alleviate against any potential flooding. The overall study and report should be completed by mid 2016.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from feasibility study to construction works commencing on the ground.

Preparedness

In Newry it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Newry which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring the following area could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Bridge Street / Cleary Crescent area.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience

- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRA's in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.7 Banbridge SFRA – Upper Bann

The core boundary of the Banbridge SFRA, which has been determined through the PFRA, is located within the Upper Bann Local Management Area and illustrated in Figure 5.7 below.

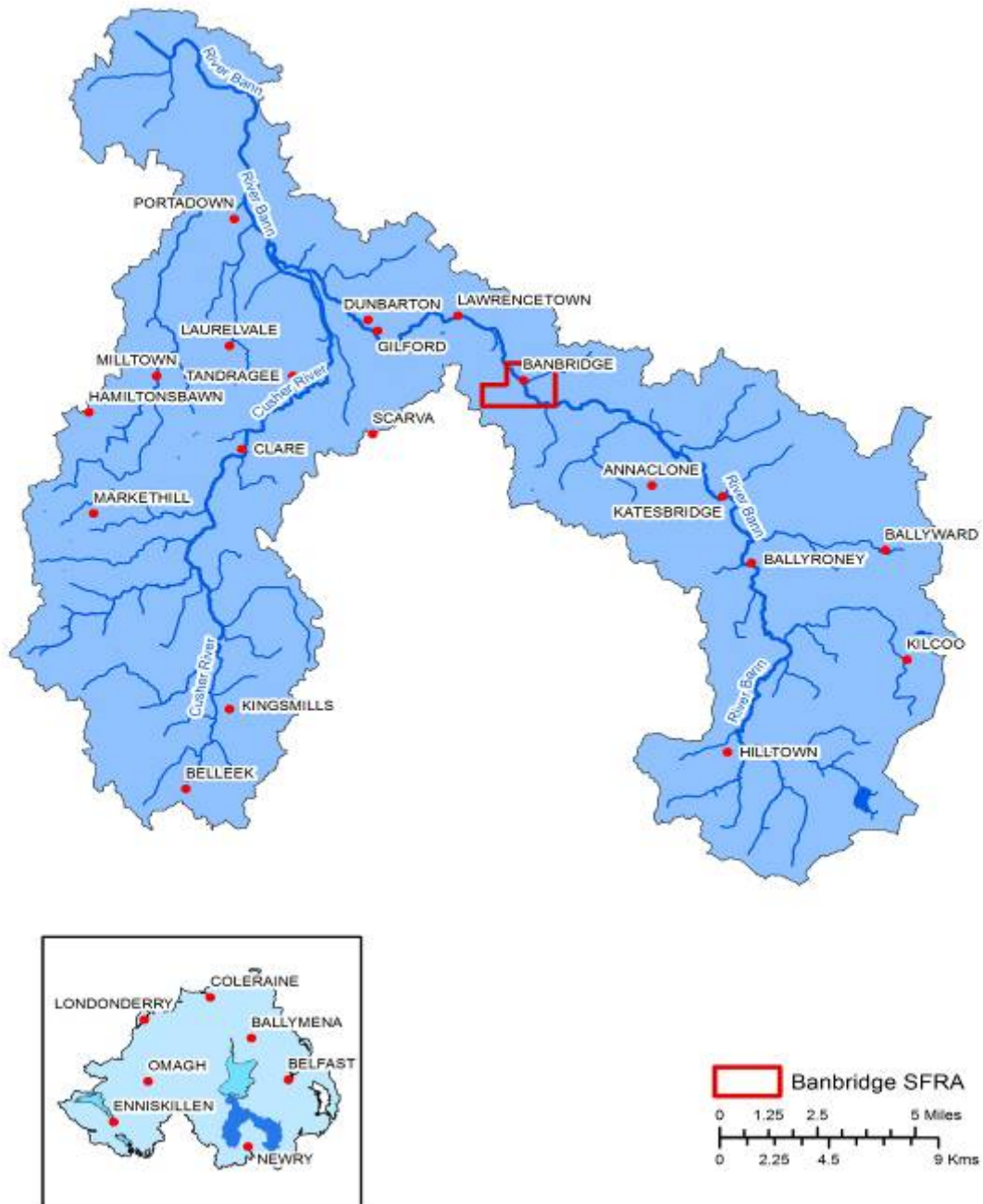


Figure 5.7 - Upper Bann LFMA and Banbridge SFRA

5.7.1 Flooding History

Rivers Agency records show that extensive flooding occurred along the Showground's Stream on the 16th August 2008. Information gathered after the event by Rivers Agency indicated that 12 houses on the Burnview Terrace and 8 houses in Willow Grove/Avenue flooded. A further 12 houses could have been affected along Burnview Terrace, if it were not for the sand bags that were deployed by Rivers Agency.

Initial investigations indicated that the flooding emanated from N.I Water and Rivers Agency culverts. There had been no previous incidents of flooding from this infrastructure recorded prior to the 16th August 2008 event.

Rivers Agency has no previous records of any flooding from Banbridge town culvert, Rifle Park Stream and Brookfield Stream.

However, Rivers Agency did carry out a culvert renovation scheme in 2004 to repair 343m of structurally defective culvert on the Rifle Park Stream, within the Maryville Estate. The existing pipeline was refurbished by installing a cured-in-place liner along much of its length at a cost of approximately £350k.

5.7.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (PRFA) (Dec 2011) the town of Banbridge, in terms of the potential adverse consequences of flooding, is ranked 13th of the twenty Significant Flood Risk Areas within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Banbridge because this national assessment is based on strategic 'undefended' flood models which do not take account of existing flood defence systems. Therefore, the assessment was in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach was taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps were prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection provided by these defences.

To facilitate a more robust assessment of the level of flood risk to Banbridge from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models give a more accurate prediction of the flooded areas which may

have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.7.3 Catchment Description

The Upper Bann Local Management Area (LMA) is part of the Neagh Bann River Basin District which drains into Lough Neagh at Bannfoot and covers an area of 397 km². The main river is the Upper Bann, with the Cushier River as a major tributary. The Upper Bann rises in the Mourne Mountains from several tributaries including the Leitrim River, the Muddock River, the Rocky River and the Upper Bann reach. It flows northwards through Banbridge and joins with the Cushier River south of Portadown.

The main towns in the Upper Bann LMA are Craigavon and Banbridge. There are also many small towns in the area including Tandragee, Markethill and Rathfriland. The main land use in the area is given over to improved grassland plus some arable horticulture and forestry.

The LMA supports a wide variety of natural habitats, several of which are protected. The river also supports a range of recreational activities such as angling, walking and canoeing.

5.7.4 Fluvial Flood Risk Assessment

Flood Model

The Banbridge flood model was constructed using InfoWorks RS 1D/ 2D (Version 13) and InfoWorks ICM 1D/ 2D (Version 3.5) modelling software. InfoWorks RS is an integrated hydrological and hydraulic modelling package developed by Innovyze. It includes full solution modelling of open channels, floodplains, embankments and hydraulic structures. InfoWorks ICM (Integrated Catchment Modelling) is an integrated modelling platform which incorporates both urban and river catchments. It provides the ability to model the complete drainage system both natural and engineered above and below-ground, including sewers, surface water, river and floodplains.

Fluvial Flooding Mechanisms

Showground's Stream

The Showground's Stream, a tributary of the River Upper Bann, flows through the eastern section of Banbridge and has a predominantly rural catchment outside the model area. Showground's Stream is approximately 4.8km long and originates in the hills near Drumneth, Co Down. It then flows in a south westerly direction before discharging into the River Bann. The catchment area is approximately 5.6km² with the upper reaches being mainly rural while the lower reaches comprise a mainly urbanised area of Banbridge.

Figure 5.7.4.1 illustrates the predicted extents of the potential fluvial flooding from the Showgrounds Stream in Banbridge and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.7.4.1.

The model shows that at the low frequency 1% AEP (Q100) flood event the floodwater is predicted to spill from the Showground's Stream culvert within the Willow Grove, Willow Avenue, Burnview Terrace and Castlewellan Road areas with the resulting surface water ponding to shallow depths up to 300mm in the low lying areas most notably at Castlewellan Road reach. It is estimated that **45** residential and **20** non residential properties could potentially be flooded in such a flood causing damages in excess of **£800,000**. The present value of the total property damages from potential future floods is calculated to be in excess of **£1.65million**.

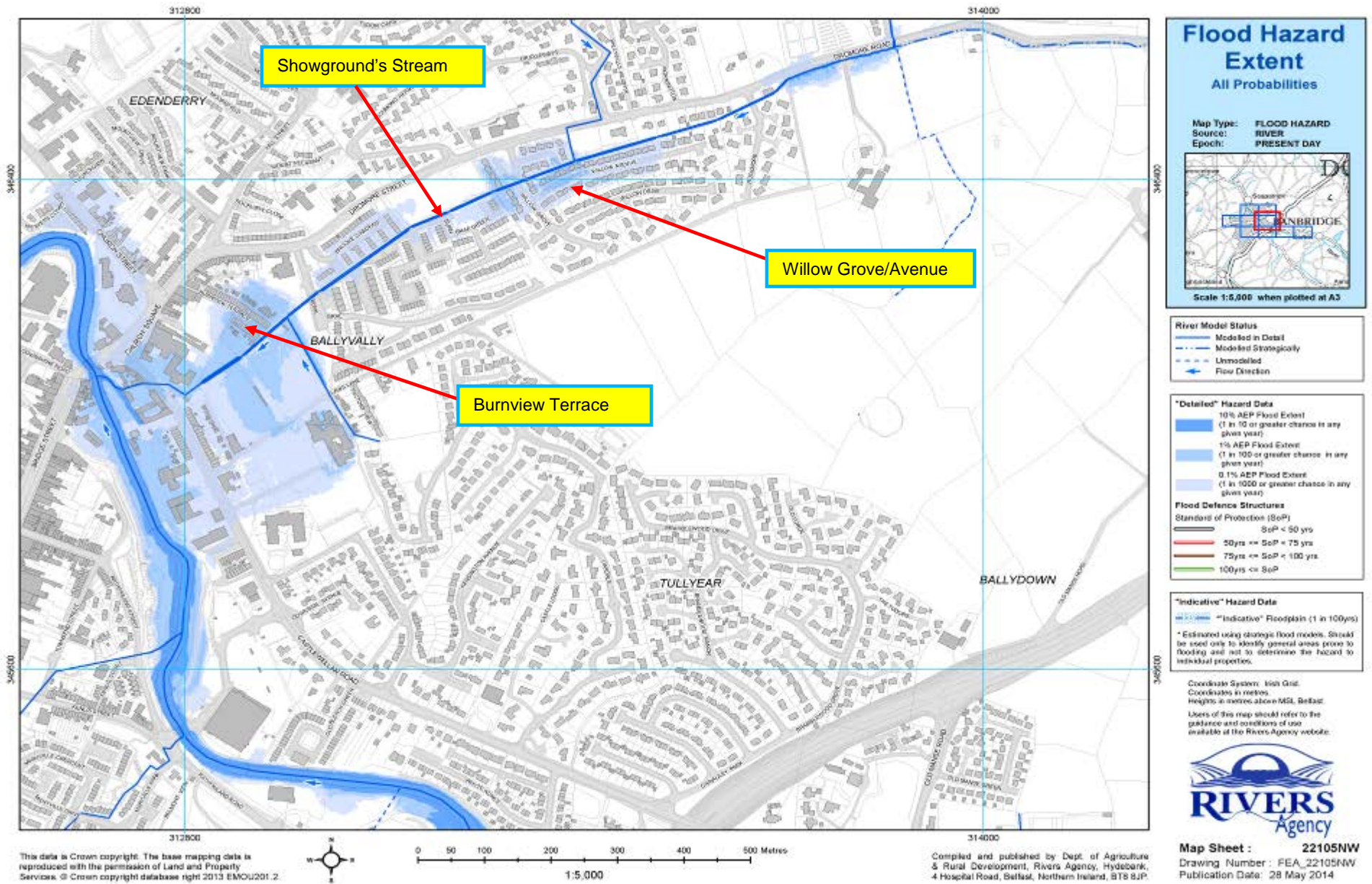


Figure 5.7.4.1 - Flood extent map for Showground's Stream, Banbridge

Table 5.7.4.1 - Banbridge SFRA – Showground’s Stream			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	0	45
Non Residential (Nr)	0	0	20
Economic Damage (£)	0	0	£800,000
Annual Average Damage (£)	£55,000		
Present Value (£)	£1,650,000		
IPPC sites (Nr)			
	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery’s	0	0	1
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	1
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	2
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Brookfield Stream

Figure 5.7.4.3 illustrates the predicted extents of the potential fluvial flooding from the Brookfield Stream in Banbridge and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.7.4.2. The Brookfield Stream is located to the north of Banbridge on the western side of the Upper Bann River. Its catchment area at the upstream extents of the model is 0.86km². The predictive model indicates that there is one primary flood risk location existing within the Brookfield Stream.

The model shows that at the very frequent 10% AEP (Q10) flood event, floodwater begins to spill from the Brookfield Stream designated grille which is located directly behind No73 Ravenswood. (See figure 5.7.4.2 below and figure 5.7.4.3). Once the flood water enters the grille it flows through a 1200mm dia concrete culvert to an open section of watercourse approximately 95m downstream. The model shows a Q100 discharge flow of 1.7m³/s. A standard 1200mm diameter culvert has the ability to vent up to a 2.15m³/s flow, therefore it is unclear what is causing this predicted flooding in this area. There is also no evidence of any historic flooding in this area from Rivers Agency flood records. Flooding from the 1% AEP (Q100) flood event is estimated to affect **14** residential properties at a cost of around **£91,000**. The present value of the total property damages from potential future floods is calculated to be in excess of **£210k**.

The model requires further investigation to determine the cause of the flooding or indeed if there is any likelihood of flooding in the Ravenswood Development area of Banbridge.

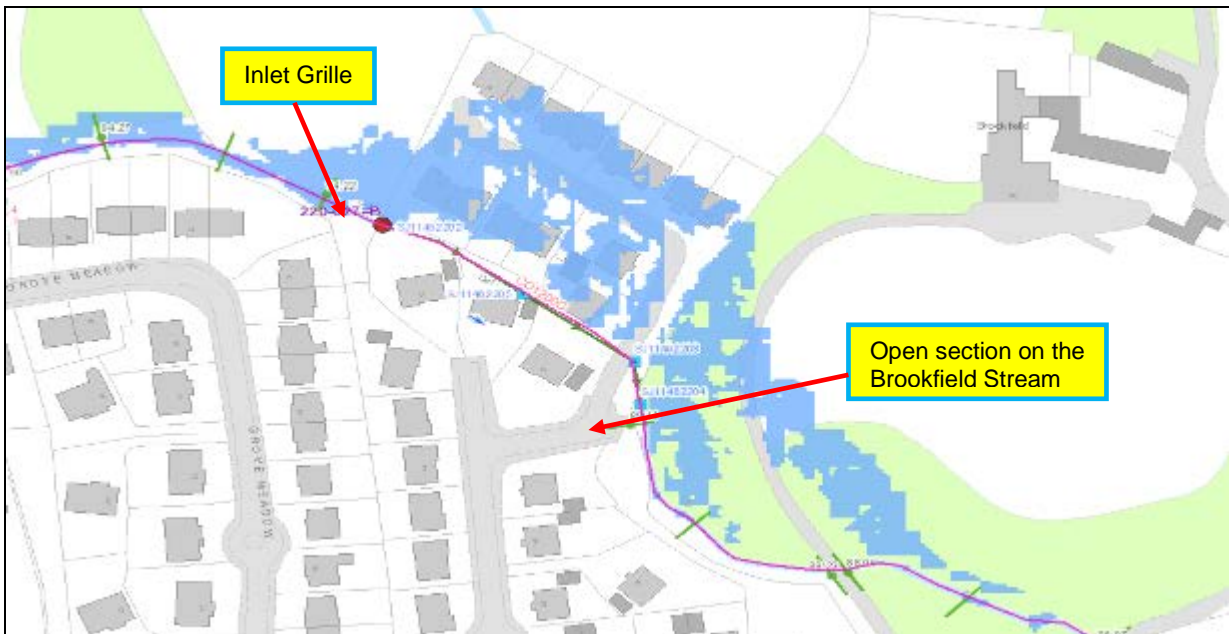


Figure 5.7.4.2 - Location of designated grille and open section on Brookfield Stream, Banbridge

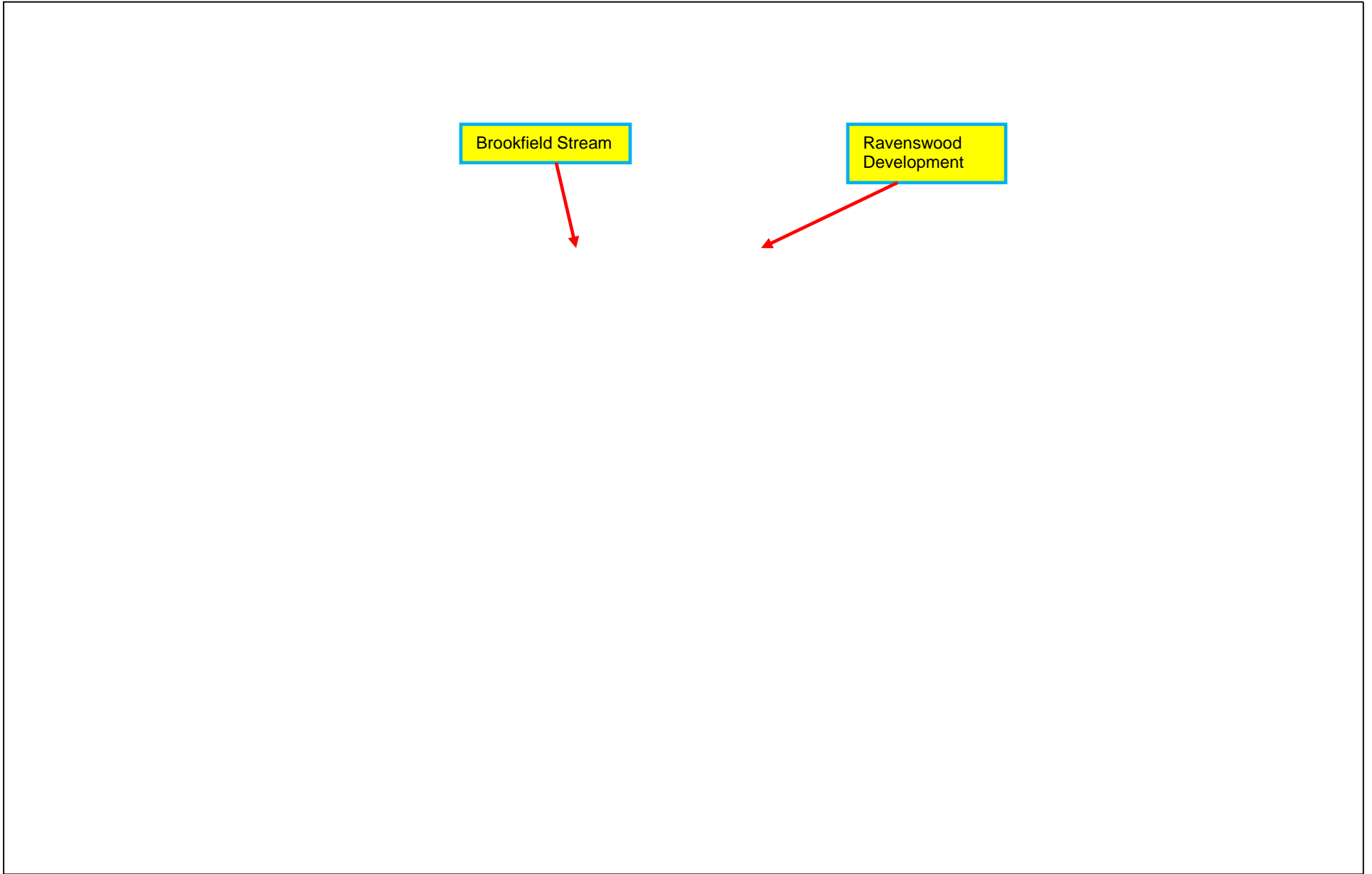


Figure 5.7.4.3 - Flood extent map for Brookfield Stream, Banbridge

Table 5.7.4.2 - Banbridge SFRA – Brookfield Stream			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	14	14	14
Non Residential (Nr)	0	0	0
Economic Damage (£)	£91,000	£91,000	£91,000
Annual Average Damage (£)	£7,000		
Present Value (£)	£210,000		
IPPC sites (Nr)			
	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Banbridge Town Culvert

The Fort Stream and Banbridge Town Culvert flow through the western section of Banbridge, draining a large part of Banbridge town, before discharging to the Upper Bann River. The computational model had two upstream boundaries and one downstream boundary. The predictive model indicates that there is one primary flood risk location existing within the Banbridge Town Culvert.

The model shows that at the very frequent 10% AEP (Q10) flood event, floodwater begins to spill from a designated grille which is located to the south of Hillhead Park road opposite a N.I Water pumping station. (See figure 5.7.4.3 below and figure 5.7.4.5). Once the flood water enters the grille it then flows through a 750mm diameter concrete culvert. The principle restriction is at the inlet grille to the culvert under the Hillhead Park Road until the culvert increases in size to a 1500mm diameter to the rear of No 14 Ballygowan Road.

Although this section of the Banbridge Town Culvert is typically 1500mm diameter it is linked into an existing 750mm diameter culvert directly upstream, crossing under the Hillhead Park Road which severely inhibits its hydraulic capacity. It is estimated that floodwater will pond to a depth of up to 300mm and 1 N.I Water pumping station may suffer internal flooding at the 10% AEP (Q10) event. At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive. Flooding from the 1% AEP (Q100) flood event is estimated to affect **2** residential and **2** non residential properties at a cost of around **£40,000**.

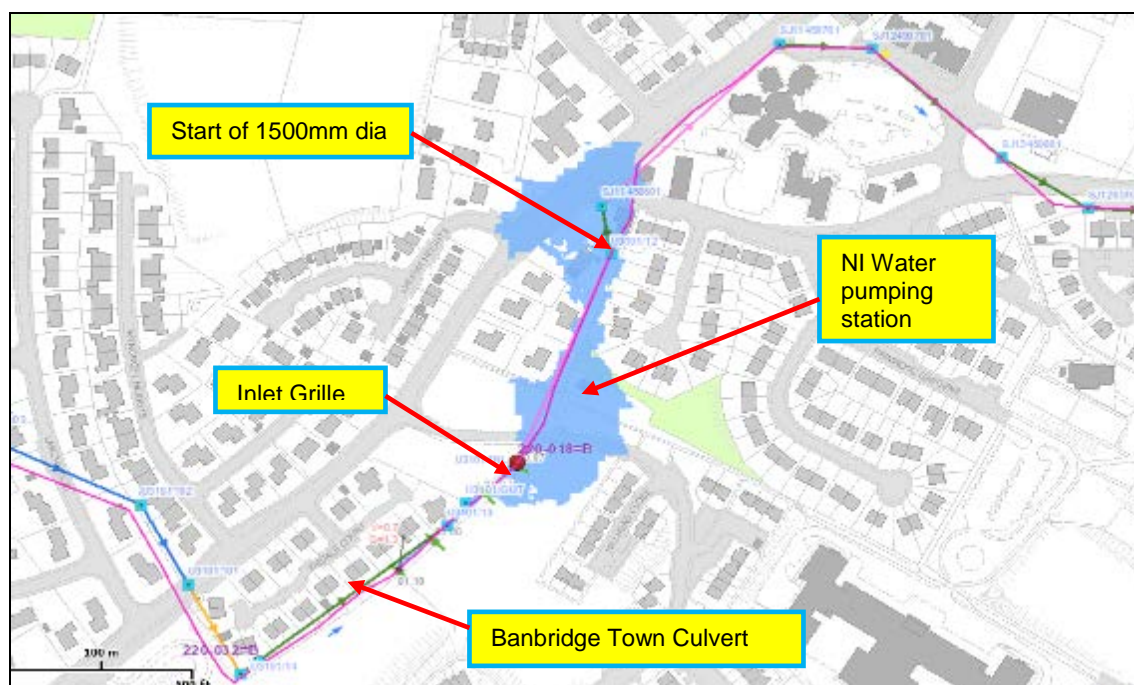


Figure 5.7.4.3 - Location of designated grille on Banbridge Town Culvert (1%AEP)

Rifle Park Stream

The Rifle Park Stream, a tributary of the Upper Bann River, is located at the southern end of Banbridge, running along the boundary of Banbridge Rugby Club (Rifle Park). The total length of the modelled river is 900m and is completely culverted through the study area. The watercourse drains a small rural catchment to the south east of the A1. The predictive model indicates that there is one primary flood risk location existing within the Rifle Park Stream.

The model shows that at the very frequent 10% AEP (Q10) flood event, floodwater begins to spill from a designated manhole on the Rifle Park Stream located to the west of Banbridge Rugby Club. (See figure 5.7.4.4 below and figure 5.7.4.5). Once the flood water spills from the manhole it flows in a northerly direction towards Iveagh Veterinary Services. The principle restriction is at the manhole located opposite the Iveagh Veterinary Services building where the culvert reduces from a 525mm diameter down to a 225mm diameter road crossing culvert then returns to a 525mm diameter culvert. The reducing in this section of the culvert size severely inhibits its hydraulic capacity causing the flood water to back up and spill from the manhole located beside the Rugby Clubhouse. It is estimated that floodwater will pond to a depth of up to 300mm with the Rugby Clubhouse being potentially damaged at this flood event causing damages in excess of **£15,000**

At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive. Flooding from the 1% AEP (Q100) flood event is estimated to affect **2** non residential properties at a cost of around **£30,000**. The present value of the total property damages from potential future floods is calculated to be in excess of **£60,000**.

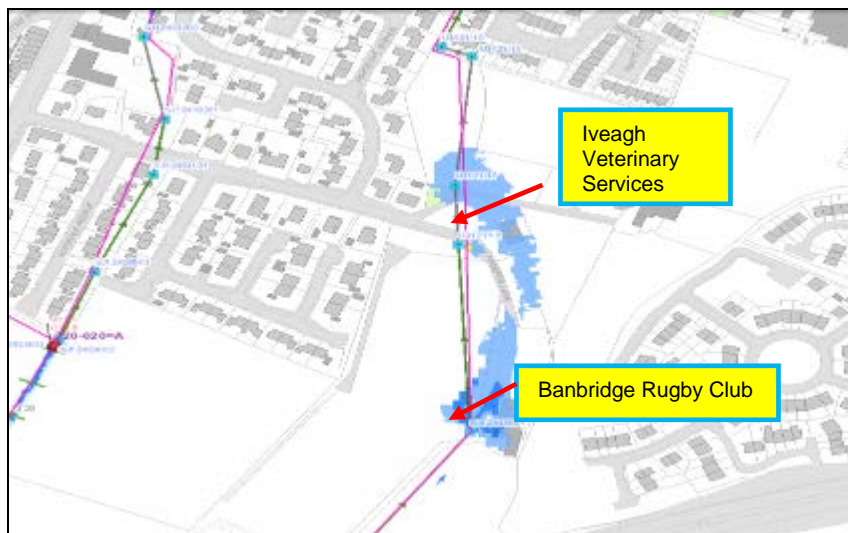


Figure 5.7.4.4 - Location of flooding on Rifle Park Stream, Banbridge

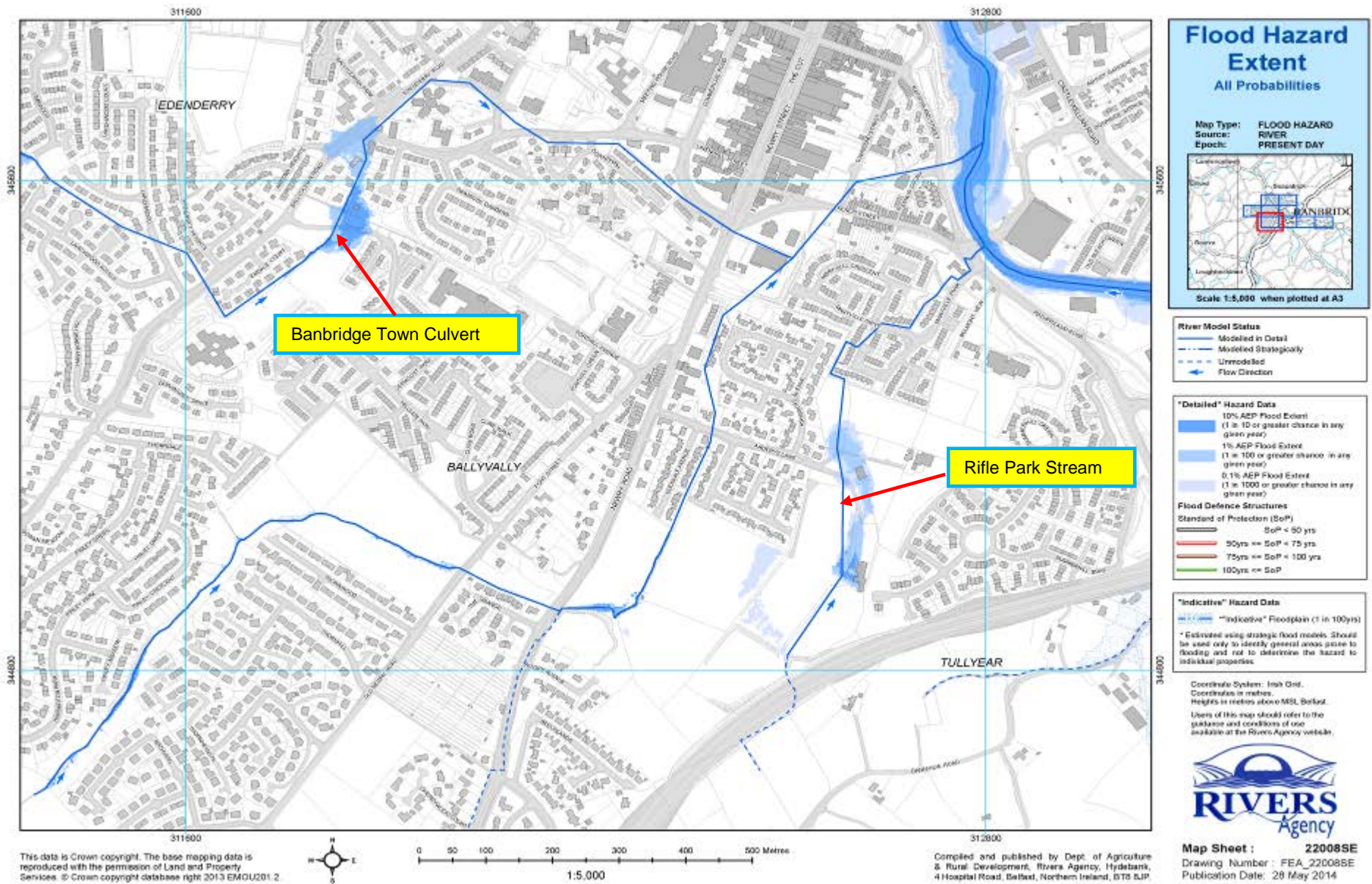


Figure 5.7.4.5 - Flood extent map for Banbridge Town Culvert and Rifle Park Stream, Banbridge

Table 5.7.4.3 - Banbridge SFRA – Banbridge Town Culvert			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	2	2
Non Residential (Nr)	1	1	2
Economic Damage (£)	£10,000	£30,000	£40,000
Annual Average Damage (£)	£3,000		
Present Value (£)	£90,000		
IPPC sites (Nr)			
	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	1	1	1
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Table 5.7.4.4 - Banbridge SFRA – Rifle Park Stream			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	0	0
Non Residential (Nr)	1	2	2
Economic Damage (£)	£15,000	£25,000	£30,000
Annual Average Damage (£)	£2,025		
Present Value (£)	£60,750		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.7.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Banbridge it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Banbridge, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency will also review the existing Development Plan for Banbridge (Banbridge, Newry and Mourne Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Banbridge area are:-

- The Crothers Memorial Playing Fields
- The area south east to the Banbridge by-pass where it crosses the Upper Bann River

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Banbridge where re-development may be likely to take place are:

- Castlewellan Road area along the right bank of the Upper Bann River

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments. Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps we will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Controlled Reservoirs identified in the Banbridge area are as follows:

- Corbet Lough

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore important, that we continue to target investment

by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Within the Banbridge area the following potential schemes have been identified and will be referred to the appropriate bodies for further investigation or detailed feasibility study.

Having conducted a detailed assessment of the fluvial flood risk to Banbridge, Rivers Agency has determined that potential flood alleviation schemes may be justified for the Banbridge Town Culvert, Showground’s Stream, and to a lesser extent, the Brookfield Stream areas.

Showground's Stream

A feasibility study for the Showground's Stream was completed in 2014 and this identified that a flood alleviation scheme may be cost beneficial. The detailed design and economic appraisal for the proposed flood alleviation scheme has commenced and will be completed in 2016. If the proposed scheme is confirmed to be economically viable the scheme will be placed on the Rivers Agency's Capital Works programme and undertaken in line with its prioritisation compared to viable schemes if and when resources are available.

Banbridge Town Culvert

Rivers Agency was to undertake 80m of a new 1200mm culvert upgrade scheme on the Banbridge Town Culvert in 2015. On commencement of the scheme unforeseen ground conditions were encountered and therefore the scheme has been stopped. The scheme has now been passed to Rivers Agency's Capital Procurement Unit to be undertaken by a Specialist contractor. This scheme is likely to proceed to the construction stage towards the end of 2016.

Brookfield Stream

From onsite inspection this development does not seem likely to flood. A quick pipe check indicates that the 1200mm diameter culvert has the capability of venting a flow of 2.2m³/s. The model shows a Q100 discharge flow of about 1.8m³/s in the Brookfield stream at the Q100. Therefore, the culvert seems to be adequately sized. Further investigation is required at this location.

Preparedness

In Banbridge it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Banbridge which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. As part of this pilot project, community engagement has been carried out with the community in Ballyvalley / Burnview area / Willow Grove area. Based on this scoring of the other areas, these did not score high enough to be placed within the top 20 communities to be offered a programme of community engagement during the period of this plan. However, if communities want to become more resilient, the Department is committed to providing assistance where possible to develop the consistent approach to resilience. The NI Direct website www.nidirect.gov.uk/ will host further information and advice on what to do in advance of flooding, what to do during flooding and how to recover after flooding. The website will also contain templates for communities wishing to develop their own plan.

5.8 Portadown SFRA – Upper Bann

The core boundary of the Portadown SFRA, which has been determined through the PFRA, is located within the Upper Bann Local Management Area and illustrated in Figure 5.8 below.

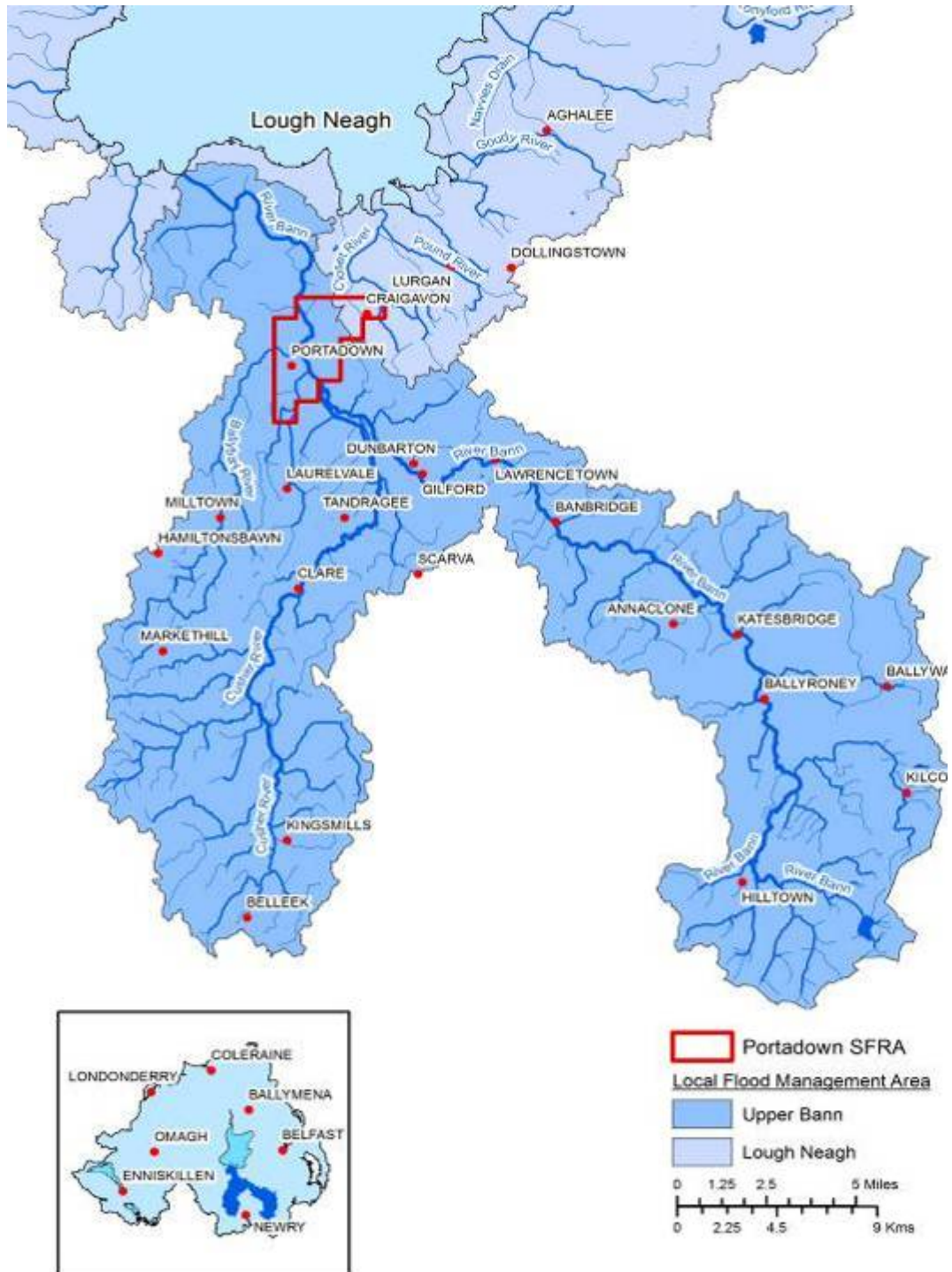


Figure 5.8 - Upper Bann LFMA and Portadown SFRA

5.8.1 Flooding history

A search of flood records in the Portadown area has revealed very limited information on historic flooding along the Upper Bann River, or elsewhere, with only very brief accounts for the years 2000, 2008, 2011 and 2014.

Since the introduction of the flooding hardship payment scheme in 2007 there have been 3 payments issued to homeowners in the Portadown SFRA. The majority of these payments (2 Nr) relate to the flooding in October 2011 which affected large parts of the province. The properties affected during this particular event were mainly in the vicinity of the Annagh Industrial Estate. The number of payments that relate to the flooding that occurred in November 2014 in the Portadown area is not yet been made available.



Figure 5.8.2.1 - Flooding in Portadown year 2000



Photo 5.8.2.1 - Portadown railway line flooded in Oct 2011



Photo 5.8.2.2 - Ashgrove Road, Portadown flooded in Nov 2014

Existing Flood Defences

The only existing flood defences in Portadown are low-level earth embankments which are located to the north and south of Portadown on both banks of the Upper Bann River (See Figure 5.8.2.2 below). These low-level earth embankments are constructed from a cohesive clay and provide an approximate standard of protection of 1:5 years to low laying agriculture land.

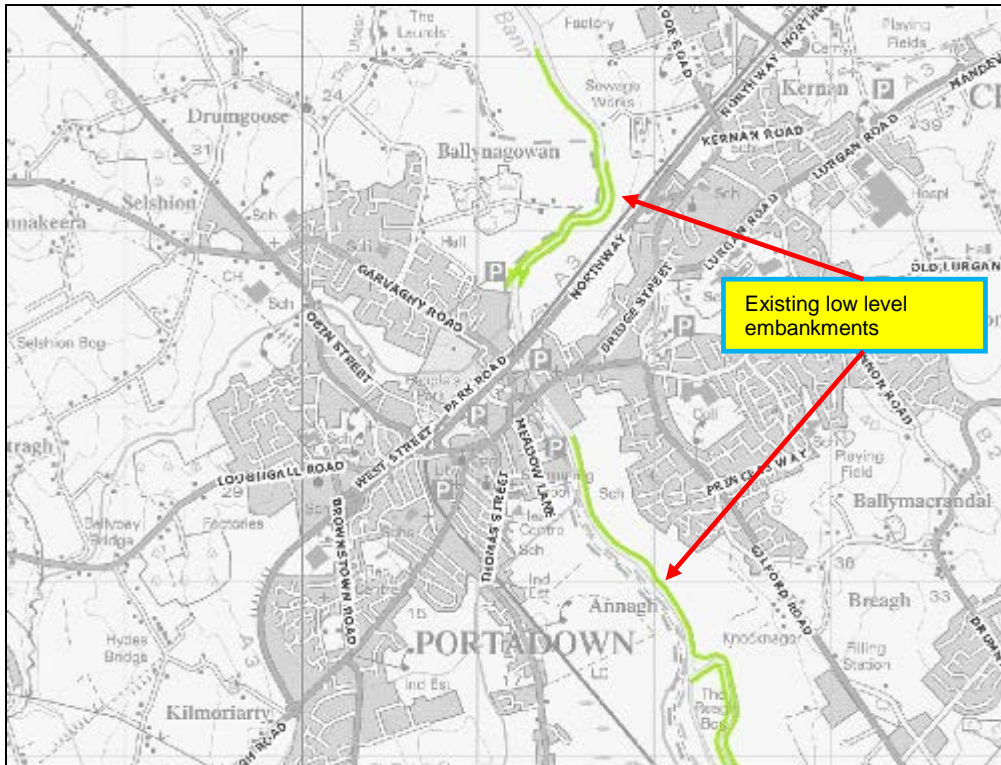


Figure 5.8.2.2 - Existing low level-flood earth embankments in Portadown

A flood alleviation scheme was proposed for the lower reach of the Ballybay River in the Garvagh Road area in the early 2000s. However, this proposal was rejected by the council because the plan included a high flood defence wall along the River Bann from the Boat House to the Ulster Carpet factory which would have only served to:-

- Cut off the view of the River from the town when efforts were being made to promote the development of the riverside and use of the river; and
- Channel flood waters further downstream thereby increasing the risk of flooding in those areas which have been historically impacted including as recently as November 2014.

5.8.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) Portadown, in terms of the potential adverse consequences of flooding, is ranked 5th of the twenty SFRA within Northern Ireland (See Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Portadown because this national assessment is based on strategic ‘undefended’ flood models which ignore the presence of existing flood defence systems. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach has been taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection provided by these defences.

To facilitate a more robust assessment of the level of flood risk to Portadown from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources of flooding. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.8.3 Catchment Description

The Upper Bann is part of the Neagh Bann River Basin District and drains into Lough Neagh at Bannfoot and covers an area of 397 km². The main river is the Upper Bann, with the Cushier River as a major tributary. The Upper Bann rises in the Mourne Mountains from several tributaries including the Leitrim River, the Muddock River, the Rocky River and the Upper Bann reach. It flows northwards through Banbridge and joins with the Cushier River south of Portadown.

The main towns in Upper Bann are Lurgan, Central Craigavon, Banbridge and Portadown. The main land use in the area is given over to improved grassland plus some arable horticulture and forestry. The river also supports a range of recreational activities such as angling, walking and canoeing. The twin forks of the upper reaches of the Upper Bann and the Cushier River border on the Mourne Area of Outstanding Natural Beauty, and the Ring of Gullion Area of Outstanding Natural Beauty, respectively.

5.8.4 Fluvial Flood Risk Assessment

Flood Model

An InfoWorks RS 1D/2D Hydrodynamic model was prepared for the Upper Bann River. The model for the Upper Bann River stretches from Milltown Corbet to its discharge point at Lough Neagh. The total length of the modelled section is 51km and includes 439 topographical survey cross sections.

There are 27 bridges along this length that affect the hydrodynamic characteristics of the river and have been included in the model along with all surveyed weirs. In order to increase the accuracy of the modelling and particularly the linkage between the 1D and 2D domains of the model a number of interpolated sections were added.

The Upper Bann River flows through a relatively steep sided valley between Banbridge and Portadown with only localised areas of expansive floodplain along this reach. This stretch of the river was modelled predominantly using 1D modelling only, with 2D modelling as required. From the Moyallan townland the floodplain expands rapidly with a large pondage area upstream of Portadown. From this location to the downstream boundary with Lough Neagh the model is 1D/2D constructed with a triangular flexible mesh generated using either LiDAR data to define the floodplains. Where buildings are present in the floodplain the mesh size is automatically reduced to more accurately represent the ground levels and flow paths in the vicinity of the buildings. The mesh has been forced to delineate roads and railways by introducing break lines based on OSNI GIS layers. This ensures that the mesh takes account of raised road and rail embankments which pass through the floodplain.

InfoWorks ICM was used for rivers flowing through urban areas. In addition to survey data, the Rivers Agency InfoNet database provided data for the ICM models. Ten InfoWorks ICM 1D/2D Hydrodynamic models were prepared for the Upper Bann River study and each of these is discussed in more detail below. The downstream boundary conditions for each of the ICM models was extracted from the model of the river into which it discharges, providing a stage/time boundary to simulate backwater effects.

Fluvial Flooding Mechanisms

Rivers Agency's flood model initially predicts flooding to begin in the Portadown pondage area from the Cusher River along the reach just to the south of Whitecoat Point as highlighted in Figure 5.8.4.1. The flooding from the Cusher then spreads north with flooding from the main Upper Bann channel overtopping the small agricultural embankments increasing the flood levels. Initial flooding to the west of the railway embankment is through the Annagh and Annagh Bypass railway bridges marked A and B respectively on Figure 5.8.4.1. Flood water eventually overtops the railway line along a section adjacent to the Cusher River. The pondage area of Brackagh Bog ultimately becomes completely inundated with properties potentially

being at risk of flooding in the Tandragee Road, Mahon and Clounagh areas of Portadown as illustrated in Figure 5.8.4.1.

Flood waters spread throughout the floodplain reaching the boundaries of housing developments along the Gilford Road. However, the properties are constructed on land higher than the 1% AEP (Q100) flood level and do not get inundated.

Much of Portadown Golf Course becomes affected initially from flood water spreading from the north and then by over topping of the banks at the peak of the flood.

Ballybay River

The Ballybay River discharges to the Upper Bann River on the downstream side of Portadown near the railway bridge. The modelled reach of the river begins on the outskirts of Portadown and flows through the Corcrain and Garvaghy areas of Portadown to its confluence with the Upper Bann River as shown in Figure 5.8.4.2.

Much of central Portadown is higher than the 1% AEP (Q100) flood level. However, there are industrial properties such as the Ulster Carpet Factory located along the banks of the Ballybay River and Upper Bann River which are potentially at risk during a 10%AEP (Q10) flood event, as can be seen in Figure 5.8.4.2. The Ballybay River also causes flooding to properties during the 1% AEP (Q100) flood event, some of which are residential properties immediately upstream of the Ulster Carpet Factory on Park Road, Garvaghy Road and in Witten Close. The Ballybay River also spills out of bank at the 1%AEP (Q100) flood event further upstream above the playing fields and at the junction of Obins Street and Charles Street, at locations marked B on Figure 5.8.4.3 in the Rose Cottages area and Corcrain Mew's area.

Ballynagowan River

Downstream of Portadown the Upper Bann River has extensive floodplains which are protected to a low standard in places by agricultural defences. However, all these defences are overtopped during the 1% AEP (Q100) flood event which is illustrated in Figure 5.8.4.4.

The flood model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the watercourse known as Ballynagowan River within the Wood Grove and Ash Grove Manor Developments. The resulting flood water ponds to depths of up to 300mm. It is estimated that **20** residential properties could be flooded at this event causing damages in excess of **£200,000**.

At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in

the vicinity of the Wood Grove Development. Flooding from the 1% AEP (Q100) flood event is estimated to affect **36** residential properties at this location causing damages in excess of **£360,000**. Table 5.8.4.2 summarises the number of properties at risk during each of the modelled return periods.

Annagh River

The Annagh River discharges to the Upper Bann River on the upstream side of Portadown, to the south of the Meadows Shopping Centre. It has a predominantly rural catchment flowing through the Annagh and Mahon areas of Portadown. The total length of the modelled river is 3km which included 37 topographical survey cross-sections. There are 3 structures along this length that affect the hydrodynamic characteristics of the river and have been included in the model.

The flood model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from the Annagh River within Annagh Hill Industrial Estate. The resulting flood water ponds to a depth of up to 300mm in places. It is estimated that **15** non residential properties could be flooded at this event causing damages in excess of **£180,000**.

At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations plus the Annagh Hill, Bann Street, Mourenview Street, Kingsway Drive, Armagh Road, The Old Golf Links and the Annagh Meadows areas, although the flood inundation areas are more extensive and deeper (up to 1m deep) particularly in the vicinity Annagh Industrial Estate. Flooding from the 1% AEP (Q100) flood event is estimated to affect **65** residential and **22** non residential properties at this location causing damages in excess of **£980,000**. Table 5.8.4.3 summarises the number of properties at risk during each of the modelled return periods.

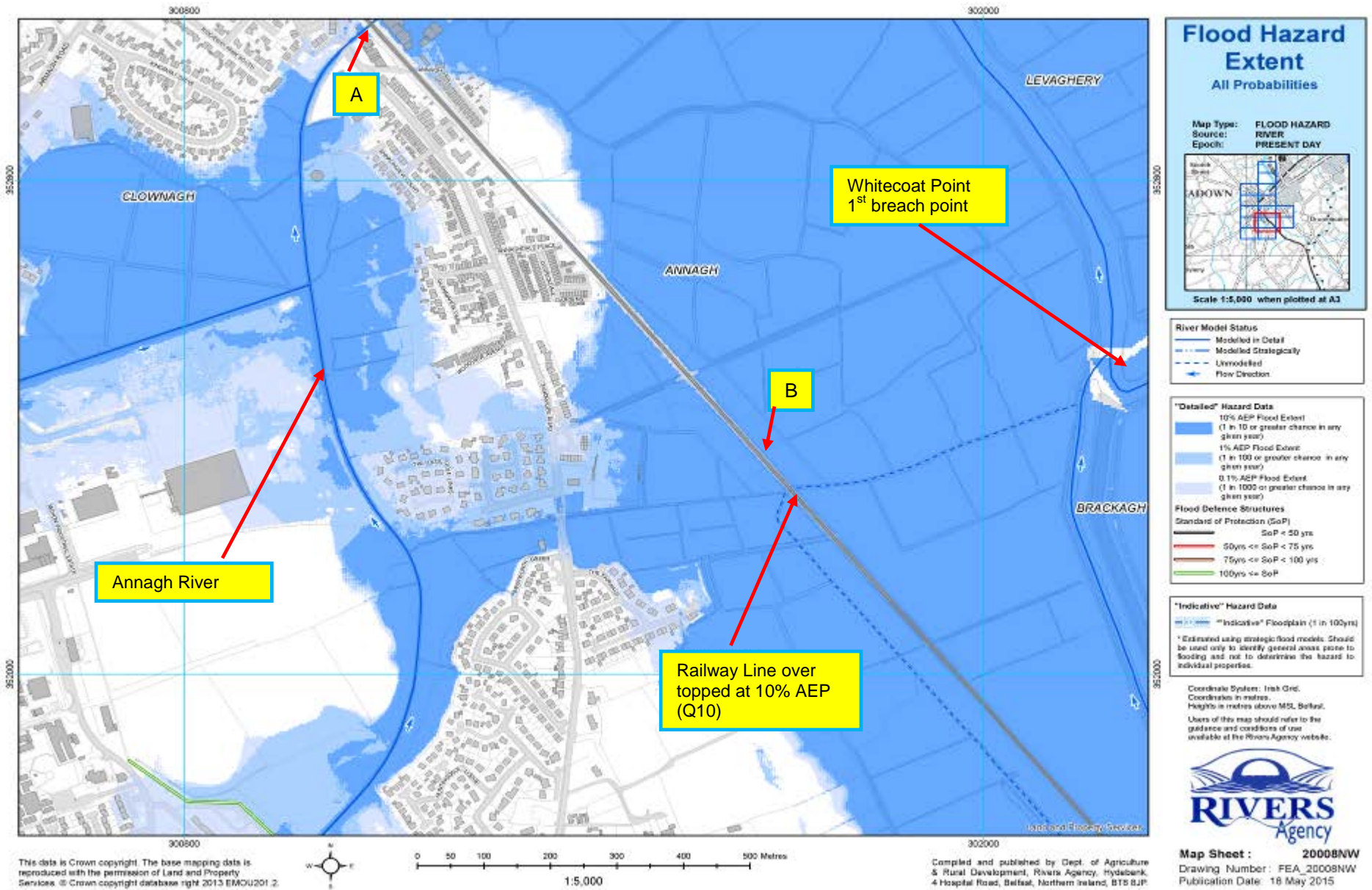


Figure 5.8.4.1 - Flood extent map for south Portadown

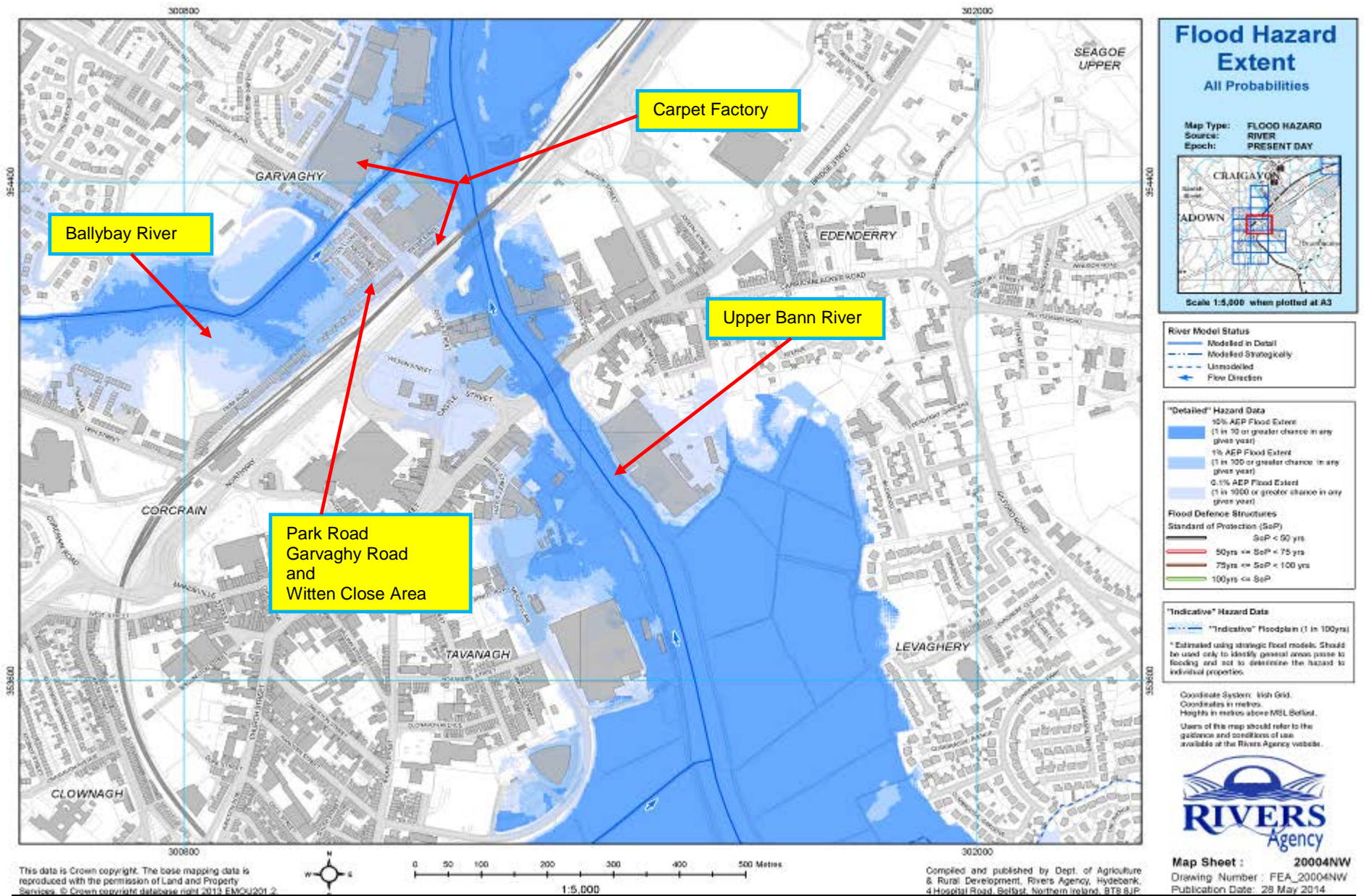


Figure 5.8.4.2 - Flood extent map for Central Portadown

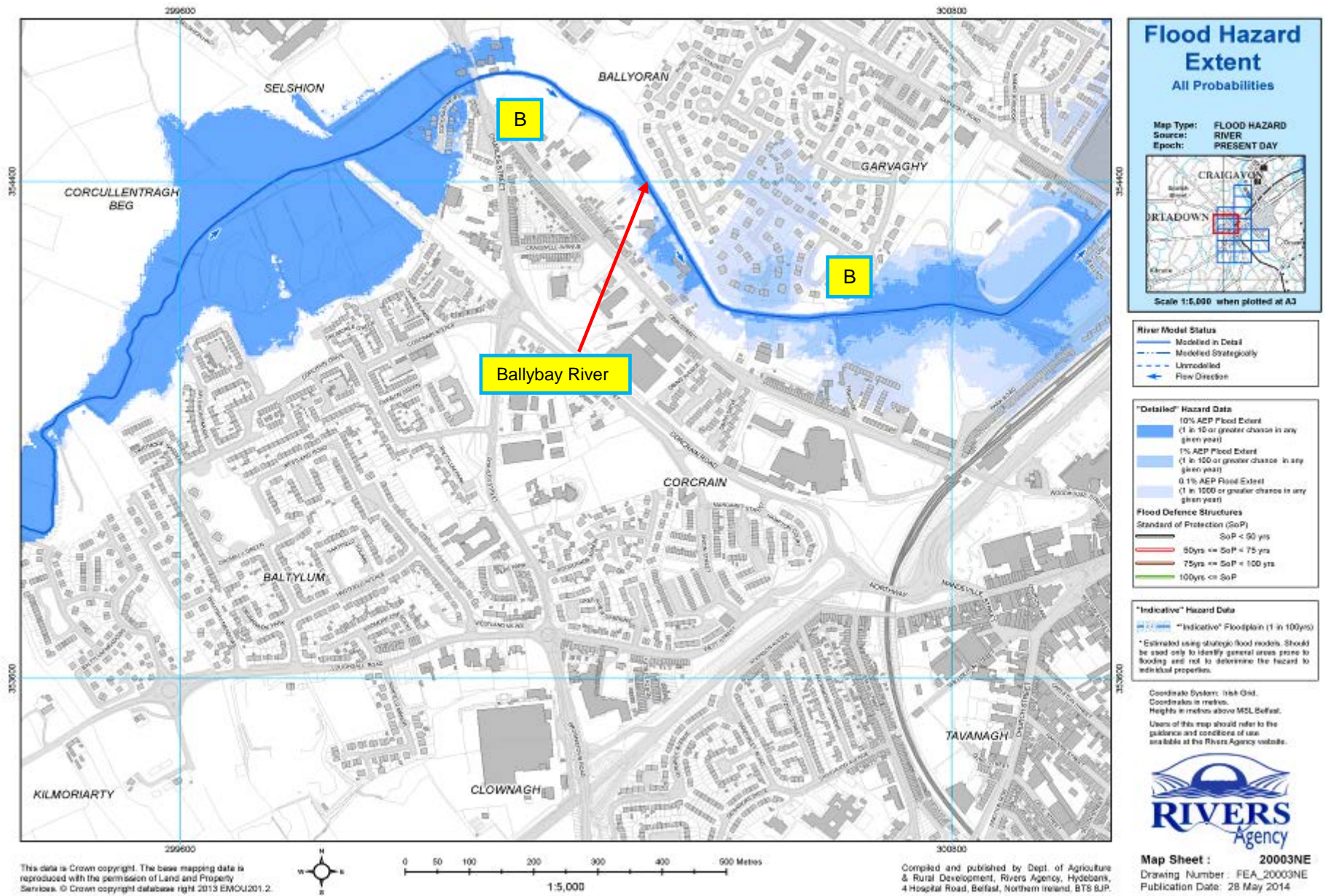


Figure 5.8.4.3 - Flood extent map for West Portadown - Ballybay River

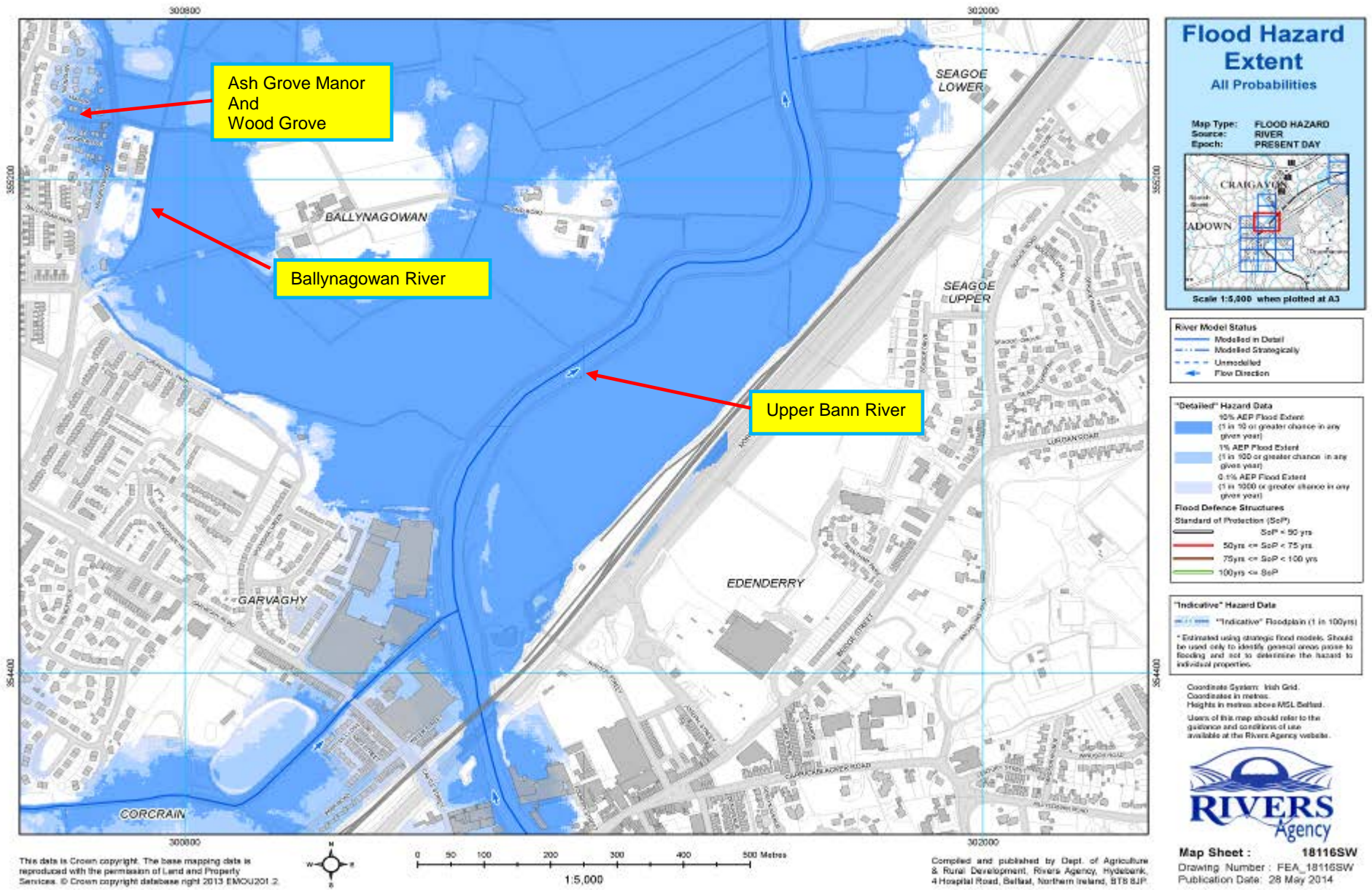


Figure 5.8.4.4 - Flood extent map for North Portadown – Ballynagowan River

Table 5.8.4.1 - Portadown SFRA – Ballybay River			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	15	47	75
Non Residential (Nr)	4	6	10
Economic Damage (£)	£231,000	£575,000	£903,000
Annual Average Damage (£)	£86,350		
Present Value (£)	£2,590,000		

Table 5.8.4.2 - Portadown SFRA – Ballynagowan River			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	20	28	36
Non Residential (Nr)	0	0	0
Economic Damage (£)	£200,000	£280,000	£360,000
Annual Average Damage (£)	£64,000		
Present Value (£)	£1,920,000		

Table 5.8.4.3 - Portadown SFRA – Annagh River			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	22	65
Non Residential (Nr)	15	17	22
Economic Damage (£)	£180,000	£424,000	£980,000
Annual Average Damage (£)	£69,180		
Present Value (£)	£2,075,400		

One Integrated Pollution Prevention Control (IPPC) site falls within the estimated 1% AEP (Q100) flood event flood extent. This is the Ulster Carpet Mills site along the Central Corridor in Portadown. Brackagh Bog has been designated an Area of Significant Scientific Interest (ASSI) by the Northern Ireland Environment Agency. The area is a wetlands bog and natural pondage area for the Upper Bann and Cushier Rivers, as such it is unlikely to be detrimentally affected by infrequent major flooding.

The Upper Bann floodplain on the downstream side of the M1 motorway is a RAMSAR site (Convention of Wetlands). Similarly to Brackagh Bog this area is unlikely to be detrimentally affected by infrequent major flooding.

5.8.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Portadown it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Portadown, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency will also review the existing Development Plan for Portadown (Craigavon Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Portadown area are:

- To the south of the town along the right bank of the Anagh River and the left bank of the Upper Bann River
- The area south of Kingsway Drive Drain
- The area east to Park Road along the banks of the Ballybay River
- To the north of the town along the left bank of Ballynagowan River and the left bank of the Upper Bann River.

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Portadown where re-development may be likely to take place are:

- Annagh Industrial Estate
- Ulster Carpet Factory

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain/ that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from Reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety. There are no Controlled Reservoirs in the Portadown SFRA.

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

A flood study for the Portadown SFRA has been requested. If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Within the Portadown area the following potential schemes have been identified and will be referred to the appropriate bodies for further investigation or detailed feasibility study.

List of possible schemes in Portadown SFRA:

Garvaghy area

- Fluvial flooding from the Ballybay River.
- Flood damage avoidance figure of **£2,590,000**.

Ballynagowan area

- Fluvial flooding from the Ballynagowan River.
- Flood damage avoidance figure of **£1,920,000**.

Annagh area

- Fluvial flooding from the Annagh River
- Flood damage avoidance figure of **£2,075,400**.

Preparedness

In Portadown it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Portadown which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring the following area could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Park Road, Portadown.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience
- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRAs in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.9 Glengormley and Mallusk - Sixmilewater

The core boundary of the Glengormley and Mallusk SFRA, which has been determined through the PFRA, is located within the Sixmilewater Local Management Area and illustrated in Figure 5.9 below.



Figure 5.9 - Sixmilewater LFMA and Glengormley and Mallusk SFRA

5.9.1 Flooding history

Rivers Agency does not have any significant flooding records within the Glengormley & Mallusk area. However, there was a significant general concern with respect to the capacity of the existing culvert network to accommodate the flood flows from the current and predicted levels of development.

It has been reported that the area around Park Road Bridge and the confluence between the Ballymartin River and Blackwater Drain is prone to out of bank flooding. No detailed records or flood data exist for the confluence but the problem has been increasing with further development of the catchment.

Records do exist however, of some localised flooding occurring on the 5th December 2001 during the development of new housing located on the left bank upstream of Park Road Bridge. Flooding was also recorded on the same day within a property in Rogan Manor.

The flood event of August 2008 caused widespread flooding across a large proportion of Northern Ireland. The most significant flooding was experienced in the North East including the overall Sixmilewater catchment. There are a number of areas within the Mallusk and Glengormley area that have flooded in the past:

- Brett Martin Factory
- 15 Roughfort Road
- 53 Lower Rogan Manor
- Localised flooding at Park Road Manor
- Commercial Property close to the Blackwater Drain at Sentry Lane

5.9.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the area of Glengormley and Mallusk, in terms of the potential adverse consequences of flooding, is ranked 16th of the twenty SFRA within Northern Ireland (See Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding in Glengormley and Mallusk because this national assessment is based on strategic 'undefended' flood models which ignore the presence of existing flood defence systems. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach has been taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and

flood modelling necessary to remove the uncertainty and establish the actual level of protection provided by these defences.

To facilitate a more robust assessment of the level of flood risk to Glengormley and Mallusk from fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these flooding sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.9.3 Catchment Description

The Ballymartin River and Black Water Drain catchment is located in the general area of Glengormley and Mallusk. The Ballymartin River discharges into the Sixmilewater at Ballymartin River Bridge to the north of Templepatrick.

The overall Ballymartin River/ Blackwater Drain catchment, upstream of the Millbank Road Bridge is measured at 28.56km². The catchment area of the Ballymartin River and Flush River upstream of the Blackwater confluence is 11.31km². The catchment area of the Ballymartin/Flush River tributary watercourse is 8.5km². This is the key sub catchment and includes the significantly developed areas of Mallusk and Glengormley.

Ballymartin River

The Ballymartin River is open channel with an isolated bridge which extends approximately 2.4km from Millbank Road Bridge to its confluence at the Blackwater Drain. The confluence is located approximately 250m downstream of Park Road Bridge.

This section of the catchment has low density urbanization with isolated developments including the Brett Martin Factory and Belfast Royal Academy (BRA) sports facilities at Roughfort Road.

Ballymartin River and Flush River

The Ballymartin River extends further upstream from the confluence with the Blackwater Drain to Hyde Park Dam and upstream through the Boghill Dam. The catchment area of the Ballymartin River upstream of the Blackwater Drain confluence is 11.3 km².

Upstream of the Hyde Park Dam the watercourse becomes the Flush River and extends approximately 2km to its source south west of Mallusk. The upper part of the catchment is steep rural land with only dispersed small holdings.

Development within the overall catchment area is relatively low with the land being relatively rural with dispersed small holdings. Current development levels increase significantly on the right bank of Ballymartin River from approximately 0.5km downstream of HydePark Dam to the confluence with the Blackwater Drain.

Blackwater Drain

The Blackwater Drain commences at the confluence with the Ballymartin River and extends upstream through the extensively urbanized areas of Mullask and Glengormley. The watercourse is generally an open channel from the confluence to the Rogan Manor housing development approximately 1.2km upstream. The watercourses upstream of Rogan Manor are generally culverted with small areas of open channel mainly close to the rural open headwaters.

The catchment area upstream of Rogan Manor is steep and has a number of reaches. The section of the watercourse that extends through the urbanized area of Glengormley has two main reaches, the Inniscoole Park Stream and the Blackwater Drain Extension.

5.9.4 Fluvial Flood Risk Assessment

Flood Model

The flood model constructed for the Glengormley and Mallusk area used Infoworks-ICM. This modelling software provides information on flood water depths, levels, velocities, timings and hazard ratings.

Existing models were converted into Infoworks-ICM. Where no existing models were available, RANI provided survey data in pdf format and InfoNet data from their asset database. This asset data provided details on the size, shape and levels of culverts, manholes and trash screens which are maintained by the Rivers Agency.

Where available, modelled flows were retained from the existing models. Typically flow estimates for the full suite of return periods required for this commission were not available in the existing model files and flows for intermediate return periods have therefore been interpolated between return periods where flow data was available based on a standard growth curve for each model domain.

Fluvial Flooding Mechanisms

Figures 5.9.4.1 to Figure 5.9.4.4 illustrate the predicted extents of the potential fluvial flooding in Glengormley and Mallusk and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.9.4.1.

The majority of the culvert network in the Glengormley and Mallusk area is undesignated and has been built in stages over many years to facilitate the industrial development. These culvert works were undertaken following the advice of Rivers Agency.

It should be noted that when approval was given, the design standard for culverts was the 2% AEP (Q50) flood event and the majority of the culverts would have been sized on the future development proposals contained within BUAP (Belfast Urban Area Plan) 2001.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from a series of undesignated watercourses in the Richmond Grove, Richmond Way, Richmond Park East, Richmond Road and Ferndale Road areas. Also at the 10% AEP (Q10) flood event water is predicted to spill from another series of undesignated culverts in the main Mallusk Industrial Estate area. The resulting flood water ponds to a depth of up to 300mm in most of these places. It is estimated that **123** residential and **55** non residential properties could be flooded at this event causing damages in excess of **£2.2 million**.

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations plus the Carolhill Park area. Although the flood inundation areas are more extensive the flood water still ponds to depth of 300mm. Flooding from the 1% AEP (Q100) event is estimated to affect **245** residential and **94** non residential properties at these locations causing damages in excess of **£3.8 million**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£13.4 million**.

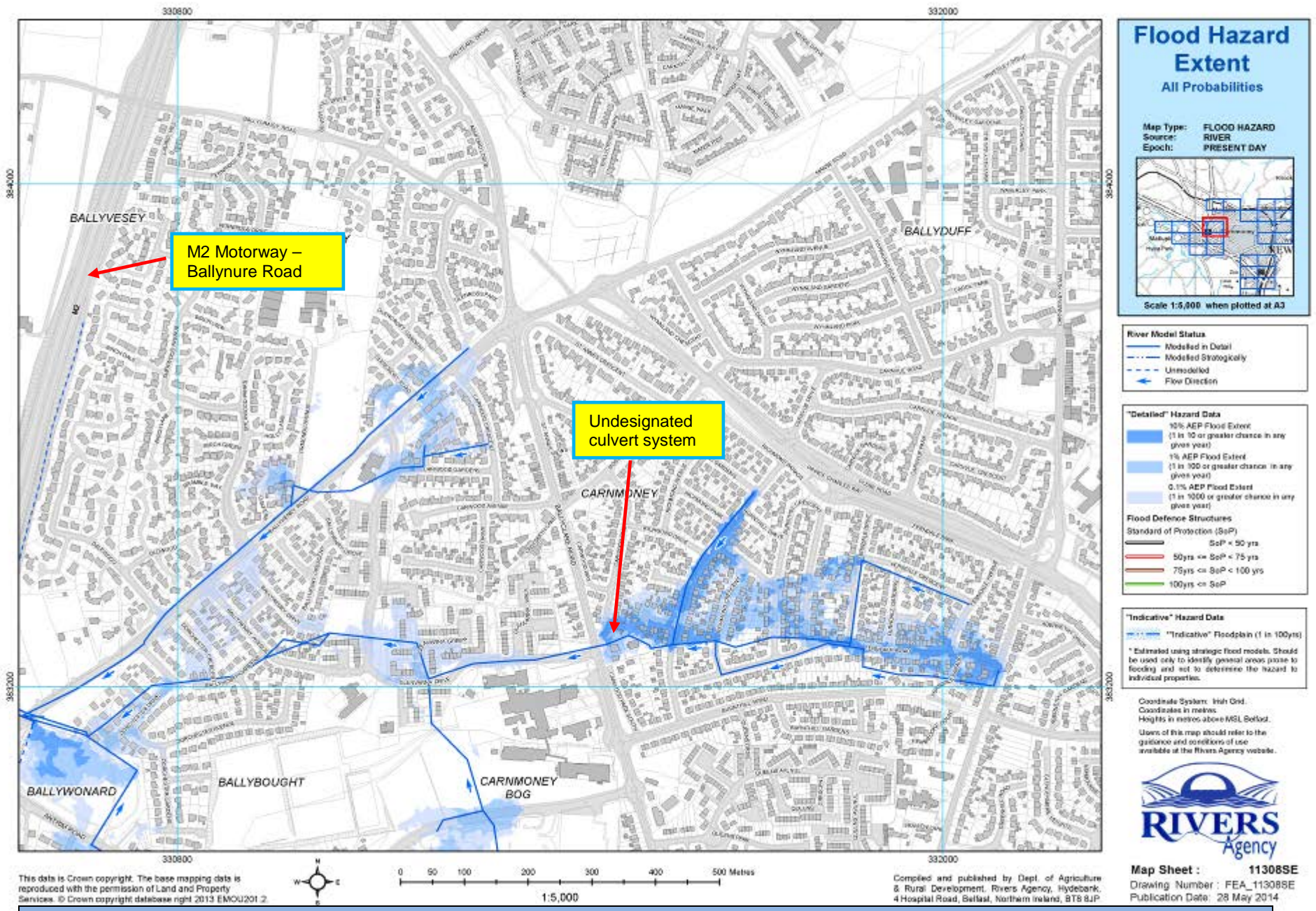


Figure 5.9.4.1 - Flood Extent map for north east Glengormley & Mallusk area

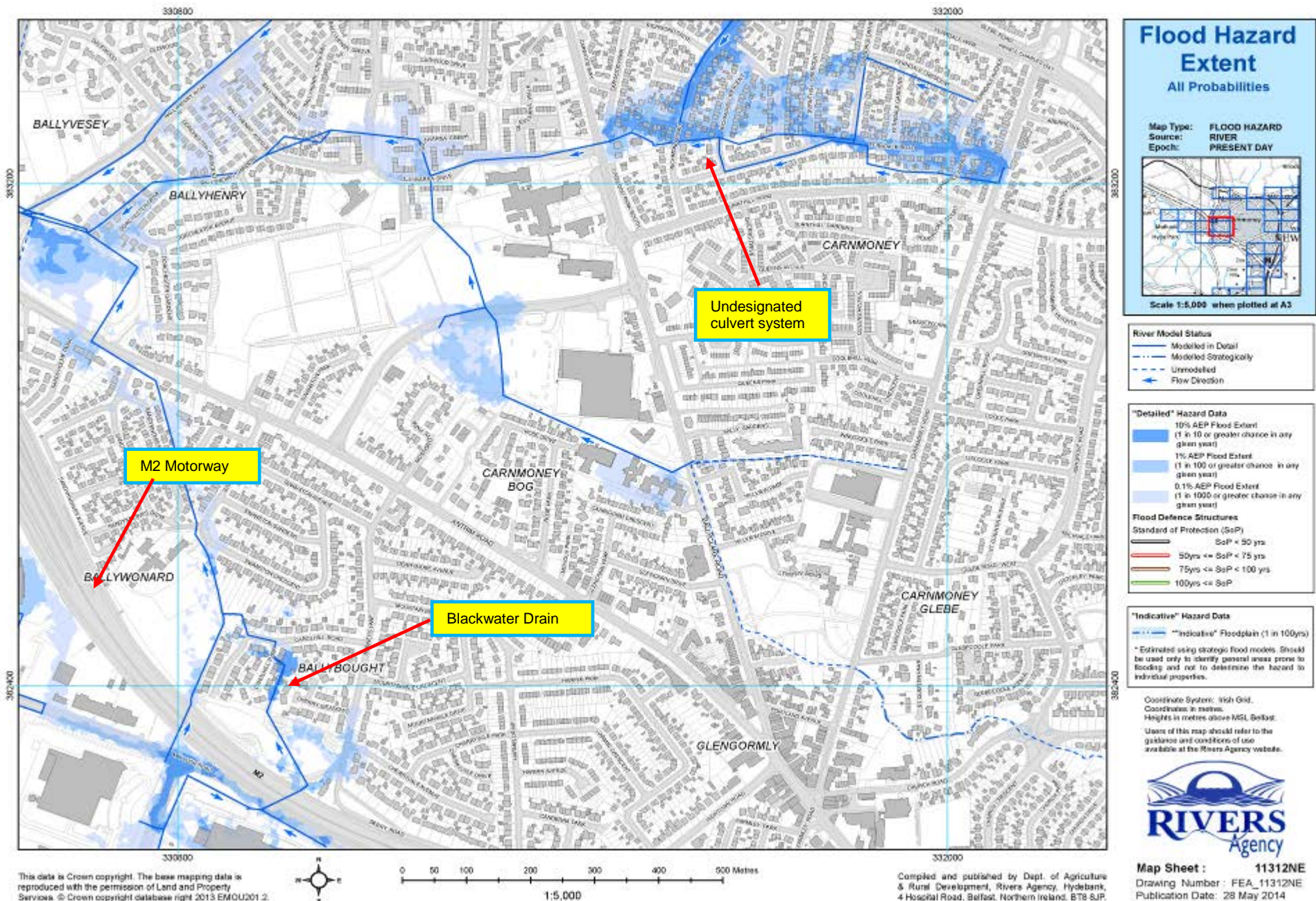


Figure 5.9.4.2 - Flood Extent map for south east Glengormley & Mallusk area

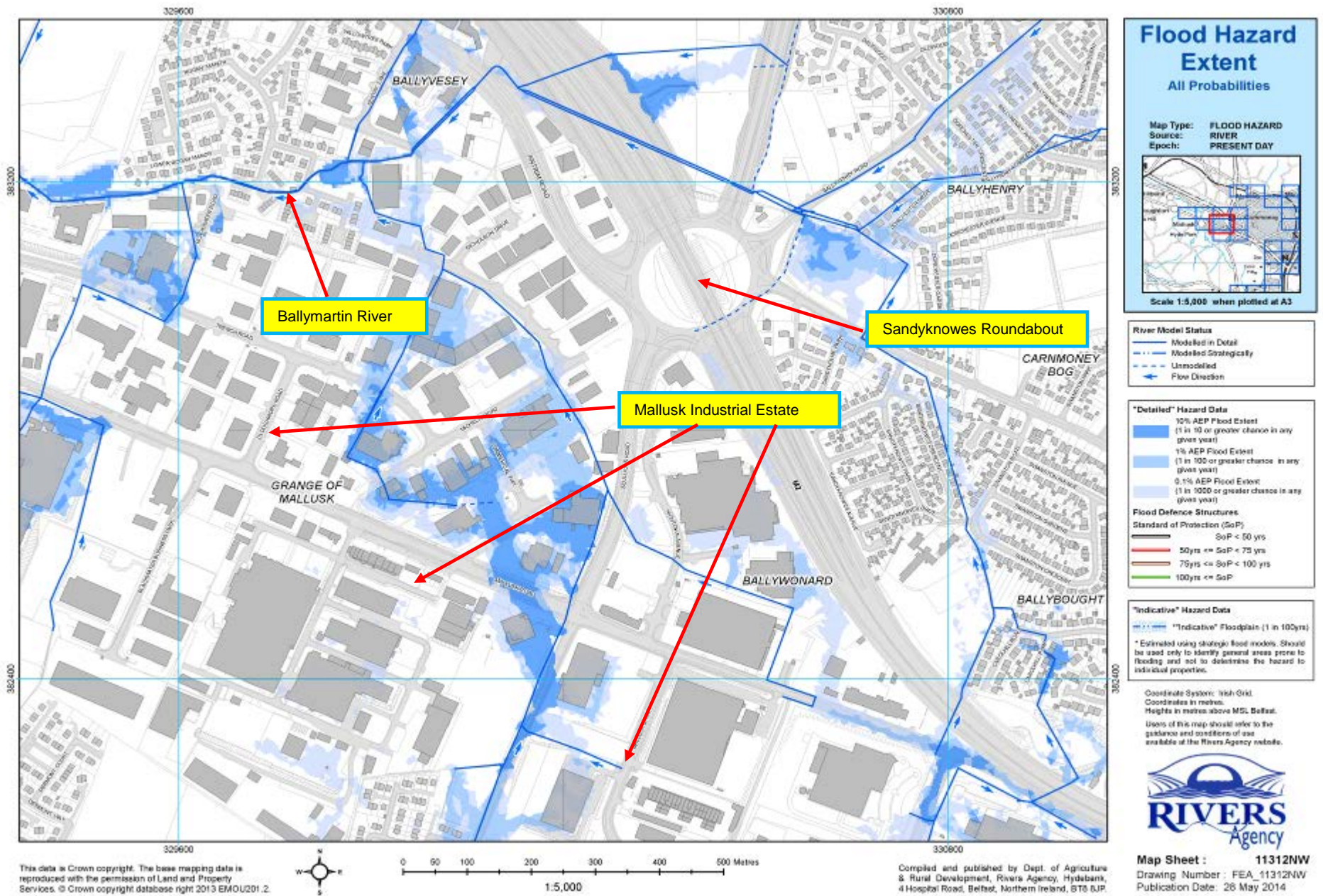


Figure 5.9.4.3 - Flood Extent map for south west Glengormley & Mallusk area

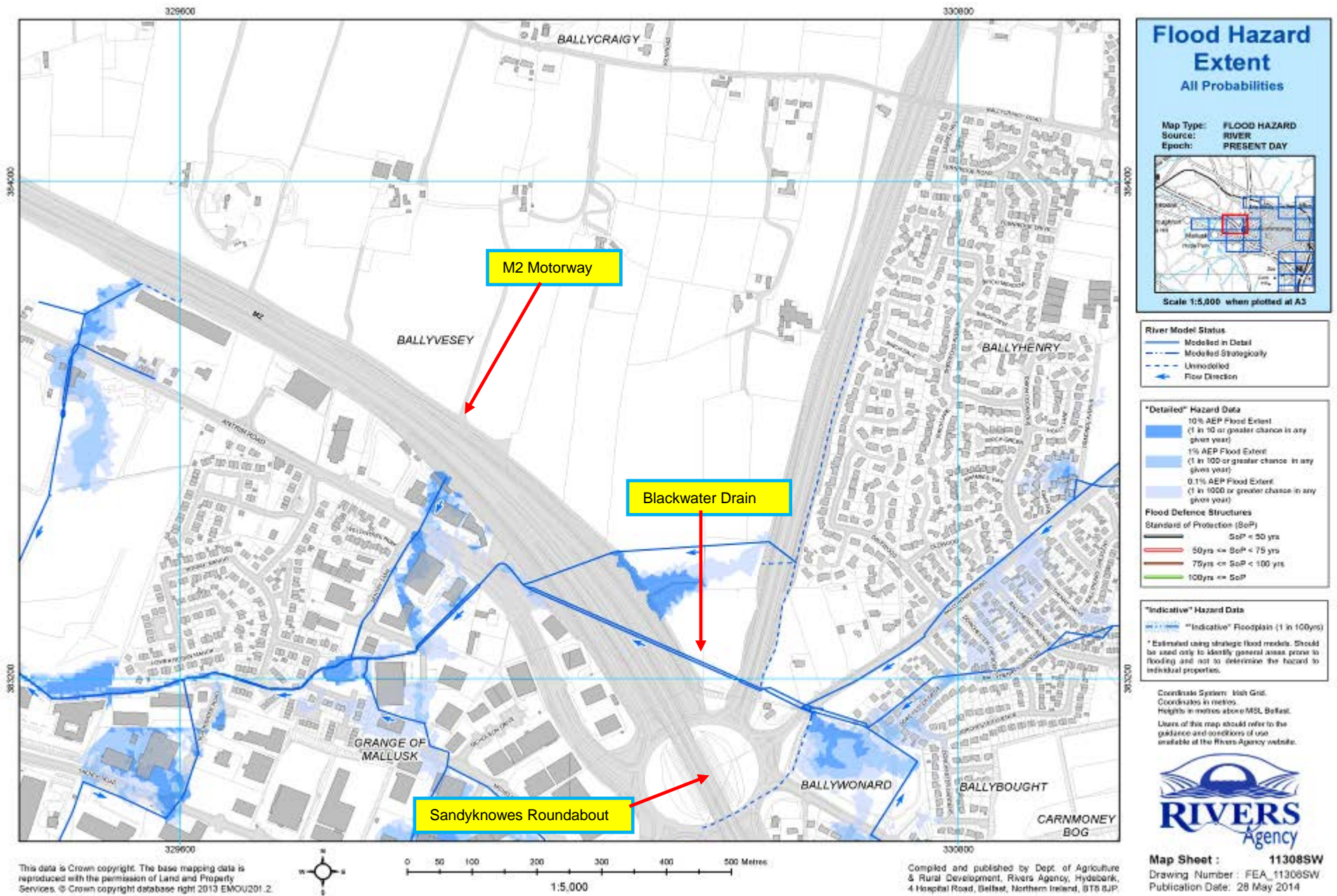


Figure 5.9.4.4 - Flood Extent map for north west Glengormley & Mallusk area

Table 5.9.4.1 - Glengormley & Mallusk SFRA			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	123	184	245
Non Residential (Nr)	55	64	94
Economic Damage (£)	£2,026,000	£2,848,000	£3,880,000
Annual Average Damage (£)	£447,140		
Present Value (£)	£13,414,200		
IPPC sites (Nr)	2	2	2
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.9.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Glengormley & Mallusk it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Glengormley and Mallusk, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

We shall also review the existing Development Plan for Glengormley & Mallusk (Belfast Metropolitan Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded area within the Glengormley & Mallusk area is:

- The Sandyknowes Parkland area

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed area, amongst others, at flood risk within Glengormley & Mallusk where re-development may be likely to take place is:

- Mallusk Industrial Estate

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety. Controlled Reservoirs identified in the Glengormley & Mallusk area are as follows:

- Hydepark Dam
- Boghill Dam
- Mossley Mill

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore important, that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Having conducted a detailed assessment of the fluvial flood risk to Glengormley and Mallusk, Rivers Agency has determined that potential flood alleviation scheme may be justified for this area.

A feasibility study was carried out in September 2014 which identified a number of locations in the Glengormley and Mallusk area that are at risk from fluvial flooding. The feasibility study found that the source of the flooding was a number of designated and un-designated watercourses. The study produced a number of recommendations to alleviate the flooding within the study area.

The recommendations regarding designated watercourses will be submitted to Rivers Agency’s Capital Procurement Unit and the recommendations regarding un-designated watercourses will be presented to the Flood Investment and Planning Group, (FIPG).

Preparedness

In Glengormley and Mallusk it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Glengormley and Mallusk which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring the following area could be considered suitable for being included in a programme of community engagement to deliver flood warning and informing initiatives:

- Sandholme Park / Sandyknowes Park.

Key activities that could be undertaken are:

- Explaining the potential and limitations of Community Resilience
- Briefing communities on information available, particularly from the Met Office
- The facilitation of self-help initiatives, including remote sandbag storage; and
- Reviewing and validating all elements of the Community Engagement Plan to help the community communicate effectively in an emergency and work together.

A table in Appendix I shows how this community ranks in the overall context of the 20 SFRAs in this Plan. It should be noted that this is an indicative assessment which may change subject to further information on flood risk becoming available.

The rollout of this work is dependent on funding being available.

5.10 Warrenpoint – Newry & Mourne

The core boundary of the Warrenpoint SFRA, which has been determined through the PFRA, is located within the Newry & Mourne Local Management Area and illustrated in Figure 5.10 below.

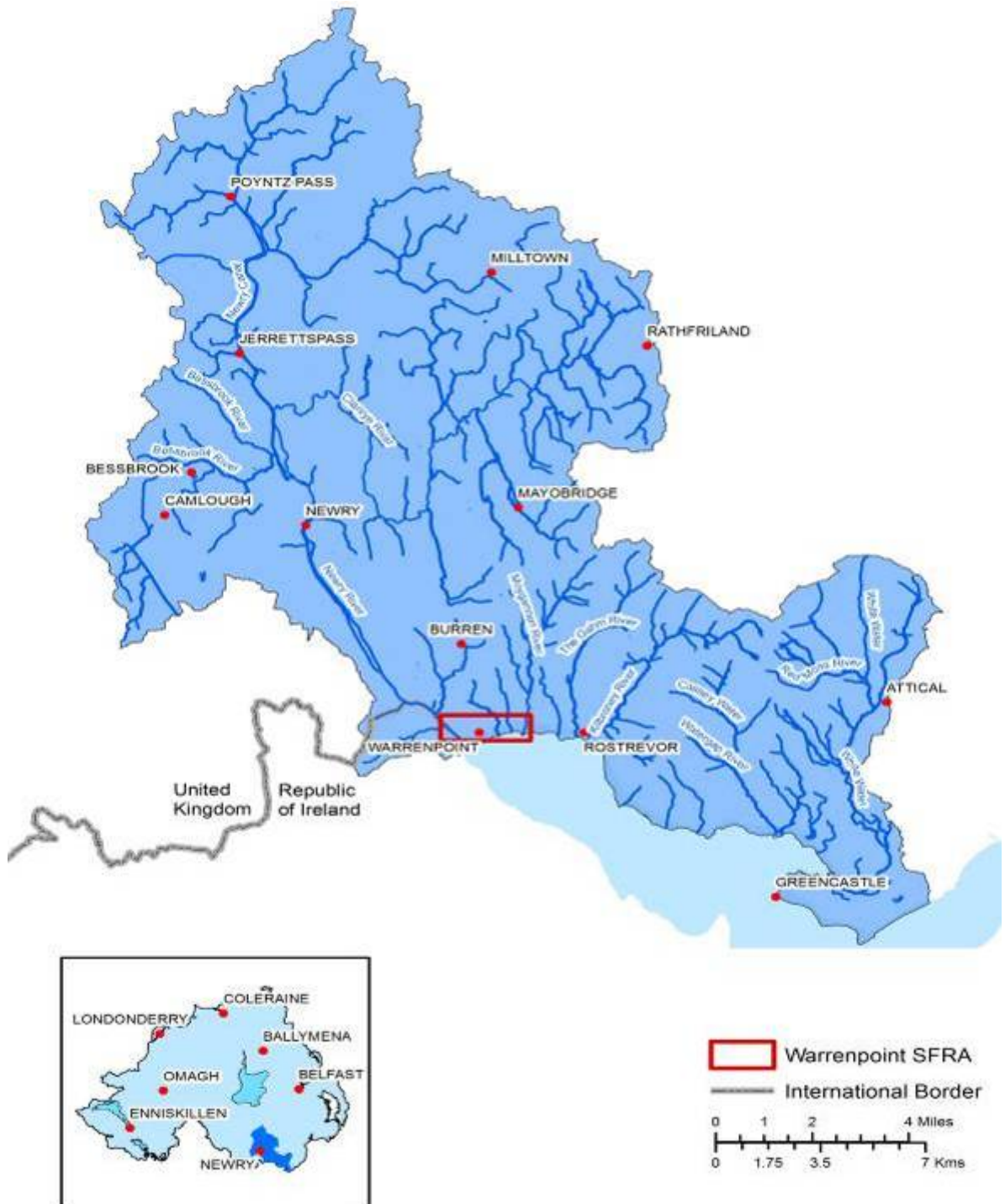


Figure 5.10 - Newry and Mourne LFMA and Warrenpoint SFRA

5.10.1 Flooding history

In order to provide added assurance in deriving flood flows and subsequent flood extents, Rivers Agency has recognised the importance of including information from extreme historic flooding events within the Warrenpoint catchment in its assessment and production of the flood extents for inclusion in this FRMP.

Therefore Rivers Agency commissioned a consultant to carry out a review of historical flooding accounts for Warrenpoint. The review encompassed a chronological collation of flood history assembled from local and national newspapers, a trawl of relevant internet sites and Rivers Agency's own data.

Information from the flooding accounts along with historical rainfall information was then used to calibrate the flood models and results analysed to ensure reliable estimations were obtained from the models.

The main source of information detailed in this section is the local press reports from newspapers and internet resources in the catchments around Warrenpoint. The inspection of entire newspaper collections to find information on flooding events was minimised by correlating newspaper publications with peak flow events recorded at gauging stations which are located within the various catchments.

Internet Sources - Warrenpoint

http://www.youtube.com/watch?v=H_CUbjJ9dds	8 th Dec 2007	Video on the flooding at a Ford off the Moygannon Road to the North of Warrenpoint.
http://news.bbc.co.uk/1/hi/northern_ireland/7557809.stm	12 th August 2008	BBC news report of flooding in Rostrevor and Warrenpoint following flash floods.
http://www.belfasttelegraph.co.uk/weather/flash-floods-warning-as-heavy-downpours-continue-13937503.html	12 th August 2008	Reports of houses being sandbagged as water levels rose.
http://www.u.tv/articles/article.aspx?cat=news&guid=b395cc3d-3549-4138-86db-727d94601d22	6 th August 2011	Description of flooding in Claremount Gardens and Dromore Road and waste-water pumping station.
http://www.pacemakerpressin.tl.com/category?id=4498	6 th August 2011	Photographs of flooded properties

2011 Flooding

In 2011 torrential rain and flash flooding caused property flooding in the Clermont Gardens area. NI Water worked alongside contractors to clear the water from three homes. The flooding was limited to the ground floor of the houses and included a small element of raw sewage. This problem was solved by the completion of the Newry Road Pumping Station upgrade in 2014 by N.I Water at a cost of £3.4million. The scheme involved the completion of two work packages in order to protect low lying properties from flooding and reduce spills to Carlingford Lough.

The scheme consisted of:

- Replacement of the existing pumping station with a new wastewater pumping station incorporating 780m³ of storage.
- Upgrading of strategic pipelines within the sewerage network.

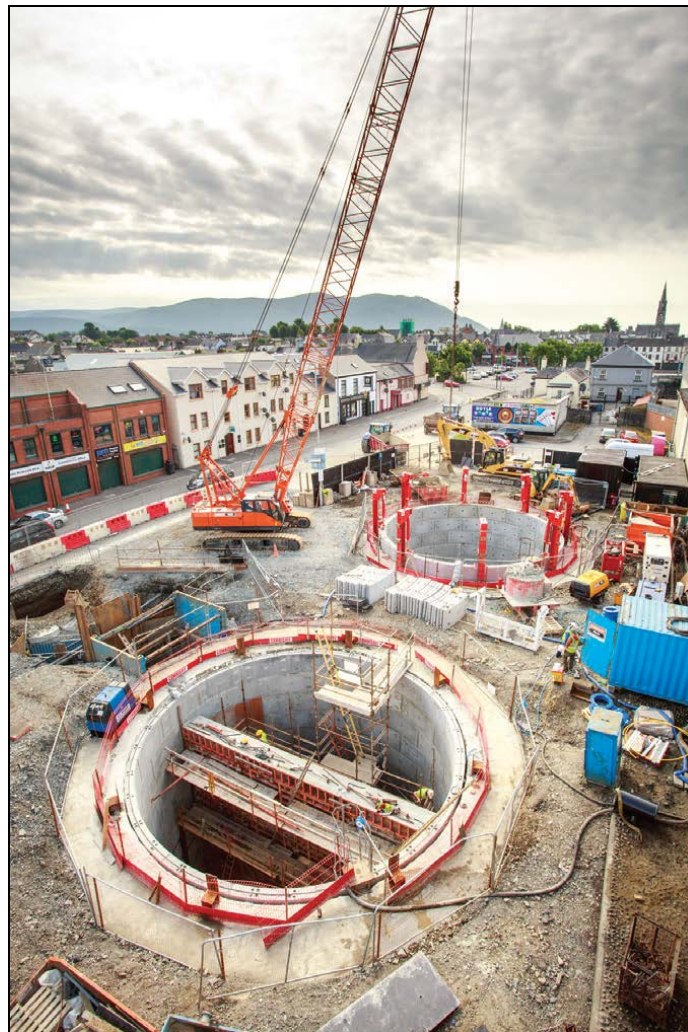


Photo 5.10.1 – Newry Street, Warrenpoint pumping station upgrade 2014

2014 Flooding

Sections of the main road between Rostrevor and Warrenpoint and the coastal road have been flooded in the past due to large wave's breaching the defences in January 2014.



Figure 5.10.1 - Warrenpoint to Rostrevor Road flooded

5.10.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) the town of Warrenpoint, in terms of the potential adverse consequences of flooding, is ranked 11th of the twenty SFRA within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the flood risk to the town is considered to arise from fluvial flooding and coastal flooding.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding and coastal flooding at Warrenpoint because this national assessment was based on strategic 'undefended' flood models which ignore the presence of existing flood defence systems. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences. This precautionary approach has been taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements

of the EU Floods Directive. This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection provided by these defences.

To facilitate a more robust assessment of the level of flood risk to Warrenpoint from fluvial and coastal flooding, Rivers Agency developed detailed predictive flood models for each of these sources of flooding. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

5.10.3 Catchment Description

Warrenpoint is located at the southern approach to the Mourne Mountains and is adjacent to the northern shore of Carlingford Lough. Designated an Area of Special Scientific Interest and Special Protection Area, Carlingford Lough is an important shellfish water and provides links to the nearby city of Newry via the Newry River and Newry Canal.

Carlingford Lough lies within the Neagh Bann River Basin District. The catchment area also drains into Dundalk Bay and covers an area approximately 823km². The largest river is the Newry River which rises around Rathfriland and flows through Newry City to Carlingford Lough. There are also a number of rivers that discharge directly into Carlingford Lough or coastal waters such as the White Water River, Kilbroney River and Cassey Water. The main towns are Newry and Warrenpoint with several smaller towns throughout the area including Rathfriland, Rostrevor and Crossmaglen.

5.10.4 Coastal Flood Risk Assessment

Model

The tidal simulations for Warrenpoint were undertaken using a detailed MIKE 21 HD model which is a sub-model driven by the Irish Surge and Tidal Model that is used to determine extreme sea levels around the non-estuarine coastline of Ireland.

Coastal Flooding Mechanisms

The 0.5% AEP (Q200) flood level for Warrenpoint was obtained from the Irish Surge and Tidal Model that is used to determine extreme sea levels around the non-estuarine coastline of Ireland. Rivers Agency new detailed coastal hazard map indicates that Warrenpoint is at risk from coastal flooding.

Figures 5.10.4.1 and 5.10.4.2 illustrates the predicted extents of the coastal flooding to Warrenpoint and details of the impact of the flooding on property and key infrastructure is summarised in Table 5.10.4.1.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to inundate the Harbour Industrial Estate, Charlotte Street and Newry Street. The flood water will pond to depths of up to 300mm in the low lying areas, most notably in the Charlotte Street area. It is estimated that **24** residential and **10** non residential properties could be flooded at this event causing damages in excess of **£390,000**.

At the more extreme 0.5% AEP (Q200) event the predicted flooding is generally confined to the same locations plus Meeting Street and the Clermont Gardens area, although the flood inundation areas are more extensive at the 0.5% AEP flood event. Flooding from the 0.5% AEP (Q200) coastal flood event is estimated to affect **59** residential and **27** non residential properties causing damages in excess of **£995,000**.

The present value of the total property damages from potential future coastal floods is calculated to be in excess of **£3.3million**. (See Table 5.10.4.1)



Photo 5.10.4.1 - Rostrevor Road in Warrenpoint flooded in Jan 2014

Table 5.10.4.1 - Warrenpoint SFRA			
Potential Adverse Consequences – Coastal Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	0.5% AEP
Residential (Nr)	24	34	59
Non Residential (Nr)	10	16	27
Economic Damage (£)	£390,000	£480,000	£995,000
Annual Average Damage (£)	£111,912		
Present Value (£)	£3,357,360		

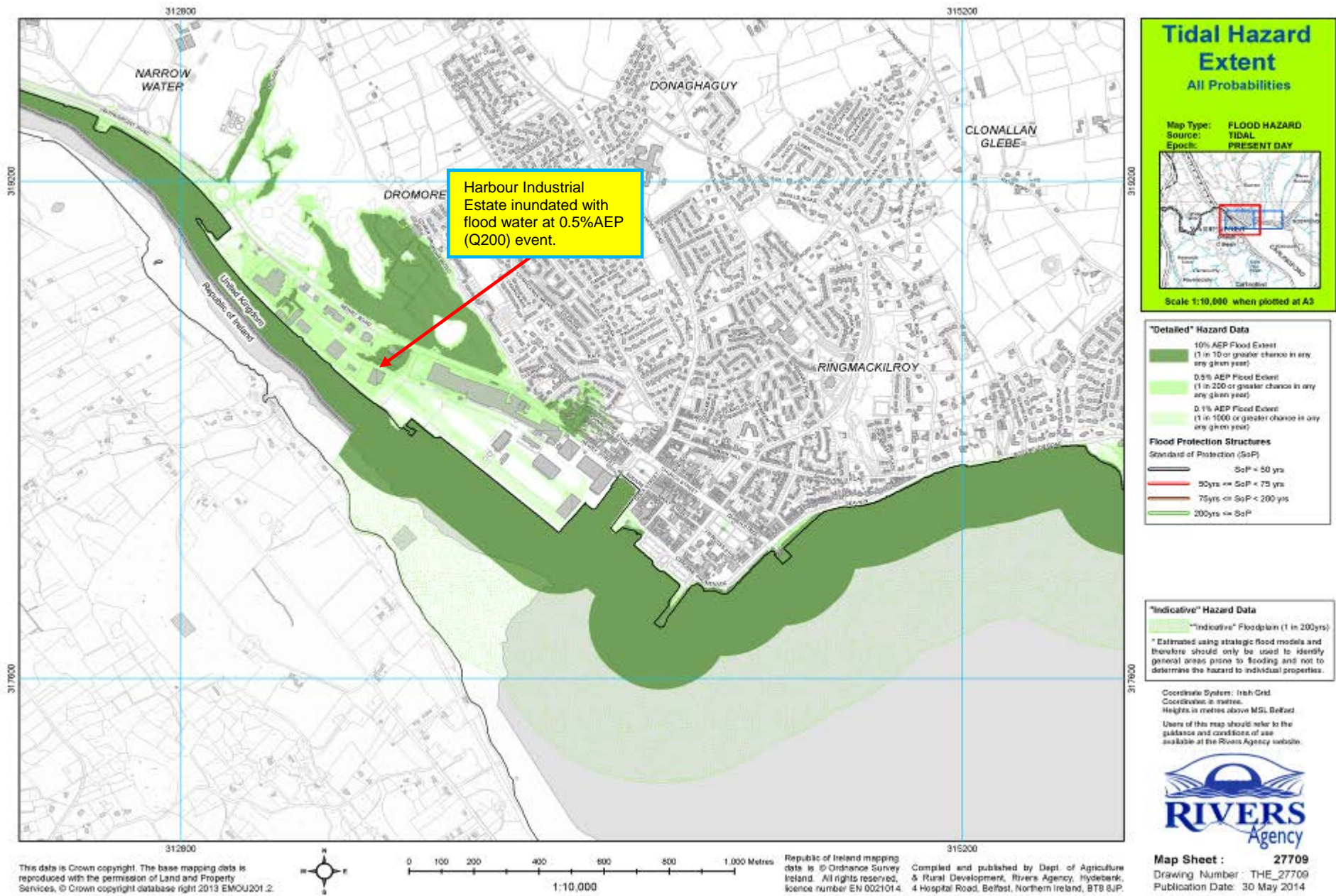
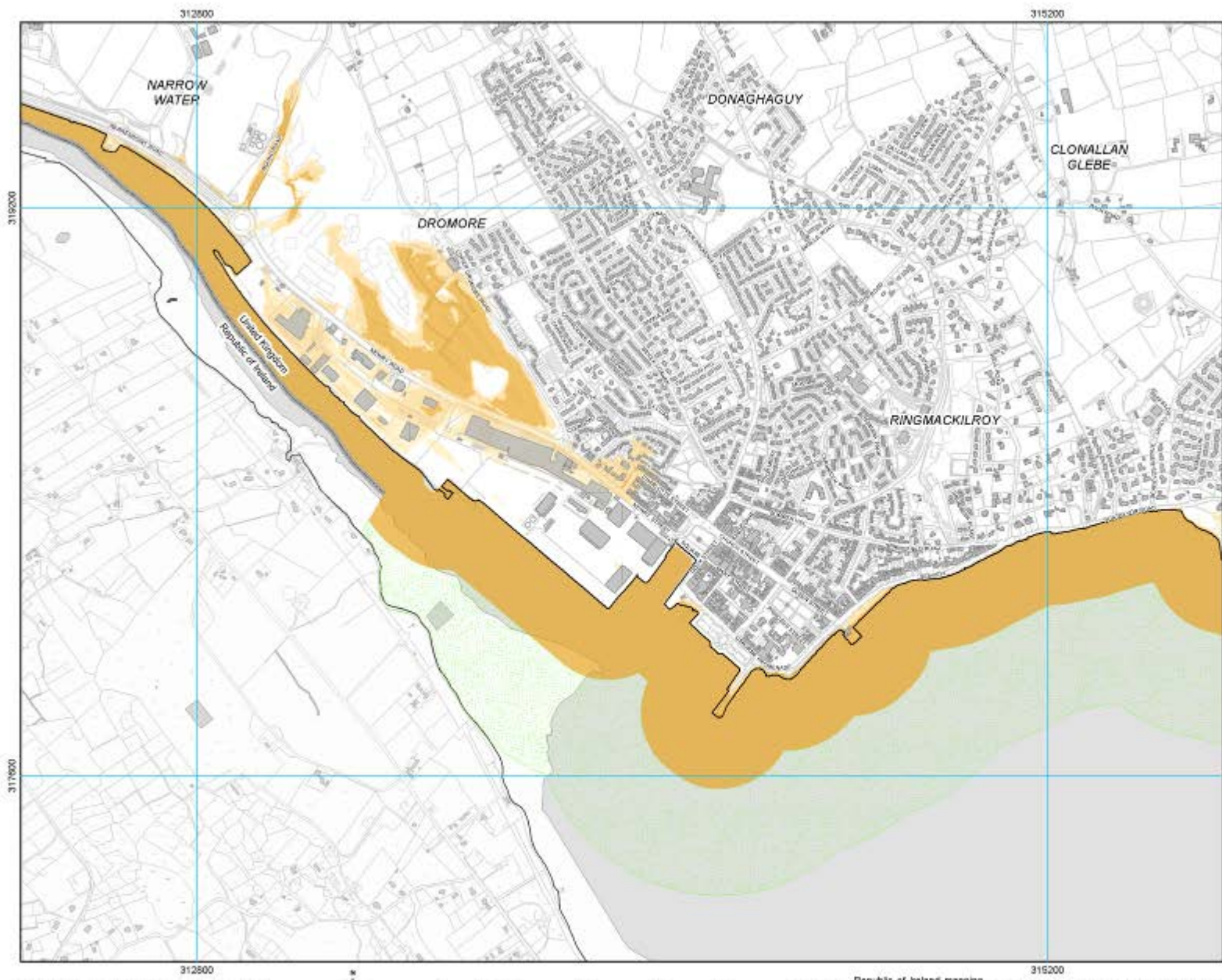


Figure 5.10.4.1 - Warrenpoint coastal hazard extent map



Tidal Hazard Depth
Medium Probability
 0.9% chance that a flood of this magnitude or greater will occur in any given year.

Map Type: FLOOD HAZARD TIDAL
 Source: TIDAL
 Epoch: PRESENT DAY

Scale 1:10,000 when plotted at A3

"Detailed" Hazard Data

- Depth < 0.3m
- Depth 0.3m - 1.0m
- Depth > 1.0m
- 12.25 Tidal/River Level (m)

Flood Defence Structures
 Standard of Protection (SoP)

- SoP < 50 yrs
- 50yrs <= SoP < 75 yrs
- 75yrs <= SoP < 200 yrs
- 200yrs <= SoP

Areas protected from tidal flooding in a 1 in 200 year flood event.

"Indicative" Hazard Data

- "Indicative" Floodplain (1 in 200yrs)

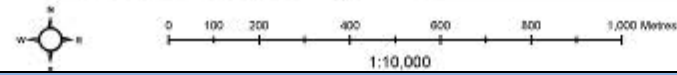
* Estimated using strategic flood models and therefore should only be used to identify general areas prone to flooding and not to determine the hazard to individual properties.

Coordinate System: Irish Grid.
 Coordinates in metres.
 Heights in metres above MSL Belfast.
 Users of this map should refer to the guidance and conditions of use available at the Rivers Agency website.



Map Sheet: 27709
 Drawing Number: TDM_27709
 Publication Date: 30 May 2014

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Figure 5.10.4.2 - Warrenpoint coastal hazard depth map

5.10.5 Proposed Coastal Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Warrenpoint it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Warrenpoint, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 200 year fluvial floodplain.

Rivers Agency will also review the existing Development Plan for Warrenpoint (Banbridge, Newry and Mourne Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

Planning Applications

Coastal areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 200 year coastal floodplain, irrespective of whether they are located within a current development plan or as a single site application outside the plan area.

For those sites within the 1 in 200 year coastal floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the

application through the appraisal of an accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed area, at coastal flood risk within Warrenpoint SFRA where re-development may be likely to take place is:-

- Harbour Industrial Estate

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)** provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from

between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Preparedness

Coastal flooding has the potential to have a significant impact in terms of risk to life. This is mainly due to the rate of inundation from the sea at the height of the tidal cycle. In light of this the emergency response to significant coastal flooding with a risk to life will be led by PSNI and evacuation of potentially affected areas will be a real consideration.

To ensure a coordinated approach local, tactical Coastal Flooding Emergency Response Plans are being developed for Warrenpoint. This will link to a strategic Coastal Flooding Emergency Response Plan.

The Coastal Flood Response Plan aims to provide a pre-planned response to a warning of coastal flooding and outline the graduated incident and coordinated inter-agency response to a potential or actual coastal flooding event.

The objectives of the plan are to:-

- Identify activation triggers for responding to a coastal flood warning or incident.
- Document the actions to be taken on receipt of a coastal flood warning.
- Set out the process for a coordinated response including the graduated incident management of a potential or actual coastal flooding event.
- Ensure a common understanding of the potential impacts of a coastal flooding event in each area and act as a reference document for all the agencies involved to provide a pre-planned response at various levels of coastal flood risk.

5.10.6 Fluvial Flood Risk Assessment

Flood Model

The consultant used InfoWorks ICM 1D/ 2D (Version 3.5) modelling software for the Warrenpoint flood model. InfoWorks ICM (Integrated Catchment Modelling) is an integrated modelling platform which incorporates both urban and river catchments. It provides the ability to model the complete drainage systems both natural and engineered above and below-ground drainage system including sewers, surface water, river and floodplains.

Hydrodynamic models were established in Infoworks ICM for each watercourse listed below:

Milltown Stream

The modelled reach of Milltown Stream starts at Ballydesland Road, flows through Milltown Industrial Estate and along the side of Warrenpoint Golf Course, before discharging to the Newry River. The total length of the modelled river is 3.27km and includes 62 topographical survey cross-sections. There are a number of culverted sections along this river.

Warrenpoint Golf Club Stream

The modelled reach of Warrenpoint Golf Club Stream flows through Warrenpoint Golf Course before discharging to the Newry River. The total length of the modelled river is 410m and includes 11 topographical survey cross-sections and 4 culverted reaches.

Clonallan Stream

The modelled reach of Clonallan Stream starts in the vicinity of St Marks High School on Upper Dromore Road, flows through the urban area of Warrenpoint and discharges to Carlingford Lough close to the junction of Springfield and Rostrevor Roads. The total length of the modelled river is 2.1km and includes 44 topographical survey cross-sections. There are 2 bridges along this length that affect the hydrodynamic characteristics of the river and are therefore included in the model.

St Leonards Stream

The modelled reach of St Leonards Stream flows for a short distance through Seafields, and discharges to Carlingford Lough. The total length of the modelled river is 500m and includes 9 topographical survey cross-sections.

Moygannon River

The modelled reach of the Moygannon River extends from upstream of the Rath Road and flows adjacent to the Moygannon Road to its discharge point to Carlingford Lough at Dobbin's Point. The total length of the modelled river is 850m and includes 17 topographical survey cross-sections. There are 2 bridge structures along this length that affect the hydrodynamic characteristics of the river and are therefore included in the model.

Fluvial Flooding Mechanisms

This section provides an overview of the main flooding mechanisms throughout the Warrenpoint SFRA.

Moygannon River

Figure 5.10.6.1 illustrates the predicted flooding along the Moygannon River. Flooding initially begins upstream of Moygannon Bridge at location A in Figure 5.10.6.1, flooding spreads across the fields eventually over topping the Rostrevor Road. Flooding is also predicted to originate from upstream of the Rath Road at

location B on Figure 5.10.6.1. Flood water overtops the Rath Road and flows through the fields towards the Rostrevor Road. At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive. Flooding from the 1% AEP (Q100) flood event is estimated to affect no properties.

Clonallan Stream

Figure 5.10.6.2 illustrates that at the 1%AEP (Q100) flood event, floodwater is predicted to spill from the watercourse known as Clonallan Stream within Springfield Road, Sea View Road, Smalls Road and Spring Meadows area. The flood water ponds to depths of 300mm in the low lying areas, most notably in the downstream reach in the Sea View Road area. This may be due to a capacity issue with the culvert under the Springfield Road. The existing culvert is 1050mm in diameter which can vent a flow of 1.6 m³/sec. The model shows a Q100 discharge flow of 2.8 m³/sec which would require a 1350mm diameter culvert. At the 1%AEP (Q100) it is also predicted that flood water spills from the Clonallan Stream in the upstream reach around the Forth Road area. It is estimated that **23** residential and **2** non residential properties could be flooded at this event causing damages in excess of **£165,000**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£315,000**. The impact of the flooding on property and key infrastructure from the Clonallan Stream is summarised in Table 5.10.6.1.

Milltown Stream

Figure 5.10.6.3 illustrates the predicted flooding from the Milltown Stream. Flooding is initially predicted at location A on Figure 5.10.6.2, from here it spreads south towards the Donaghaguy Reservoir. Flooding is also predicted to originate at location B, the inlet to the culverted reach under the Milltown Industrial Estate.

The model shows that at the relatively high frequency 10% AEP (Q10) flood event, floodwater is predicted to spill from Milltown stream in the Milltown Industrial Estate and Milltown Street areas. The flood water ponds to depths of up to 300mm in this area. It is estimated that **3** residential and **2** non residential properties could be flooded at this event causing damages in excess of **£35,500**.

At the more extreme 1% AEP (Q100) flood event the predicted flooding is generally confined to the same locations although the flood inundation areas are more extensive. Flooding from the 1% AEP (Q100) flood event is estimated to affect **3** residential and **9** non residential properties causing damages in excess of **£91,500**.

The present value of the total property damages from potential future floods is calculated to be in excess of **£150,000**. The impact of the flooding on property and key infrastructure from the Milltown Stream is summarised in Table 5.10.6.2.

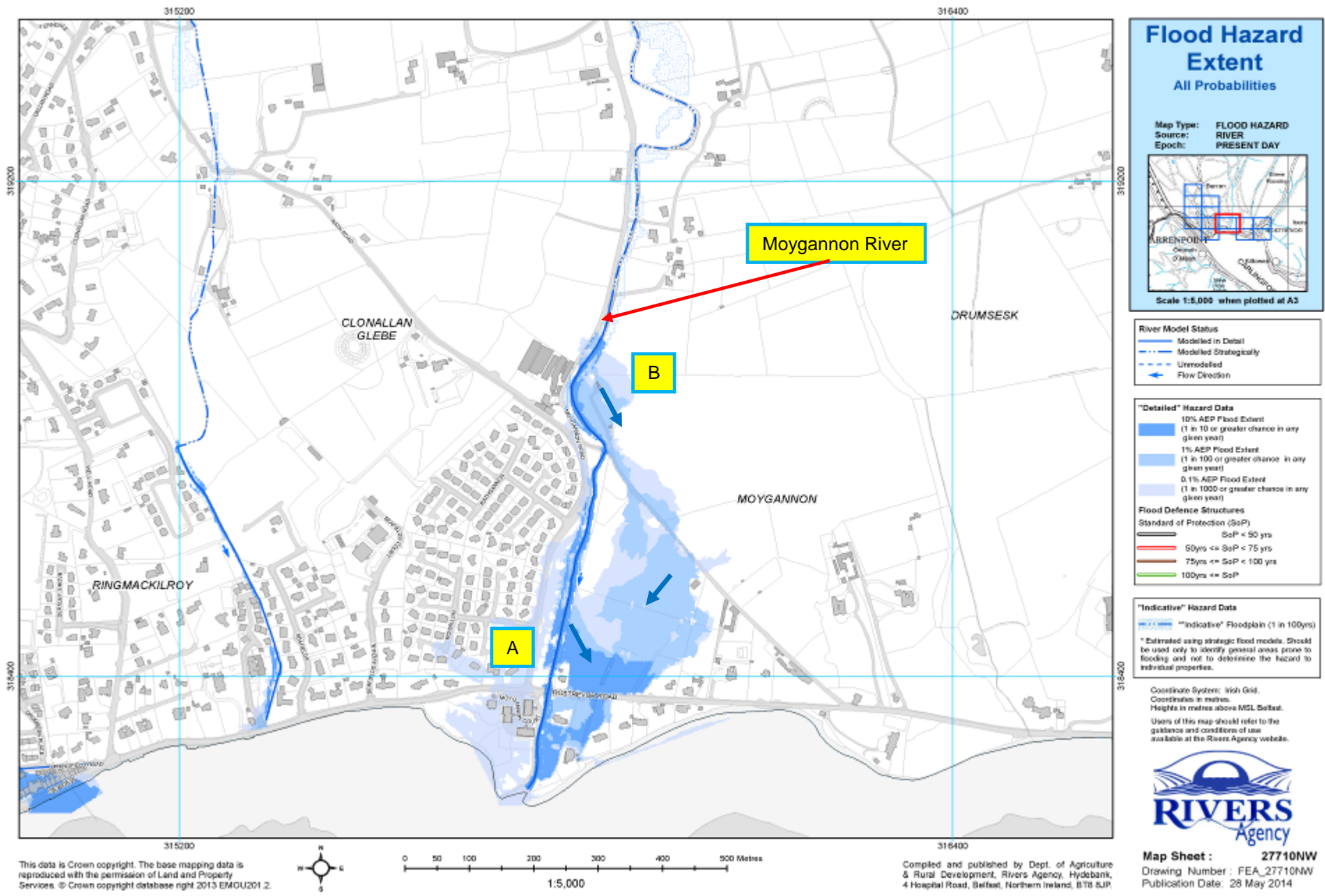


Figure 5.10.6.1 - Moygannon River Flood Hazard Extent map

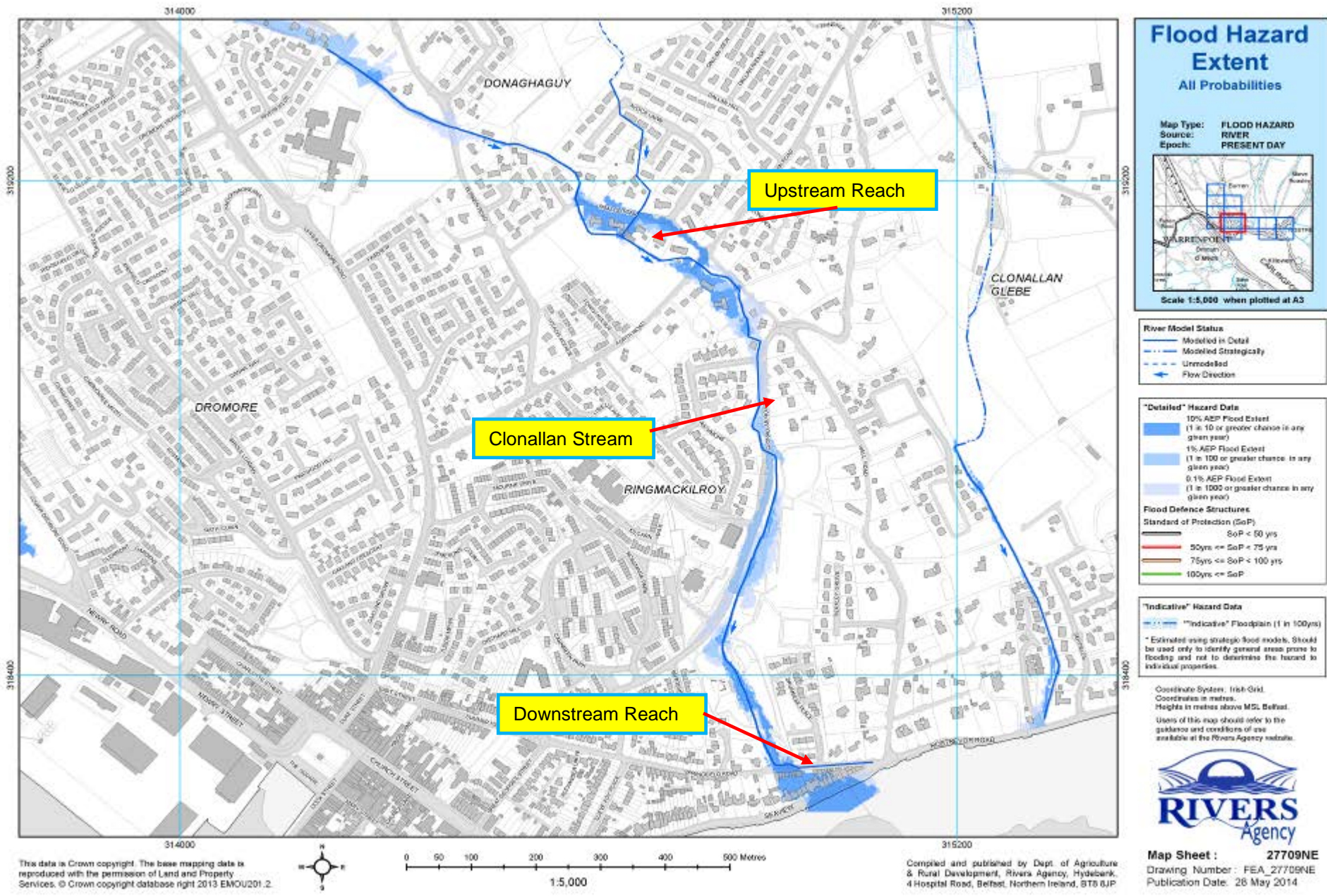


Figure 5.10.6.2 - Clonallan Stream Flood Hazard Extent map

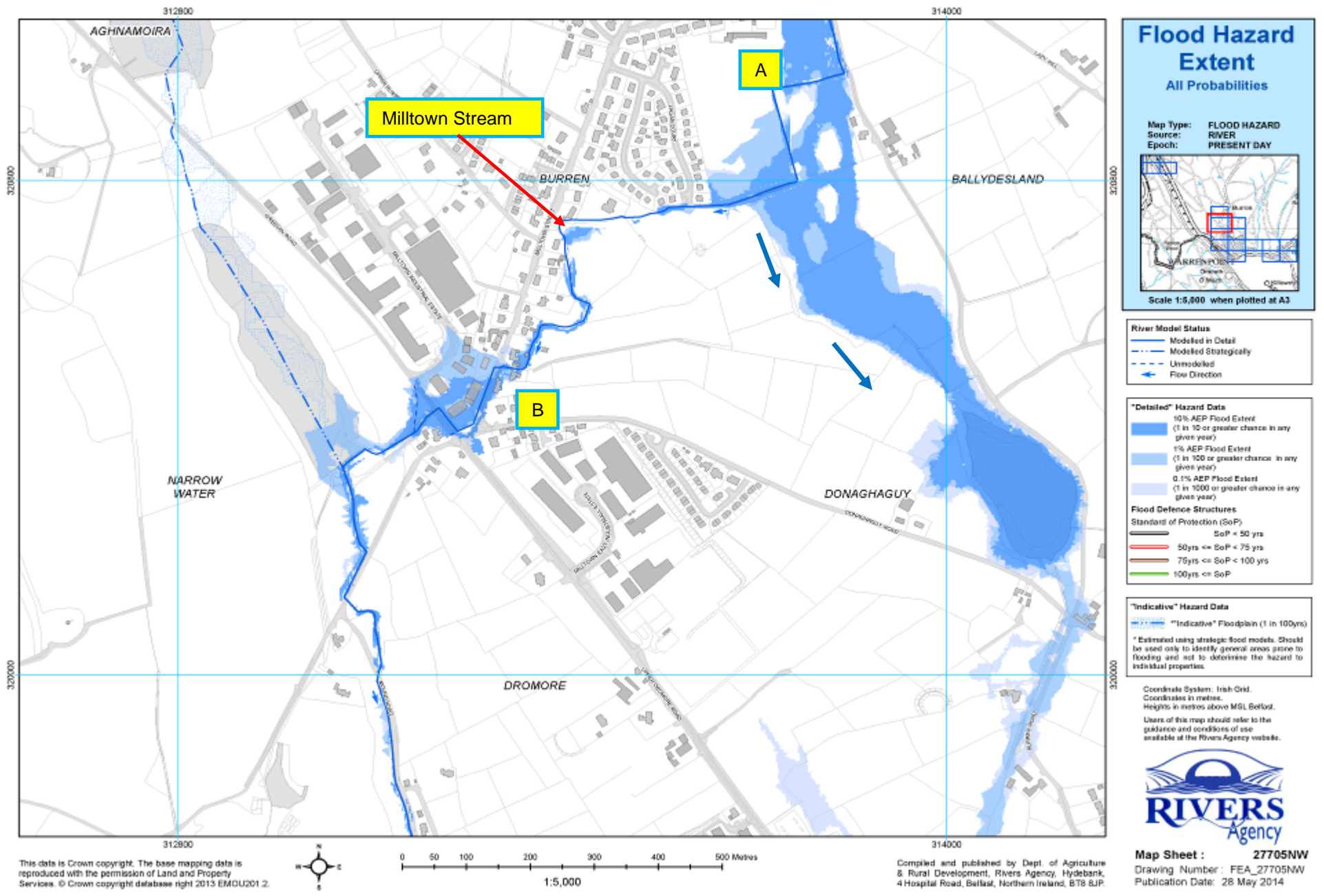


Figure 5.10.6.3 - Milltown Stream Flood Hazard Extent map

Table 5.10.6.1 - Warrenpoint SFRA – Clonallan Stream			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	23	23	23
Non Residential (Nr)	2	2	2
Economic Damage (£)	£165,500	£165,500	£165,500
Annual Average Damage (£)	£10,500		
Present Value (£)	£315,000		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Table 5.10.6.2 - Warrenpoint SFRA – Milltown Stream			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	3	3	3
Non Residential (Nr)	2	5	9
Economic Damage (£)	£35,500	£59,500	£91,500
Annual Average Damage (£)	£5,000		
Present Value (£)	£150,000		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	0	0
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.10.7 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Warrenpoint it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Warrenpoint, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency will also review the existing Development Plan for Warrenpoint ([Banbridge, Newry & Mourne Area Plan 2015](#)) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Warrenpoint area are:

- To the north west of the Upper Dromore Road, (upper reach of the Clonallan Stream)
- The Warrenpoint Golf Course

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain, irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the "Exception Test", Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed area, at flood risk within Warrenpoint where re-development may be likely to take place is:

- Milltown Industrial Estate

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Controlled Reservoirs identified in the Warrenpoint area are as follows:

- Donaghaguy Reservoir
- Mill Pond Donaghaguy

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment

by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool”, (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Within the Warrenpoint area the following potential schemes have been identified and will be referred to the appropriate bodies for further investigation or detailed feasibility study.

List of possible schemes in Warrenpoint SFRA:

Milltown Area

- Fluvial flooding from the Milltown Stream
- Flood damage avoidance figure of £150k

Springfield Road, Seaview Road and Forth Road areas

- Fluvial flooding from the Clonallan Stream
- Flood damage avoidance figure of £315k

Preparedness

In Warrenpoint it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Warrenpoint which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring these areas did not score high enough to be placed within the top 20 communities to be offered a programme of community engagement during the period of this plan. However, if communities want to become more resilient, the Department is committed to providing assistance where possible to develop the consistent approach to resilience. The NI Direct website www.nidirect.gov.uk/ will host further information and advice on what to do in advance of flooding, what to do during flooding and how to recover after flooding. The website will also contain templates for communities wishing to develop their own plan.

5.11 Coleraine SFRA – Lower Bann

The core boundary of the Coleraine SFRA, which has been determined through the PFRA, is located within the Lower Bann Local Management Area and illustrated in Figure 5.11 below.

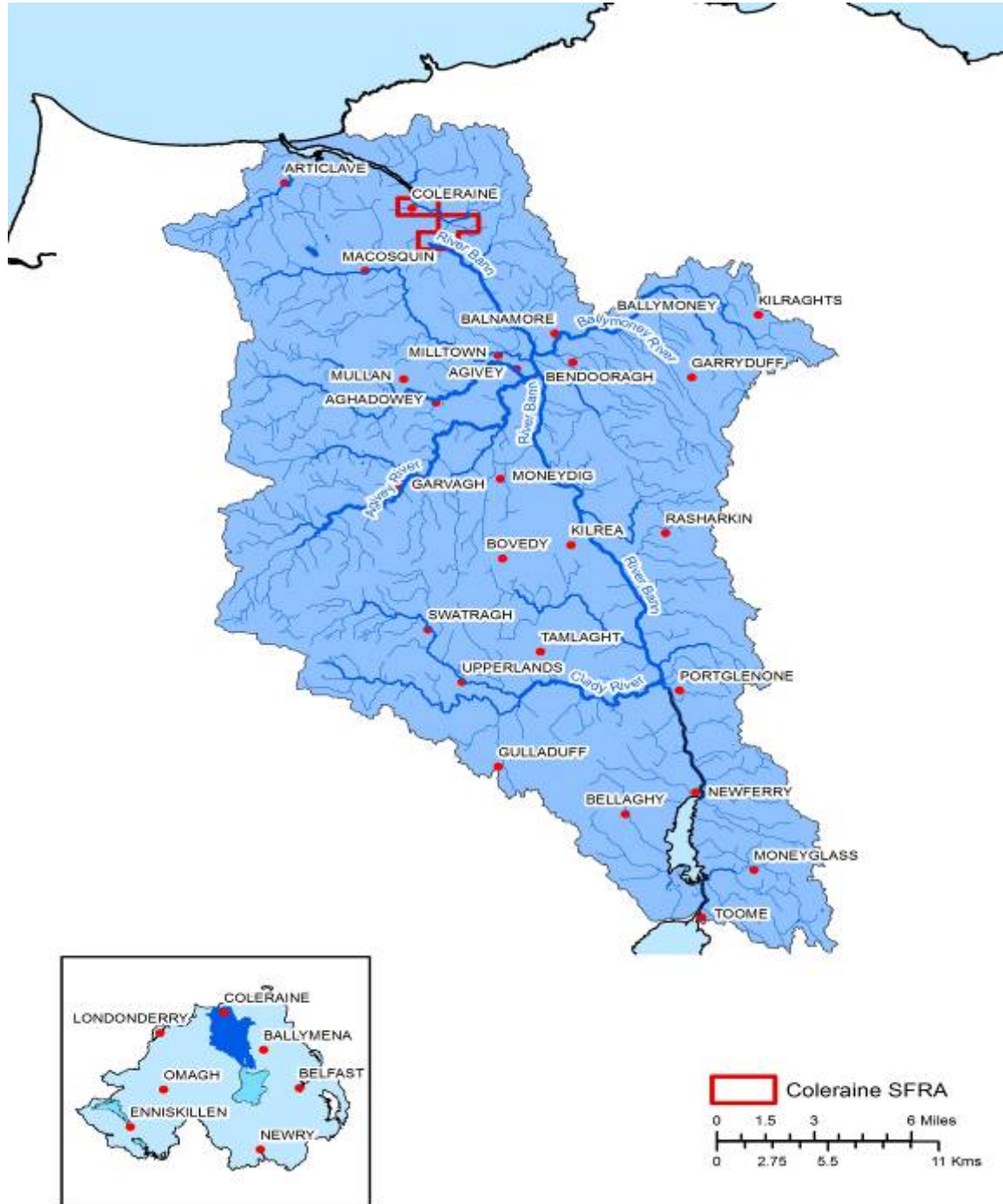


Figure 5.11 – Lower Bann Local Management Area and Coleraine SFRA

5.11.1 Flooding History

Coleraine has been identified as being an area at risk from flooding as a result of the preliminary flood risk assessments carried out by Rivers Agency.

Coleraine has no registered flooding hotspots nor has it any record of any flood relief payments made by the Coleraine Council in the last 7 years. There are also no records of flooding on the current NI Water DG5 register.

There have been a number of occasions in the past where flooding has occurred in the Lodge Burn area through Coleraine, particularly in Anderson Park and downstream of Millburn Road area of Coleraine. Anderson Park previously had a pond located at its centre which the Lodge Burn River flowed through. (See photo 5.11.1.1 below.)



*Photo 5.11.1.1 –
Anderson Park pre Flood
Alleviation Scheme*

The Anderson Park pond had a very visible siltation problem which, in turn, led to some local flooding issues in the surrounding areas. However, the siltation problem was incorporated into the Lodge Burn flood alleviation scheme, which was carried out by Rivers Agency in 2012. (See photo 5.11.1.2.)



*Photo 5.11.1.2 –
Anderson Park post Flood
Alleviation Scheme*

Lodge Burn Flood Alleviation scheme

The Lodge Burn Flood Alleviation scheme is a complex urban flood defence scheme that required the construction of flood walls within close proximity to existing buildings, structures and street slopes. The geotechnics were complex with an artesian water table below the near surface clay layer. This prompted a bored piled secant wall solution with reinforced concrete up-stand walls. (See photo 5.11.1.3.)



Photo 5.11.1.3 – New secant piled reinforced concrete flood wall with toe protection.

5.11.2 PFRA – Identification of Potentially Significant Flood Sources

According to the Preliminary Flood Risk Assessment (Dec 2011) Coleraine, in terms of the potential adverse consequences of flooding, is ranked 14th of the twenty SFRA within Northern Ireland (see Figure 4.1). On the basis of this initial assessment, which was undertaken using the strategic flood maps, the predominant flood risk to the town was considered to arise from fluvial flooding. However the strategic flood map for Coleraine indicates a minor risk from coastal flooding, in particular to the area west of Millburn Road. This is not a significant risk as there is a lack of coastal flood history for the Coleraine area.

It should be noted that the PFRA flagged up the potential for significant fluvial flooding at Coleraine because the assessment is based on the strategic 'undefended' flood models, which ignore the presence of existing flood defence systems such as the Lodge Burn Flood Walls. Therefore, the assessment is in effect based on the worst case scenario, as it assumes there is no benefit from the defences (See Figure 5.11.2.1). This precautionary approach was taken because at the time of the assessment there was a degree of uncertainty about the level of protection that each of the existing flood defence systems provides. By adopting this approach, the urban areas that are located behind existing flood defence structures were determined to be SFRA's by default and as a consequence detailed Flood Hazard/Risk Maps had to be prepared in compliance with the requirements of the EU Floods Directive (See Figure 5.11.2.2). This provided the opportunity to undertake the detailed structural assessments and flood modelling necessary to remove the uncertainty and establish the actual level of protection offered by these defences.

To facilitate a more robust assessment of the level of flood risk to Coleraine fluvial flooding, Rivers Agency developed detailed predictive flood models for each of these sources. It is considered that the flood hazard maps produced from these models will give a more accurate prediction of the flooded areas which may have been over or under estimated by the strategic flood maps. Details of the models and their output are described in the following sections.

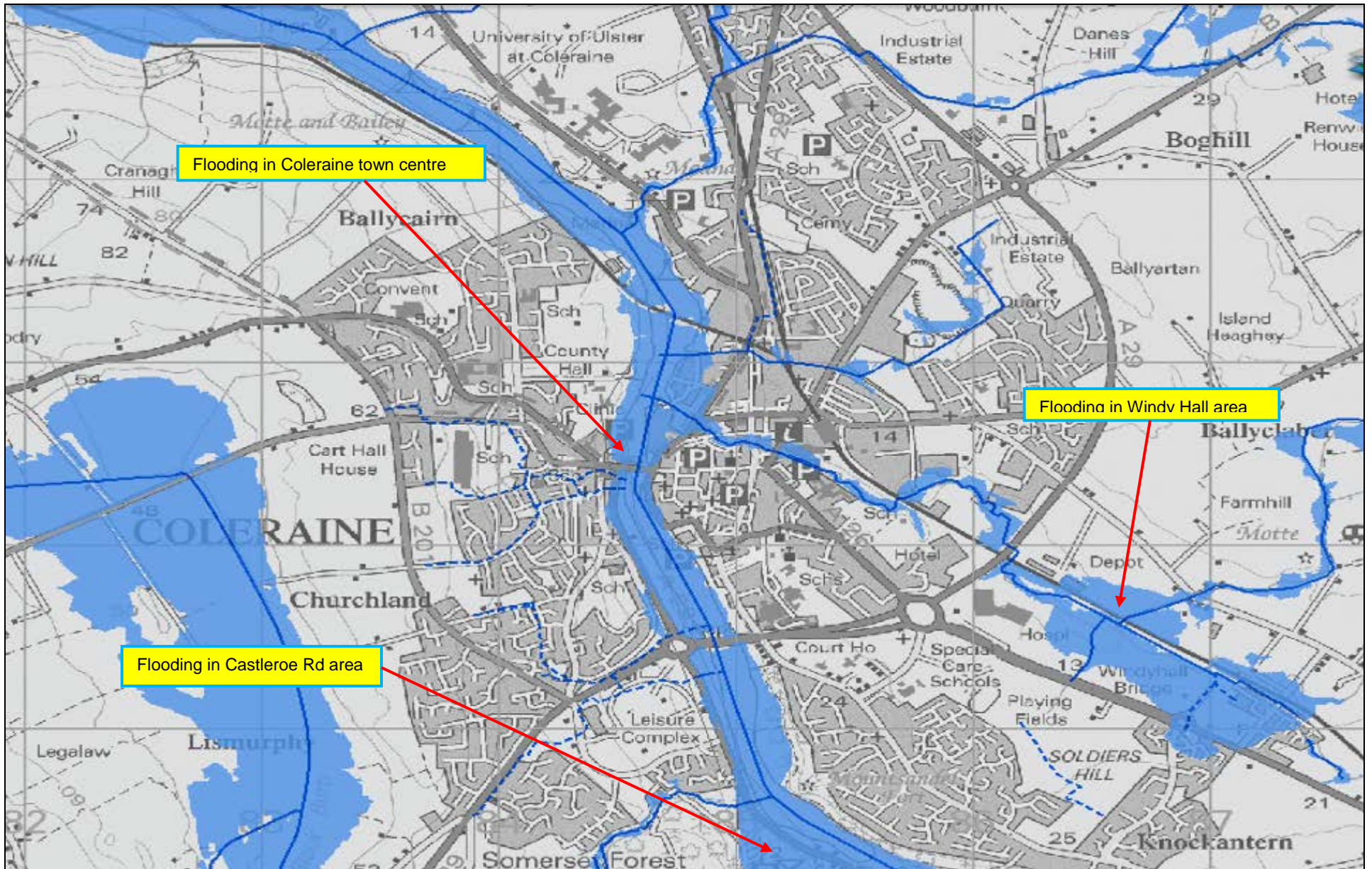


Figure 5.11.2.1 - Map indicating the **strategic** flood outline for Coleraine SFRA.

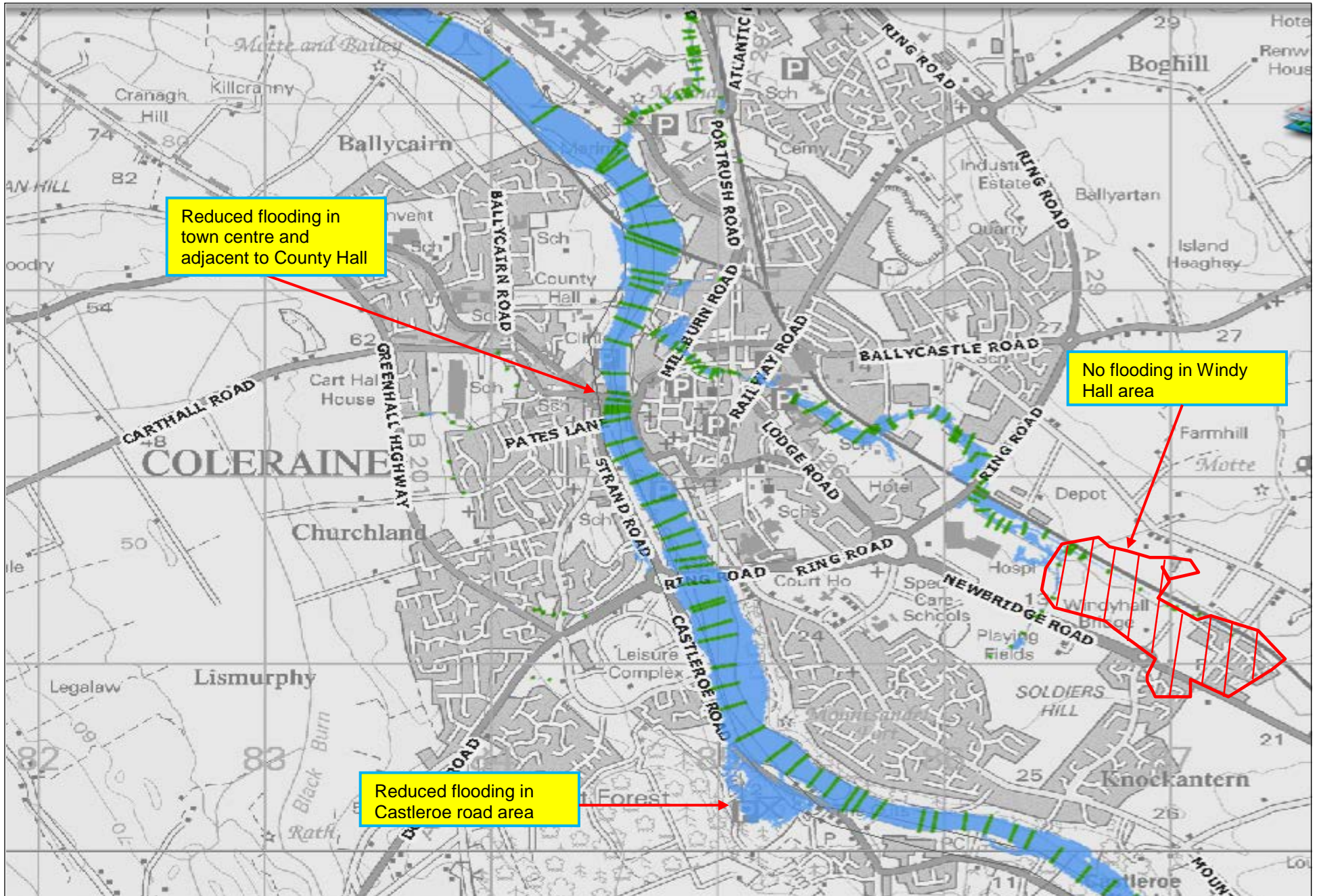


Figure 5.11.2.2 - Map indicating the **new detailed** flood outline for Coleraine SFRA.

5.11.3 Catchment Description

The River Bann catchment is the largest catchment in Northern Ireland (5,697km²) to the downstream limit and drains 43% of the Northern Ireland catchment (See Figure 5.11.3.1). The lower reaches of the Bann cover County Antrim and Londonderry and the upper reaches covers Lough Neagh, County Down, Armagh and Tyrone.

The main tributaries of the River Bann include the Rivers Moyola, Clady, Macosquin, Aghadowey, Agivey and Ballymoney. The catchment is largely rural, however, the drainage network at Coleraine is very heavily urbanised. The River Bann catchment is also characterised by Lough Neagh mid-way along its reach (upstream of the model limits). This presents significant attenuation of flow within the catchment.

Rainfall in Northern Ireland varies widely, with the wettest places being in the Sperrin, Antrim and Mourne Mountains. The highest areas have average annual totals of about 1600 mm, which is about half that of the English Lake District or the western Highlands of Scotland. The standard average annual rainfall for the Coleraine area is approximately 1000mm to 1200mm.

Coleraine town centre is a very heavily urbanised area with a lot of hard standing areas with some large amenity areas such as Andersons Park. Approximately 90% of Coleraine town is urbanised.

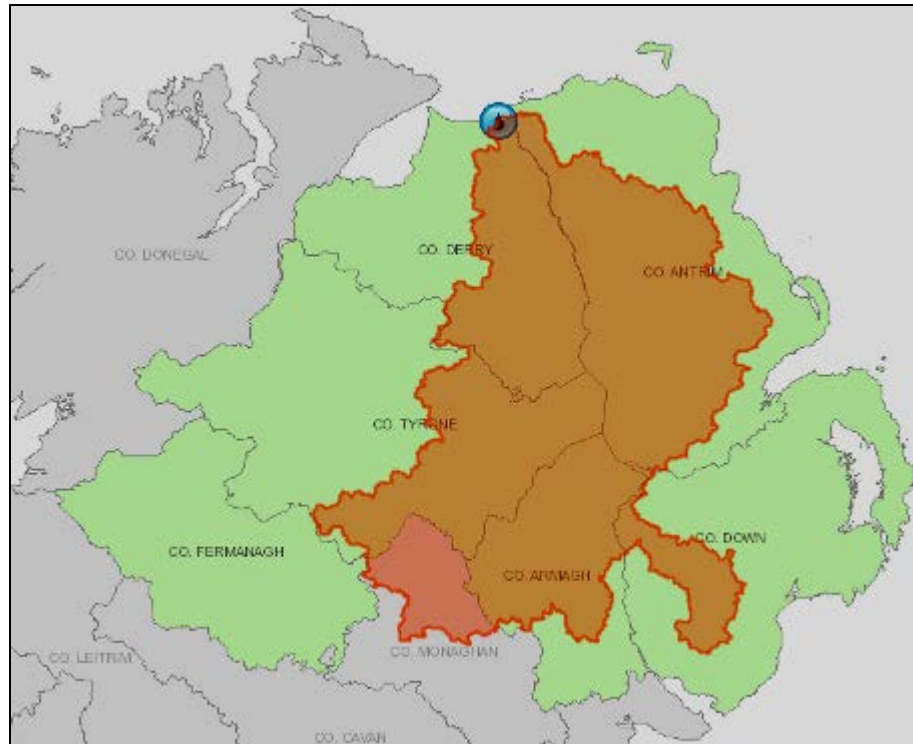


Figure 5.11.3.1 – Lower Bann Catchment

5.11.4 Fluvial Flood Risk Assessment

Flood Model

A hydrodynamic Infoworks-ICM model has been developed for the purposes of this SFRA. This model incorporated several existing models into a new model. The existing models were converted into Infoworks-ICM format and combined with the newly modelled watercourses. All of the modelled watercourses have been incorporated into the same model and share the same 2D domain. This allows for interaction between the watercourses.

A sensitivity analysis has also been undertaken on the model. This involved testing the effects of hydraulic roughness, flow and bank coefficients on maximum water levels along the study reach.

The model included both open channels and culverted urban watercourses in Coleraine. Figure 5.11.4.1 shows the watercourses modelled in the Coleraine Flood Model.

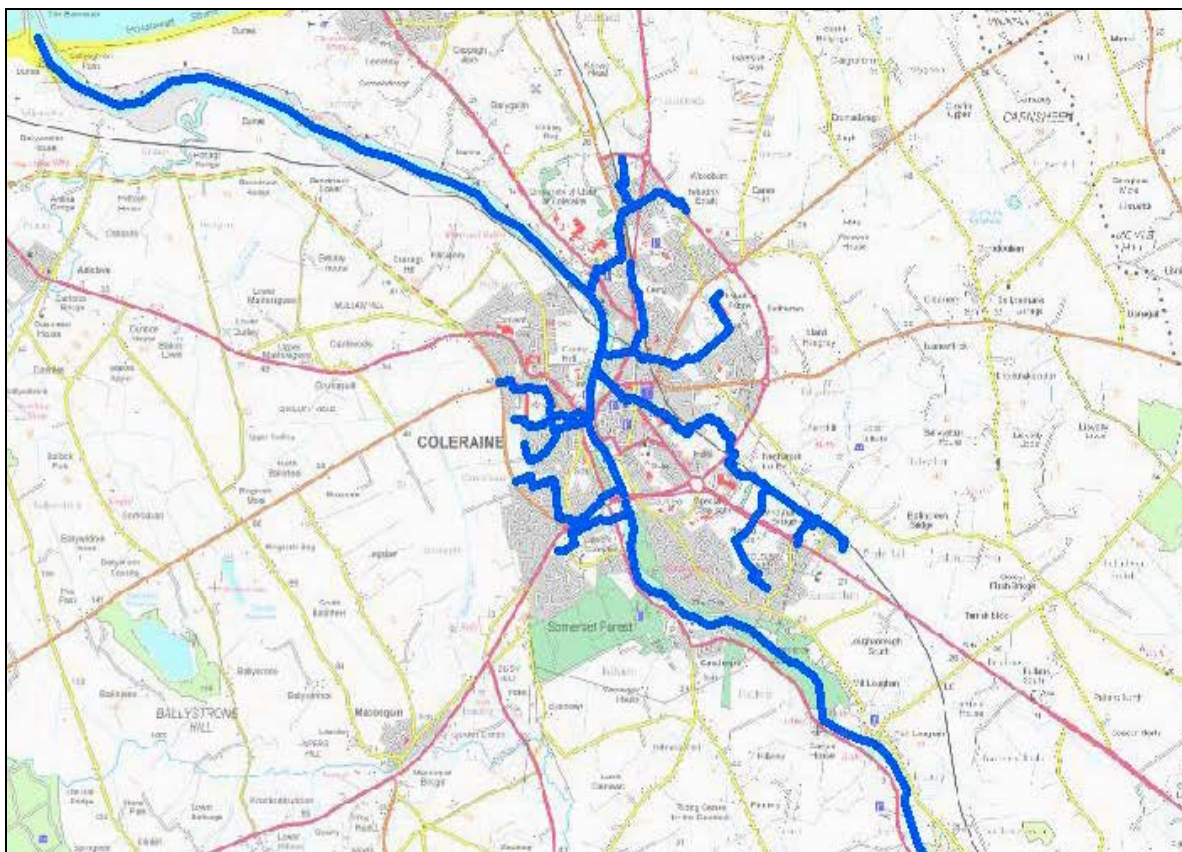


Figure 5.11.4.1 - Map showing the watercourses included in the Coleraine model.

Fluvial Flooding Mechanisms

The source of flooding in Coleraine occurs from fluvial flooding from the Lower Bann River and from two tributaries known as the Lodge Burn and Jubilee Terrace River. The PRFA indicated flooding in and around the town centre along with the Windy Hall area of Coleraine. The new detailed flood hazard map shows a reduced flood outline in both of these areas (See Figures 5.11.2.1 and 5.11.2.2)

Flood water exceeding bank full levels and spilling onto the floodplain causes some flood risk in the Coleraine SFRA. Additionally, when the capacity of culverted watercourses is exceeded flood water can either build up behind the culvert and spill out over banks or escape out of manholes onto the floodplain.

The two main areas that indicate flooding in the Coleraine SFRA according to Rivers Agency new flood hazard maps are:

- Castleroe Road,
- Millburn Road, Riversdale Trade Effluent storage facility

The main source of flooding in Coleraine SFRA is from the River Bann and the Lodge Burn which joins the River Bann from the east of Coleraine. The majority of flood water flows along the River Bann remain in bank apart from a few localised locations as highlighted on the next page.

Figures 5.11.4.2 and 5.11.4.3 on the next pages illustrates the predicted extents of the potential fluvial flooding from the Lower Bann River in Coleraine and details of the impact of the flooding on property and key infrastructure to the Millburn Road and Castleroe areas is summarised in Tables 5.11.4.1 and 5.11.4.2.

The model shows that at the relatively high frequency 10% AEP flood event, floodwater is predicted to spill from the downstream limit of the Lodge Burn watercourse and the resulting flood water ponds to shallow depths up to 300mm in the low lying areas most notably at the tennis courts off Millburn Road, Coleraine. It is estimated **1** non residential property could be flooded at this event causing damages in excess of £ **£22,844**

At the more extreme 1% AEP (Q100) event the predicted flooding is generally confined to the same locations plus the Castleroe Road area where the rivers agency depot is located. The flood inundation areas are more extensive and tend to be slightly deeper (up to 1m deep). Flooding from the 1% AEP (Q100) event is estimated to affect **3** residential and **11** non residential properties at a cost of around **£119,997**. The present value of the total property damages from potential future floods is calculated to be in excess of **£577,000**.

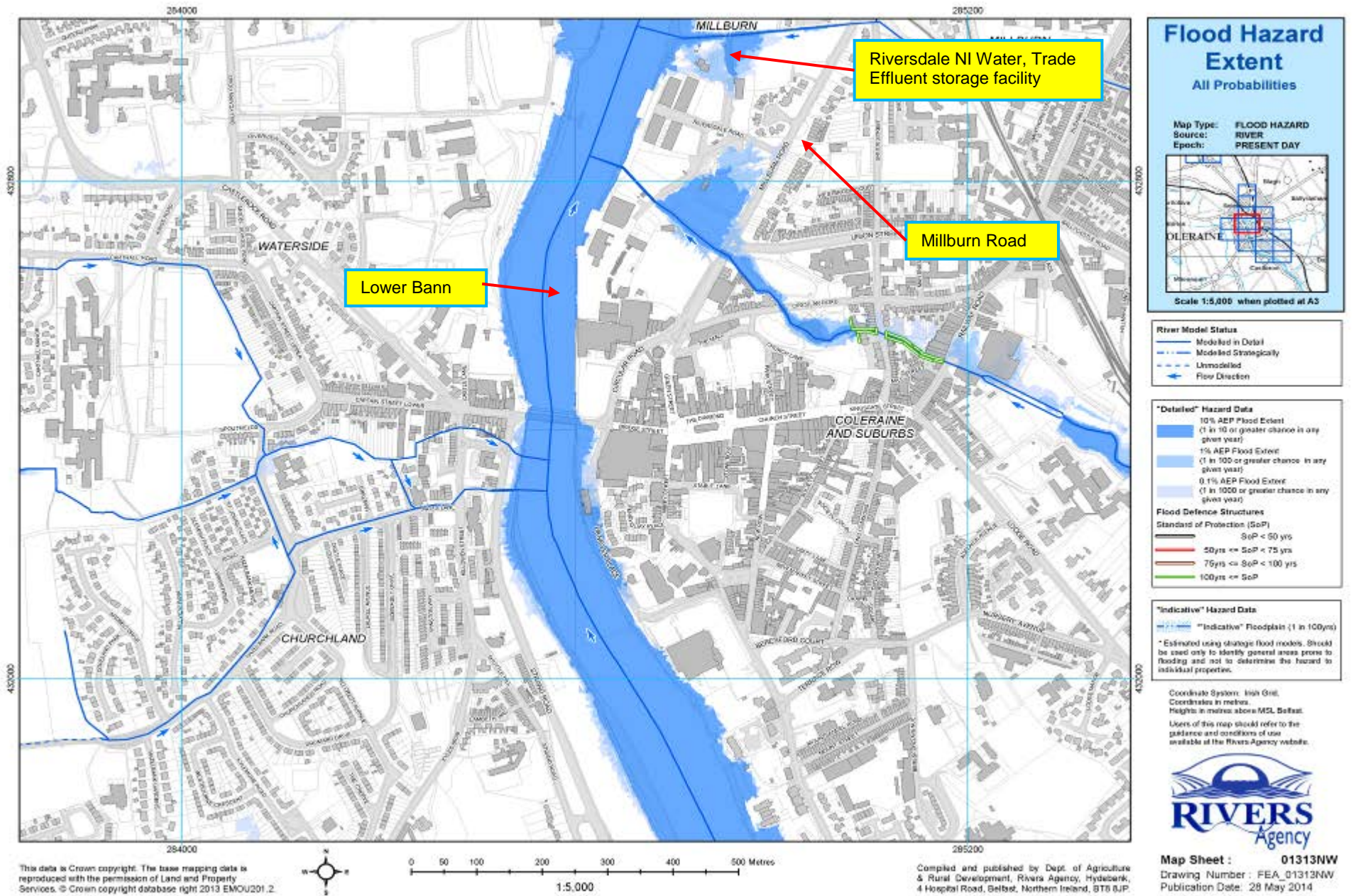


Figure 5.11.4.2 - Map indicating the 1%AEP (Q100) flood outline around NI Water storage facility, Millburn Road Coleraine

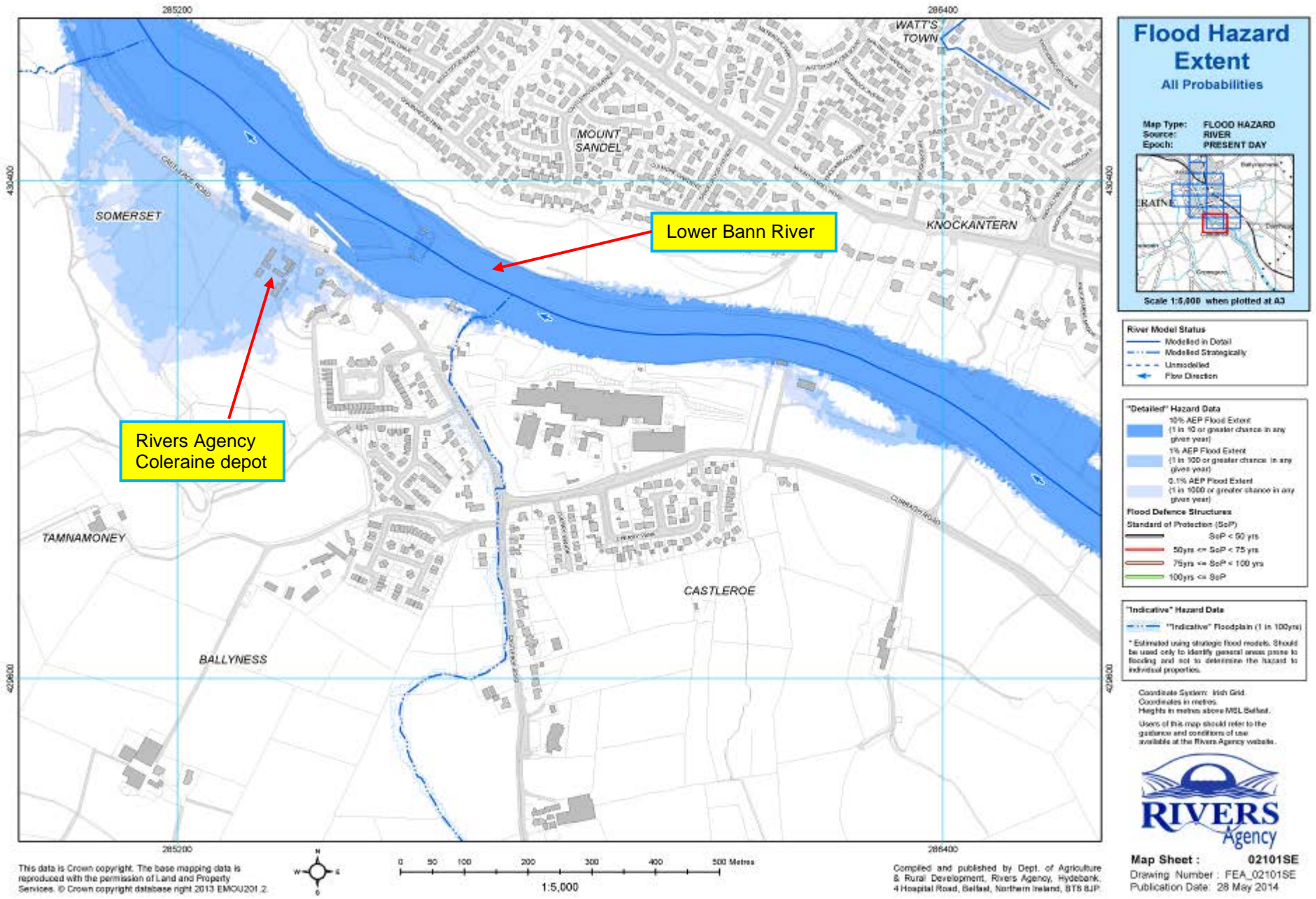


Figure 5.11.4.3 - Map indicating the 1%AEP (Q168) flood outline around the Rivers Agency depot

Table 5.11.4.1 - Coleraine SFRA – Castleroe Road area			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	1	1	3
Non Residential (Nr)	0	1	8
Economic Damage (£)	£6,555	£16,661	£66,739
Annual Average Damage (£)	£4,740		
Present Value (£)	£142,200		
IPPC sites (Nr)	0	0	0
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	1
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	0	0
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	1	1	1
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	2	2	2
Sites and Monuments Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

Table 5.11.4.2 - Coleraine SFRA – Millburn Road			
Potential Adverse Consequences – Fluvial Flooding			
	Flood Event % AEP		
	10% AEP	4% AEP	1% AEP
Residential (Nr)	0	0	0
Non Residential (Nr)	1	2	3
Economic Damage (£)	£22,844	£26,508	£55,258
Annual Average Damage (£)	£14,500		
Present Value (£)	£435,000		
IPPC sites (Nr)	1	1	1
Community Assets (Nr)			
Care Homes	0	0	0
GP Surgery's	0	0	0
Fire stations	0	0	0
Hospitals	0	0	0
Police Stations	0	0	0
Schools	0	0	0
Key Infrastructure (Nr)			
NIW Wastewater Treatment Works	0	0	0
NIW Sewage Pumping Stations	0	0	0
NIW Water Treatment Work	0	0	0
NIW Treated Water Pumping Stations	0	0	0
NIE Substation 6to11kV	0	5	5
NIE Substation 33kV	0	0	0
NIE Substation 275kV	0	0	0
NIE Substation 110kV	0	0	0
Road Service - Trunk Road	0	0	0
Environmental Designated sites (Nr)			
AONB	0	0	0
ASSI	0	0	0
Environmentally Sensitive Areas	0	0	0
Maritime Nature Reserve	0	0	0
Nature Reserve	0	0	0
RAMSAR	0	0	0
SAC	0	0	0
Sites of Local Nature Conservation Importance	0	0	0
SPA	0	0	0
RSPB Reserve	0	0	0
UWT Nature Reserve	0	0	0
Built Heritage sites (Nr)			
National Trust	0	0	0
Listed Buildings	0	6	6
Site and Monuments and Records	0	0	0
Buildings of Special Architectural or Historical Interest	0	0	0
Areas of Significant Archaeological Interest	0	0	0
Historic Gardens	0	0	0

5.11.5 Proposed Fluvial Flood Mitigation Measures

Prevention

As well as managing the existing flood risk to people and properties in Coleraine it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

Reference should be made to Section 4.4 under the headings Planning NI and Local Government regarding the reform and restructuring of the planning system in Northern Ireland. Rivers Agency's Planning Advisory Unit provides advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular Local Councils are advised on Development Plans and at the Planning Application stage. Flood mapping information is used to inform the local Development Plans to ensure, where possible, that new zonings are located outside the identified flood risk areas. In the determination of planning applications any proposed development within a flood risk area will either be advised against or will be further considered if it meets one of the "Exception" rules and is accompanied by a suitable Flood Risk/Drainage Assessment. Applications that relate to "Greenfield" built development in fluvial floodplains are unlikely to be accepted, whereas applications for recreation purposes and amenity open space will usually be accepted.

Development Plans

In the preparation of new Development Plans for Coleraine, Rivers Agency will advise against bringing forward sites or the zoning of any land, particularly for built development, that has been identified from the flood maps as being within the 1 in 100 year fluvial floodplain or is susceptible elsewhere to surface water flooding.

Rivers Agency shall also review the existing Development Plan for Coleraine (Northern Area Plan) with a view to addressing flood risk issues which have only recently been identified as a result of the new flood maps.

The main (undeveloped) flooded areas within the Coleraine SFRA are:

- In the Anderson Park area in the town centre
- To the west of the Coleraine Ring Road in the Bellasses area
- The area to the north west of the Rivers Agency depot along the Castleroe Road

Planning Applications

Fluvial areas at risk

Rivers Agency will advise against the development of all sites that are located within the 1 in 100 year fluvial floodplain irrespective of whether they are located within the current plan or as a single site application outside the plan area.

For those sites within the 1 in 100 year fluvial floodplain where the principle of development has been accepted by Local Council as meeting the “Exception Test”, Rivers Agency will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures.

The main existing developed areas, amongst others, at flood risk within Coleraine where re-development may be likely to take place are:

- Castleroe Road
- Millburn Road

Areas at risk of surface water flooding

For those sites outside the 1 in 100 year fluvial floodplain that are located in an area where there is evidence of a history of surface water flooding identified by the flooding hardship payments Rivers Agency will further consider the application through the appraisal of the accompanying Drainage Assessment that will need to demonstrate suitable flood mitigation measures.

Where there is potential for surface water flooding as indicated in the purple predicted areas on the surface water maps, Rivers Agency will advise that the applicant should assess the flood risk and drainage impact to the site themselves and construct in the appropriate manner.

Areas at risk of flood inundation from reservoirs

For all development proposals that are located within the potential flood inundation area of a Controlled Reservoir we will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety.

Protection

Structural measures are still one of the main options in providing flood protection to people and property impacted by the effects of extensive flooding. It is, therefore, important that we continue to target investment by providing flood defence, culvert alleviation schemes and infrastructure upgrade works to those communities at greatest need.

The alleviation of surface water flooding, in particular, will require input from a number of bodies. The **Flood Investment and Planning Group, (FIPG)**, provides a coordinated approach across Government in relation to the investigation of flooding, agreeing responsibilities and identifying collaborative solutions. The group is represented by Rivers Agency, NI Water and Transport NI, amongst others, with flood risk management responsibilities.

There are a number of stages to follow when procuring a flood alleviation scheme. The potential scheme needs to be first subjected to a feasibility study that will also include an economic appraisal. From the detailed Hazard and Risk Maps a “Flood Risk Metric Tool” (FRISM) is used in urbanised flooded areas to get an estimate of the likely property damages as a result of a range of flood events. The estimated cost of a scheme is then compared to the total “damage avoidance benefits” that the scheme will provide to the property over the scheme’s design life. If the benefit/cost ratio is greater than 1 (Net Present Value, NPV, figure is positive) then the potential scheme will be referred to Rivers Agency’s Capital Procurement Unit for a feasibility study to be undertaken.

If the flooding issue identified is not solely Rivers Agency’s responsibility, or is the responsibility of NI Water or Transport NI such as a local drainage or road infrastructure issue, it will be referred either to FIPG or directly to the responsible body, for their further consideration.

If a benefit cost analysis identifies a viable scheme, a scheme will be placed on a prioritisation list for works with other competing schemes. The position on the list will depend on a set marking criteria, such as the benefit/ cost ratio and the overall scheme costs. Depending on the availability of resources it may take from between 2 – 5 years for the scheme to progress from the start of the feasibility study to construction works commencing on the ground.

Determination on the need for an engineering solution

Having conducted a detailed assessment of the flood risk to Coleraine from the Lower Bann River and its tributaries, Rivers Agency has determined that a broad scale engineering solution is not justified at this time. Although the model predicts that there is a low risk to property from a section of the main Lower Bann in the vicinity of Castleroe Road and Millburn Road, there are no records of historical flooding to property at these locations to support this conclusion. As there is a degree of uncertainty with all of the predictive flood models, there is always a possibility that the model is overestimating the likelihood of flooding from these watercourses. Therefore, Rivers Agency will engage with the affected parties with regard to informing them that they lie within the flood plain and may consider site specific arrangements such as water level recorders, text alerts or voice announcer/online access to live water levels.

Preparedness

In Coleraine it is not possible to prevent or protect against all flooding. Indeed even where flood defences exist it is possible in an extreme event that these could be over topped and flooding could still occur.

Having recognised this fact, considerable effort in recent years has been made by emergency planners in Government Departments, Councils and the Emergency Services working together and sharing information to ensure a coordinated response.

However, despite these improvements during significant flood events the emergency response of Government Departments and the Emergency Services can become over stretched. This means that not all calls for assistance during a flood event may be responded to in a timely manner. With this in mind it is important that households and communities, subject to a known flood risk, are prepared. The detail of preparedness actions, including flood warning and informing activities planned from a regional perspective, are provided in Appendix E.

This is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.

From the flood risk assessment there are certain areas of Coleraine which are subject to flood risk and may have flooded before. Therefore, they may benefit from the flood warning and informing proposals outlined in Appendix D.

A pilot project of community engagement to deliver flood warning and informing, held in 2014, identified basic assessment formulae to assess and score areas that could potentially be a focus for flood warning and informing actions. Based on this scoring these areas did not score high enough to be placed within the top 20 communities to be offered a programme of community engagement during the period of this plan. However, if communities want to become more resilient, the Department is committed to providing assistance where possible to develop the consistent approach to resilience. The NI Direct website www.nidirect.gov.uk/ will host further information and advice on what to do in advance of flooding, what to do during flooding and how to recover after flooding. The website will also contain templates for communities wishing to develop their own plan.

Section 6

6. Implementation

This section details how the measures to manage flood risk for each Significant Flood Risk Area (SFRA) will be implemented. It also explains how they will influence future actions and highlights the benefits of their implementation.

The measures (Prevention, Protection and Preparedness) are identified for each SFRA in Sections 5 of this document.

The detail on specific protection measures, that is, the appraisal and development of flood alleviation schemes, including natural flood risk management options if feasible, will be developed throughout the cycle of these FRMPs.

6.1 Prevention

6.1.1 Prevention – Implementation

The Prevention measure will be implemented through Rivers Agency's Planning and Advisory Unit providing advice to Planning NI and Local Councils in relation to the prevention of flooding. In particular, Local Councils are advised at the Development Planning and Planning Application stages of the planning process, concerning proposed development in floodplains that it considers to be inappropriate.

The role of Rivers Agency's Planning Advisory Unit (PAU) will be key in implementing this measure.

The detail of the approaches that underpin *Prevention* are expanded upon in the text for each SFRA in Section 5. The implementation of this measure will continue throughout the cycle of these FRMPs.

6.1.2 Prevention – Drivers for future actions

The implementation of this measure will drive the following:-

- The need to review, as necessary, Planning Policies in relation to flood risk.
- The need to have up to date flood risk and hazard mapping.
- The need to further engage with critical infrastructure providers on the appropriate location and resilience of their installations.
- The need to link development emergency response plans, compiled as part of a flood risk assessment, with broader community emergency plans taken forward in implementing the preparedness measure.

6.1.3 Prevention – Key Benefits of Implementation

In Northern Ireland the application of a robust planning policy in relation to land use planning, has already been beneficial in ensuring that the overall numbers of properties and critical infrastructure at risk of flooding do not increase and that any re-development is built with suitable flood resistance/resilience measures.

In Northern Ireland, the number of properties at risk of flooding is around 1 in 18, compared to 1 in 6 in England.

The critical factor in keeping this figure so low in Northern Ireland has been the strict application of a sustainable land-use policy (particularly PPS15). It is vital, therefore, that planning policy relating to flood risk is strictly adhered to throughout the duration of these FRMPs and beyond.

6.2 Protection

6.2.1 Protection - Implementation

Protection measures will be implemented by the completion of already identified and programmed flood alleviation schemes, infrastructure upgrading works and routine maintenance activities, as well as carrying out studies to identify further works to be taken forward.

This will involve Transport NI, NI Water and Rivers Agency both individually and, where necessary, collectively, working together particularly through the auspices of the Flood Investment and Planning Group (FIPG). At an early stage in this first Plan cycle, these organisations will be moving together into a new department which should benefit the implementation process.

The detailed analysis of each of the SFRAs identifies, as appropriate, the need for further studies to determine approaches in implementing protection measures. In some locations this will build upon the investment in flood alleviation schemes already made in these areas.

These FRMPs do not deal with the detail of individual schemes or definite scheme proposals, as this is not possible for all the SFRAs at this stage. The focus, in the first instance, is on assessing the potential benefit, in terms of damage avoided, for each of the SFRAs.

This strategic approach, at this stage, is reasonable as the FRMPs are intended to consider a proactive approach to protection measures, as opposed to a post flood event reactive approach. It also allows for a broader approach in the development of flood protection infrastructure, in terms of funding, partners and the implementation of natural flood risk management techniques.

A Homeowner Flood Protection Grant Scheme, will be introduced in early 2016. This will improve the ability of householders and communities to enhance their property's resistance to flooding through the provision of individual property protection measures.

Details of flood protection measures for any of the SFRA's already underway, or at an advance stage of development will be presented at Local Flood Forum meetings in 2016.

6.2.1 Protection – Drivers for future actions

The implementation of this measure will drive the following:-

- The need for continued inspection and maintenance of drainage and flood protection infrastructure including designated watercourses, culverts, sewerage systems and road drainage systems.
- A proactive, strategic approach, in the development of flood protection measures and work programmes.
- The development of Natural Flood Risk Management techniques in co-operation with partner organisations and the necessary underpinning policies to allow for a wider range of options to be used in developing flood protection measures.
- Greater integration with all flood protection, drainage and watercourse infrastructure providers in developing joint schemes with multiple benefits.
- The opportunity to review investment and financing options from a wider catchment based perspective.

6.2.1 Protection – Key Benefits of Implementation

The key benefits in providing and maintaining flood protection and drainage infrastructure over the duration of these FRMPs is:

- The avoidance of risk to life and damage to property and infrastructure, which would otherwise be unprotected from flood risk.
- Opportunities for 'joined up' working with other infrastructure providers in terms of scheme development and investment efficiency.
- Opportunities to look at flood risk from a catchment-wide perspective with other water resource interested organisations and explore 'multiple benefits' that could be realised.

Other benefits include improved quality of life for those currently anxious about their property's vulnerability to flooding. Less pressure on emergency response resources, in protected areas, will mean improved efficiency in responding to those still exposed to a greater level of flood risk.

6.3 Preparedness

6.3.1 Preparedness – Implementation

Preparedness measures will be implemented by a range of approaches. These include continuing to work together with co-responders, voluntary sector groups and communities to ensure a co-ordinated and timely emergency response when flooding occurs. The role of Local Government Emergency Planning Co-ordination Officers (EPCOs) is essential in implementing this element of preparedness activities. In addition, lessons learnt from post flood event debrief reports will inform improvements for the future.

Emergency planning exercises will, as resources permit, be held to add clarity to roles and responsibilities and share knowledge.

Flood Warning and Informing activities will also be key to ensuring responders and the public are able to put the necessary preparations in place in the event of flooding. The activities include development of the Community Resilience programme along with installation of new text alert stations to better inform communities at risk.

Enhancement of the 'Flooding Incident Line' will also take place. This will not only improve the reporting of flooding by the public but also communication between co-responders and better information during flooding events.

6.3.2 Preparedness – Drivers for future actions

The implementation of this measure will drive the following:-

- The need for further emergency planning exercises.
- A review of 'Flood Warning and Informing' activities to inform further development in this area.
- Development of the Flooding Incident Line to improve this service for the public and provide real time data to co-responders during a flooding event.

6.3.3 Preparedness – Key Benefits of Implementation

The key benefits in implementing the preparedness measures in this Plan are:-

- Improved emergency response from 'Government' during a flooding event.
- Better integration with co-responders in relation to information sharing before and during a flooding event.
- Communities at known risk more resilient in dealing with flooding.
- Improved communications in relation to reporting a flooding event.

Section 7

7. Overview of Measures and Costs of Implementation

7.1 Regional Measures – An Overview

7.1.1 Regional Measure 1 - Rivers Agency Drainage and Flood Defence Infrastructure Management

There are approximately 15,500 properties protected from flooding by above and below ground flood defence and drainage infrastructure which is inspected and maintained by the Department. Properties protected include homes, businesses, key networks of national infrastructure and many important historic buildings.

The Department adopts a sustainable approach to managing the risk of flooding by inspecting and maintaining its flood defence and drainage infrastructure. It also provides new infrastructure to reduce flood risk.

The Department's appraisal of drainage and flood defence infrastructure performance is based on routine visual assessments of infrastructure condition, risk assessments and risk analysis, supported by in-built asset redundancy (e.g. surcharge, free-board, etc). Change in performance can occur due to factors such as structural deterioration over time, physical damage, climatic change, increased development, poor maintenance, lack of resource/funding allocation etc. Thus there are many reasons to periodically undertake performance appraisals.

As an integral part of the management of its infrastructure, the Department considers six core priorities when establishing annual programmes for maintenance and capital expenditure: -

- Fulfil statutory responsibilities;
- Maintain infrastructure networks in a safe and satisfactory condition;
- Have full regard for safety, health and welfare of the public and employees;
- Support economic growth by reducing the risks of flooding;
- Provide the optimum standard of service to customers;
- Comply with the principles of sustainable development.

Achievement of the above priorities is considered when ranking programmes of maintenance works and individual schemes. Furthermore, maintenance and capital programmes are evaluated by taking account of environmental obligations, contractual commitments and cost-benefit criteria prior to inclusion in the annual works programme.

The Department delivers an annual infrastructure maintenance and capital programme aligned to the Department's objectives, annual budget allocations and infrastructure performance targets. In order to

maximise the use of available funding, it is necessary to prioritise investment on those elements of the network that provide the greatest drainage and flood risk benefit for the lowest whole-life cost.

7.1.2 Regional Measure 2 - Rivers Agency Watercourse Inspection and Maintenance

DARD Rivers Agency is responsible, on a permissive basis, for the maintenance of designated watercourses in Northern Ireland. This is necessary to alleviate flooding and to assist land drainage. In open watercourses, this work includes clearance of silt and gravel deposits in an environmentally acceptable manner; these build up naturally in river channels and can restrict the flow of water. Debris such as fallen trees, which can lead to blockages in watercourse channels, at bridges or at other channel constrictions, is also removed.

In the urban areas of towns and cities, watercourses may be culverted below ground and there is a substantial network of watercourse culverts in Northern Ireland. A comprehensive inspection and survey programme to assess their structural condition is undertaken on a cyclical basis. The Agency carries out maintenance work along the lengths of these culverts and at their inlets where metal screens, known as grilles, are often located to prevent debris entering and causing blockage which may result in flooding. Grilles are regularly inspected and debris is removed as necessary.

The Department adopts a standardised inspection and maintenance rolling programme to define standards, inspection frequencies and priorities depending on flood risk, land use drainage requirements and watercourse characteristics. Systematic inspection systems provide an objective approach to the need for, and quantification of, maintenance and form a defensible basis for the maintenance programmes. The Department's Maintenance Manual and Policy & Guidance documents provide a framework for the maintenance of Designated Watercourses. All such works are subject to the availability of resources.

Inspections and/or maintenance can be undertaken by Departmental staff or by contract depending on the particular circumstances. Rivers Agency's maintenance programme is published annually and is scrutinised by a variety of bodies with diverse interests.

Culvert inspection is undertaken to determine any obvious structural or serviceability defects that may result in increased flood risk. Inspection and repair of culverts is co-ordinated between operational and Headquarters staff to ensure efficiency and accuracy of records. Culvert inspections take the form of manhole inspections to check for standing water and obvious defects, walkthrough inspections in suitable systems using an underground team of trained personnel or, through surveying by CCTV camera.

Inspection Frequency

Watercourses can flow over considerable distances and have changing characteristics as they move from source to the sea. Due to differing channel characteristics, flood risk and drainage considerations, it is usually unnecessary to maintain the entire length of a watercourse under the same frequency of inspection.

Therefore, watercourses may be divided into defined “reaches”, to be inspected in different years and at different frequencies if required.

Minimum inspection frequencies for open watercourses: -

Rural Areas - In general, an inspection frequency of 6 years is adequate although this may be extended to up to 10 years.

Urban Areas - In general, an annual inspection is undertaken.

Maintenance

Each year the Department carries out routine maintenance work on designated main, minor and urban watercourses. Watercourse maintenance is mainly required to reduce flood risk and to maintain the agricultural production potential of land. Minor works of repair and refurbishment to ancillary structures and installations are also carried out.

Consideration is given to whether any obstructions to flow or reduction in channel dimensions will have a significant impact on drainage and flood defence standards. Land use in the vicinity of a watercourse is taken into account when considering the degree of maintenance required and the methods to be employed. Where works have been identified that may impact on areas with environmental designations or other environmental features, careful consideration is given to the extent and methods used in consultation with the Department’s Environmental staff.

Urban watercourses may require more frequent maintenance. These are generally defined as being within current urban development limits and/or where flooding, if it occurs, is likely to significantly affect built property or major infrastructure. Ad-hoc inspection and maintenance may be undertaken in advance of a storm, in response to complaints, interference by third parties, flooding incidents etc.

7.1.3 Regional Measure 3 - Rivers Agency Planning Advice

Rivers Agency’s Planning Advisory Unit (PAU) plays a key role under the heading of ‘Prevention’ in providing advice to Planning NI and local Councils on all drainage and flood related matters in regard to proposed development. In particular, local Councils are advised on the Development Plans and Planning Application stages. The recent transfer of planning functions from Planning NI to the 11 new Councils in April 2015 has resulted in significant changes for the parties involved in Planning.

Planning Advisory Unit’s responsibilities are as follows:

- Providing expert engineering advice to Planning NI and Councils on proposed Area Development Plans and on individual Planning Applications and providing written representation and attendance at Public Examinations / Planning Appeals when required to do so;
- Providing advice to Planning NI and Councils on Environmental Impact Assessments and Statements relating to developments;

- Minimising flood risk to people, property and the environment through adherence and application of Planning policy relating to Flood Risk;
- Appraising Flood Risk Assessments and Drainage Assessments submitted by developers and their agents in accordance with the requirements of Planning policy;
- Providing internal advice to Rivers Agency staff on complex development issues and strategic infrastructure projects.

7.1.4 Regional Measure 4 - Rivers Agency Capital Works Programme in all areas including the 20 SFRAs

The Department is responsible in the Province for the maintenance of river drainage infrastructure and the execution of works to protect people and property against flooding from watercourses where need has been identified and where intervention can be justified on economic grounds. This is for all areas and not just within the 20 SFRAs. A formal and robust procedure for prioritising works schemes is necessary to ensure the Department addresses the areas of greatest need and facilitates proper management of limited budgets. This procedure also fulfills the requirement for accountability by the Department and reassures the Accounting Officer concerning the expedient use of public funds.

7.1.4.1 Prioritisation - General Principles

The need to carry out Capital Works is identified on a proactive basis, through the Flood Risk Management Plans (FRMPs) which identify Significant Flood Risk Areas (SFRAs) where there is potential for future flooding and, on a reactive basis, where there is a history of previous flooding or where Asset Management Plans (AMPs) identify assets that are in poor condition and need replacing or upgrading.

The Department's Capital Works Programme addresses these needs through the delivery of three main types of works:-

- River Flood Protection
- Coastal Flood Protection
- Repair / Replacement (Urban Culverts)

Each scheme is assessed against the following four criteria which are relevant in the decision making process and enable comparisons to be made on a consistent basis. The criteria listed in order of importance are:

- Degree of protection / Risk of failure
- Economics
- Special Consideration
- Financial Control

A score is assigned to each scheme for each criterion. The criteria are then weighted and scored to determine the final priority score of each individual scheme.

Assessment of Scheme Priority is carried out at an early stage in the life of a potential scheme, once the need for a scheme has been identified. As better information becomes available about the scheme, its priority may be reassessed; this may be undertaken, for example, during completion of the scheme feasibility study or scheme design. Priority may also be reassessed as a result of further flooding or as a result of other changes which may occur which impact on the scheme.

7.1.4.2 Programme Information on the Internet

The Department publishes information on its larger flood risk management projects on the Investment Strategy for Northern Ireland's (ISNI's) website <http://isni.gov.uk/> in the form of an 'Investment Activity Report'.

The Department posts information on:

- Construction Projects of value greater than £0.5m and,
- Services Projects e.g. Consultant Feasibility Studies or Reports, of value greater than £100k.

A current list of these flood risk management projects is available on an ISNI Project Report page via the following web-link:-

http://isni.gov.uk/projects_rslt.aspx?p=135

Anyone accessing this Project Report can click on each project to access more detailed information.

Anyone requiring information about flood risk management projects, whether mentioned on the ISNI website or not, they should contact the Department via the contact details included within these FRMP documents.

7.1.5 Regional Measure 5 - DRD Transport NI - Road Drainage

Transport NI is the sole Roads Authority in Northern Ireland. It has responsibility for over 25,000 km of public roads, together with 9,000 km of footpaths and a substantial number of bridges, street lights and public car parks.

Along with DARD Rivers Agency and NI Water, DRD Transport NI is one of the 3 government drainage asset owners in Northern Ireland. Transport NI operates a network of road drainage systems essentially to provide effective drainage of surface water from road carriageways.

Transport NI deals with the impacts of roads-related flooding. They maintain road drainage systems, organise road closures and traffic diversions, clear blockages during flooding and remove debris once flooding has receded. They will also take action to protect property that may be affected by road flooding.

Transport NI applies Sustainable Drainage Systems (SuDS) solutions, where appropriate, in their major road schemes.

Transport NI does not have a capital budget specifically allocated to flooding but in order to prevent as far as possible the occurrence of standing water or flooding of roadways, drainage systems are maintained as and

when required. Gullies in urban and rural areas are cleaned by Transport NI on a programmed basis, generally twice per year in urban situations and once per year in rural areas, and if necessary in an emergency.

In relation to major capital road improvements, an element of the work undertaken will include improved drainage; however, the associated costs attributable to any reduction in flooding are not readily identifiable. To improve drainage, capital funding is allocated through the structural maintenance budget. In 2015-16 year, £3.5m was allocated. The purpose of the allocation is for roads purposes only and it is not utilised for other local drainage or flood alleviation purposes.

Future budget allocations for structural maintenance are not known at this time. Therefore, for the purposes of the FRMP it is assumed that the element of Transport NI's budget which contributes to reduced flooding may be smaller and consequently an annual expenditure of £1m is included against Transport NI in the assessment of Costs for the Plans.

This work and its associated expenditure is considered to be spread throughout the Region and is therefore not specific to Significant Flood Risk Areas or Areas for further Study.

7.1.6 Regional Measure 6 - DRD Water Policy Division– Living with Water Programme

DRD Water Policy considers that significant capital investment is necessary in Belfast's drainage infrastructure to address the following issues:

- Increasing instances of serious flooding;
- Pollution risks: In 2014 the EU Water Framework Directive (WFD) water quality classification of the Belfast Harbour was classified as 'bad', and the inner part of Belfast Lough classified as 'moderate' status. NIEA assessed that this was due to continued diffused and point source pollution, such as from combined sewer overflows and WwTW discharges;
- Wasterwater Treatment Works working above capacity: The main Wastewater Treatment Works serving Belfast (Belfast WwTW at Duncrue) has to operate well above its theoretical design capacity, receiving more sewage than it was designed to treat.

In response to this requirement, in July 2014, the NI Executive agreed that the Department for Regional Development (DRD) should set up an interdepartmental group to develop a 'Strategic Drainage Infrastructure Programme' to determine the capital investment necessary to protect against flood risk (excluding flooding from the sea), enhance the environment and support economic growth.

To facilitate the development of this Programme, DRD has established the 'Living With Water Programme' (LWWP), the Board of which includes representatives from DRD, NI Water, Rivers Agency, TransportNI, Belfast City Council, DOE, NIEA, DFP and the Strategic Investment Board. In order to take a holistic, integrated approach to planning future drainage provision in 2015 the LWWP initiated 15 inter-linked work

packages. The focus of these work packages is to develop the detailed capital investment plan which will, when implemented, achieve the objectives at reduced cost and disruption, whilst also securing the necessary community and stakeholder support.

The main outputs of the Belfast Strategic Infrastructure Programme are expected to be:

- a) Private drainage infrastructure – ownership defined, brought up to standard
- b) Storm separation - progressed across areas of Belfast
- c) Sewers - capacity increased and maintained
- d) Watercourses – capacity increased if necessary, maintained, amenity value increased
- e) Drainage infrastructure - designed for exceedance
- f) Combined Storm Overflows – some closed, others improved
- g) Sewage pumping stations - upgraded or replaced
- h) Increased storm storage within the sewerage network and WwTW
- 1) Belfast WwTW upgraded (increased capacity & new discharge standard)

Other activity will include:

- Catchment management measures to reduce diffused pollution
- Increased used of sustainable drainage systems (SuDS)

The LWWP will also drive close working between a number of organisations which are to become part of the new Department for Infrastructure from May 2016. As such, it will be at the forefront of establishing new ways of integrated working to deliver improved services and essential infrastructure across Northern Ireland.

In late 2015 the development of the Programme is being funded through existing resources from the members of the Programme Board. Early estimates for the project delivery stage range from £350m to £750m for Belfast alone, and the various elements of the Programme need to be fully costed. It is envisaged that construction works will commence in 2020 and be completed in 2026. The projected capital expenditure in 2020/21 is £11m.

In relation to the flooding elements of the LWWP, it is projected that these will comprise around 25% of the associated costs. This will include a cost overhead for staff time and consultancy expertise in developing the Programme, generating feasibility studies and design & supervision of capital works.

From the information above, within the period of the Flood Risk Management Plans, the LWWP will be scheduled to commence in the final year of this cycle, so within this Plan period, £11m is projected to be spent of which approx £3m will be on flood alleviation. The main elements of the LWWP will be undertaken during the 2nd FRMP cycle, from 2021-2026 which could entail expenditure on flood alleviation of the order of £90m- £190m. An amount of £1m per annum has been included for fees associated with the development of flood alleviation proposals.

7.1.7 Regional Measure 7 - Northern Ireland Water – Proposed schemes to alleviate flooding

Northern Ireland Water (NIW) is responsible for the provision of 625 million litres of clean water a day for almost 1.7 million people as well as the treatment of 134 million m³ of wastewater every year. It is responsible for the following drainage assets:-

- 26,500 km of water-mains;
- 14,500 km of sewerage mains;
- 47 water treatment works and
- 918 wastewater treatment works.

During the 6 year period of the Flood Risk Management Plans, from 2015 – 21, NIW plans to undertake works to alleviate flooding related to their infrastructure, through the following three programme elements in their PC15 business plan:

DG5 (Internal Flooding) Work Programme – these schemes are undertaken to directly address out-of-sewer internal flooding at specific properties;

Stormwater Separation – these schemes aim to keep rainwater out of NI Water’s sewers and enhance sewer network capacity by disconnecting impermeable areas and thereby alleviating flooding across the Province. NI Water has a target of removing 190,000m² of impermeable surface by the end of the PC15 funding period (i.e. by 2020/21).

SCAMP - Sustainable Catchment Area Management Planning Northern Ireland (SCaMP NI) was initiated in 2013 and aims to improve the quality and reliability of the raw water received at NI Water’s raw water abstraction points. The SCaMP improvements are to be achieved through sustainable catchment based solutions that focus on protecting the natural environment delivering favourable condition and habitat improvements and there can also be beneficial effects for downstream water flows (and flooding) as the project includes activities to retain groundwater in upland peat restorations.

7.2 Costs of implementing Flood Risk Management Plans

7.2.1 General

This section gives an overview of the costs of implementing the measures to manage flood risk identified in the 20 SFRAs along with costs of Regional measures which will be undertaken throughout the Northern Ireland region.

The Floods Directive Article 7.3 requires FRMPs to take into account relevant costs. It is to be acknowledged the costs included in this section are high level and strategic in nature and represent an overall order of costs to manage flood risk. The costs in the assessment have been compiled under the broad headings of Prevention, Preparedness, and Protection.

More detailed estimates will be produced over the lifetime of these Plans as more information, particularly in relation to flood 'protection' activities, is known and Regional infrastructure plans and programmes are developed.

7.2.2 Costs included in the PEDU Report 2012

The PEDU report, published in 2012, recommended "that Rivers Agency, Roads Service (now Transport NI) and NI Water work with their parent Departments to review current flood defence expenditure priorities and report to the Executive on their adequacy to meet the potential threats over the next 10 years". This 10 year period encompasses the duration of these Flood Risk Management Plans.

It was estimated that a combined figure of approximately £24 million of resource expenditure and £36 million of capital investment per year for all the Drainage Agencies, was needed to maintain drainage infrastructure and execute a programme of flood alleviation projects, to reduce flood risk. These estimates were based on plans and a broad estimate of necessary works at the time the PEDU report was compiled. The findings of this report were presented to the NI Executive in April 2013.

The measures identified in these FRMPs would require this level of investment as a minimum to reduce flood risk. These minimum estimates in PEDU did not include operational costs in relation to emergency planning and the administration of Planning Policy. Costs of other organisations, such as Local Councils, PSNI, NIFRS and Consumer Council, who play a significant role in the emergency response to flooding were also not included.

The PEDU report also included estimates of costs to accelerate implementation and the costs of undertaking 'new activities' to address issues of exceedance and infrastructure which was not part of the public network. As part of the PEDU spending review it was recognised that investment could be

increased annually (should funding be made available), to accelerate programmes of capital investment and improve maintenance of infrastructure, a critical aspect in the management of flood risk. An additional combined figure of £4 million resource expenditure and £36.5 million of capital investment, per year for all the Drainage Agencies was identified. It was also estimated, that in order to address vulnerabilities in infrastructure which was not part of the public network, approximately £12 million per year, of mainly capital investment, would be required.

Whilst the PEDU estimates do not directly read across to all the activities to implement the measures in these Plans, they provide broad indicative costs of managing flood risk in Northern Ireland.

Working through investment needs, particularly where more than one organisation is involved will require a strategic targeted approach. These Plans give the overall regional strategic approach to collectively managing flood risk. Cross-Departmental Groups will have a key role to play in facilitating appropriately targeted investment in areas of joint responsibility.

7.2.2.1 Impacts of Resourcing Pressures

It should however be noted that the resourcing pressures on all Departments, particularly in terms of resource funding, will impact directly on the maintenance of critical drainage infrastructure and the risk of flooding could increase as a result.

The pace of delivery of flood alleviation schemes will be linked to levels of capital investment available and this will mean that priorities for funding will need to be kept under review and reprofiling of programmes may be necessary.

The advances made in relation to flood emergency response with co-responders outside of the Drainage Agencies, particularly PSNI, NIFRS and Local Councils could regress if they also are faced with significant resourcing pressures. The effect of any stalling or regression in progressing this measure would be magnified by the fact that public expectation will not reduce.

7.2.3 Costs of Regional and River Basin District Measures

7.2.3.1 Costs associated with Drainage and Flood Risk Management Measures

The Department has prepared costs to be incurred by the Department and other organisational partners in relation to measures to address flooding. These cover both costs of measures within the 20 Significant Flood Risk Areas and costs associated with measures in areas outside SFRAs e.g. in Areas of Further Study or in other areas of Northern Ireland to address local flood risk issues, or more broadly associated with flood risk at a regional level.

It is not possible to relate these costs directly to those broad strategic costs provided within the PEDU but they do add additional detail to some of the elements. The related text also provides information as to which organisation will be responsible for the expenditure. The costs in the assessment have been compiled under the broad headings of Prevention, Protection and Preparedness.

Where possible, costs have been estimated for the measures to be undertaken to address flood risks within the 20 SFRAs during the first Plan cycle 2015-21. Where it has not been possible to allocate costs of measures directly against the 20 SFRAs, costs have been compiled on 'regional' basis..

Costs have also been estimated for:

- Measures which may be undertaken in the 2nd Plan cycle within the 20 SFRAs and;
- Measures to be undertaken during the first Plan cycle 2015-21, in other areas of flood risk which are outside the 20 SFRAs.

7.2.3.2 Prevention

Costs of Rivers Agency's liaison with planning authorities regarding new development

These are estimated running costs under the heading of 'Prevention' associated with the Department's provision of flood risk management advice to DoE Planning NI and local Councils. This advice, regarding developments and flood risk, is provided strategically during the preparation of development area plans and, in relation to individual planning applications.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Prevention	£500	£500	£500	£500	£500	£500	£3,000

7.2.3.3 Protection

Costs of measures in Rivers Agency's Capital Works Programme within the 20 significant flood risk areas during first Plan cycle

This table is a summary of costs associated with Rivers Agency's programme of Capital Works in relation to measures identified within the SFRAs during the first Plan cycle.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Protection	£6,005	£6,000	£4,815	£6,675	£6,025	£5,180	£34,700

Costs associated with Rivers Agency's proposed operation of the Homeowner Flood Protection Grant Scheme

Within the first year of the Flood Risk Management Plans, the Department proposes to commence the first Grant Scheme for Property Level Flood Protection in Northern Ireland. Funding for the Scheme over the first 3 financial years spanning 2015-18, is estimated to be of the order of £960k. Costs are under the heading of 'Protection'.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Protection	£0	£480	£480	tbc	tbc	tbc	£960

Costs associated with Stakeholder Groups formed to address the requirements of the Floods Directive

In order to implement the requirements of the Floods Directive in Northern Ireland, under Communication and Engagement (see Section 4.3), a number of groups were formed to provide opportunities for public bodies and the general public to participate in discussion and the exchange of views and information relating to the preparation of the FRMPs and related documents. Following the completion of the FRMPs, these groups will continue to meet regarding, implementation of measures in the FRMPs, development of new measures for future Plan cycles and to be informed and give views on flood-related matters. Costs associated with these groups are allocated under the 'Protection' heading since they deal predominantly with flood mitigation.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Protection	£30	£30	£30	£30	£30	£30	£180

Costs associated with drainage maintenance

These are costs associated with the routine maintenance by Rivers Agency of designated open and culverted watercourses, and by the DRD agencies of their storm drainage and road drainage systems throughout Northern Ireland. While these costs would include routine maintenance within the 20 SFRAs, much of this work is undertaken outside the 20 SFRAs. It is difficult to specifically attribute costs to SFRAs and therefore this has not been done.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Protection							
River Maintenance	£8,000	£8,000	£8,000	£8,000	£8,000	£8,000	£48,000

Rivers Agency expends approximately £8m per annum on river maintenance. DRD NI Water and Transport NI have routine maintenance responsibilities for major storm drainage and for road drainage networks throughout Northern Ireland. A cost estimate of £21m per annum has been obtained from NIW for base maintenance of both storm and foul systems; the proportion of cost attributable to storm drainage is not known and so is not included in the table above. Transport NI have not provided costs for their routine maintenance of road drainage but it thought to be substantial.

Costs associated with drainage and flood risk management activities by DRD Transport NI

Transport NI's capital funding is allocated through the structural maintenance budget, mainly linked to resurfacing work to renew existing drainage systems. In 2015-16 year, £3.5m was allocated and for the FRMPs it has been assumed that this level of expenditure will continue for the duration of this Plan cycle. It has been assumed that a proportion of approximately 30% will be expended on upgrading of road drainage systems to reduce susceptibility to surface-water flooding. These costs are included in the FRMPs under the heading of 'Protection'.

Structural maintenance(£k) Protection	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTALS (£k)
Structural Maintenance	£2,500	£2,500	£2,500	£2,500	£2,500	£2,500	£15,000
Upgrading	£1,000	£1,000	£1,000	£1,000	£1,000	£1,000	£6,000
TOTALS (K)	£3,500	£3,500	£3,500	£3,500	£3,500	£3,500	£21,000

Costs associated with drainage and flood risk management activities by Northern Ireland Water

In NI Water's PC15 business plan, the following costs have been included during the first cycle of the FRMPs associated with works to address DG5 (Internal Flooding), Storm-water Separation and SCAMP (Sustainable Catchment Area Management Planning Northern Ireland). These cost estimates are under the heading of 'Protection'. It is estimated that 100% of DG5 and Stormwater Separation costs, and 3% of SCAMP costs will contribute towards the alleviation of flooding.

Element of programme (£k) Protection	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	TOTALS (£k)
DG5 (Internal Flooding)	£5,200	£5,000	£2,960	£1,960	£1,960	£1,960	£19,040
Storm-water Separation	-	£1,173	£1,000	£1,000	£1,000	£1,000	£5,173
Sustainable Catchment Area Management Planning Northern Ireland (SCaMP NI) – 3% Costs attributable to flood alleviation	£6	£6	£6	£6	£6	£6	£36
TOTALS (K)	£5,206	£6,179	£3,966	£2,966	£2,966	£2,966	£24,249

Costs associated with drainage and flood risk management activities in the DRD 'Living with Water' Programme (LWWP)

The LWWP will be developed over the next 5 years. Estimated costs of fees for feasibility & design are included (based on the potential costs of flood alleviation elements of £90 - £190m). Essentially, alleviation works associated with LWWP may be not scheduled to commence until the final year of this FRMP cycle. Cost estimates fall under the heading of 'Protection'.

Expenditure (£k)	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	TOTALS (£k)
Protection							
Plan Development	£1,000	£1,000	£1,000	£1,000	£1,000	–	£5,000
Works	–	–	–	–	–	£3,500	£3,500
TOTALS	£1,000	£1,000	£1,000	£1,000	£1,000	£3,500	£8,500

7.2.3.4 Preparedness

Costs associated with Rivers Agency's provision of Emergency Planning Expertise, Flood Warning, Informing and Awareness activities

These are estimated costs incurred under the heading of 'Preparedness' for provision of Emergency Planning and Hydrometric services. Costs include the following:-

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTALS (£k)
Preparedness (Flood Data Acquisition, Warning & Informing)	£350	£350	£350	£350	£350	£350	£2,100
New Alert Stations	£215	£200	£200	£200	£200	£200	£1,215
Preparedness (Emergency Planning)	£100	£100	£100	£100	£100	£100	£600
TOTALS (K)	£665	£650	£650	£650	£650	£650	£3,915

Community Resilience costs

The following are estimated costs incurred by both the Department and other organisations under the heading of 'Preparedness' associated with Community Resilience. Costs include the following:-

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Preparedness (Regional Community Resilience Group)	£15	£15	£15	£15	£15	£15	£90
Preparedness (Community Resilience Programme – 10 existing + 20 new communities)	£40	£40	£40	£40	£40	£40	£240
TOTALS (K)	£55	£55	£55	£55	£55	£55	£330

7.2.3.5 Additional Protection Costs (for more detail, see Appendix J)

Costs associated with measures identified in the 20 Significant Flood Risk Areas in 2nd Plan Cycle.

Expenditure (£k)	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	TOTAL (£k)
Protection	£400	£2,600	£1,800	-	-	-	£4,800

Costs associated with measures in other areas outside SFRAs in 1st Plan Cycle.

Expenditure (£k)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	TOTAL (£k)
Protection	£1,075	£1,500	£1,935	£900	£1,350	£2,520	£9,280

Regional Measures Cost Summary							
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Total (k)
Prevention							
Rivers Agency - PAU	£500	£500	£500	£500	£500	£500	£3,000
Protection							
Rivers Agency - Flood Alleviation Schemes	£6,005	£6,000	£4,815	£6,675	£6,025	£5,180	£137,599
Rivers Agency - Homeowner Flood Protection Grant Scheme	£10	£480	£480	TBC	TBC	TBC	
Rivers Agency - Stakeholder Groups	£30	£30	£30	£30	£30	£30	
Rivers Agency - Maintenance	£8,000	£8,000	£8,000	£8,000	£8,000	£8,000	
Transport NI - Structural Maintenance	£2,500	£2,500	£2,500	£2,500	£2,500	£2,500	
Transport NI - Upgrading	£1,000	£1,000	£1,000	£1,000	£1,000	£1,000	
NI Water - DG5 (Internal Flooding)	£5,200	£5,000	£2,960	£1,960	£1,960	£1,960	
NI Water - Storm-water Separation	-	£1,173	£1,000	£1,000	£1,000	£1,000	
NI Water- Sustainable Catchment Area Management Planning Northern Ireland (SCaMP NI) – 3% Costs attributable to flood alleviation	£6	£6	£6	£6	£6	£6	
DRD (LWWP) - Plan Development	£1,000	£1,000	£1,000	£1,000	£1,000	-	
DRD (LWWP) - Protection (Works)	-	-	-	-	-	£3,500	
Preparedness							
Rivers Agency - Warning & Informing	£665	£650	£650	£650	£650	£650	£4,245
Rivers Agency - Community Resilience	£55	£55	£55	£55	£55	£55	
Total Per Year (k)	£24,971	£26,394	£22,996	£23,376	£22,726	£24,381	£144,844
Cost of measures in Significant Flood Risk Areas in the Next Plan Cycle							
	2012-22	2022-23	2023-24	2024-25	2025-26	2026-27	Total (k)
Protection							
Rivers Agency - Flood Alleviation Schemes	£400	£2,600	£1,800	-	-	-	£4,800
Cost of Measures outside the Significant Flood Risk Areas							
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Total (k)
Protection							
Rivers Agency - Flood Alleviation Schemes	£1,075	£1,500	£1,935	£900	£1,350	£2,520	£9,280

Section 8

This Section details the monitoring and review arrangements for the implementation of these FRMPs.

8.1 Monitoring

Progress on the implementation of these FRMPs will be reported on an annual basis to the European Commission (EC) through the normal reporting processes. Any reports presented to the EC will be made publicly available by publication on the Department's website.

8.2 Reviewing

The EU Floods Directive requires that the FRMPs are reviewed on a 6 year cycle. The time line of the next (2nd) cycle is:-

- Further Preliminary Flood Risk Assessment – 22 December 2018
- Flood Hazard and Risk Maps update – 22 December 2019
- The Flood Risk Management Plans update – 22 December 2021

The Significant Flood Risk Areas identified during the first Planning cycle were based on the coarse Strategic Flood Map information. They are already under review due to the availability of the detailed Flood Hazard and Risk Maps produced in 2014. Further reviews of the SFRA's will be ongoing as new and updated information, such as recent flood history and changes in levels of protection, becomes available.

Regular reviewing and updating of the flood maps is an ongoing process. This will include the validation of existing mapping information and updating the maps based on new hydrometric information, tide level data, historical flood events and climate change factors. Based on new information, the effectiveness of existing defences and the likelihood of overtopping for predicted design events will also be reviewed.

Section 9

9.1 Next Steps

The next step is to commence the Flood Risk Management Planning cycle over again beginning with the 2nd Preliminary Flood Risk Assessment to be undertaken by 22 December 2018.

9.2 Conclusion

These FRMPs will seek to build on past successes and provide a more coordinated approach to managing flood risk at the River Basin District level.

Using the Flood Hazard and Risk Maps it is now possible to identify, not only historical flooding, but also future flooding which can be predicted with more accuracy. This has facilitated the development of a range of measures to mitigate flooding in the Significant Flood Risk Areas. Rivers Agency will continue to build on relationships with others with a role in flood risk management. The forming of inter-departmental groups on flood risk management, such as the Flood Investment and Planning Group, (FIPG) and the Strategic Drainage Infrastructure Programme Board means that roles and responsibilities can be agreed, as well as funding arrangements and approaches to joint solutions and responses. There have been significant developments in improving collaboration between agencies and other organisations in relation to flooding emergency response, and this is welcome. The amalgamation of the agencies with drainage and flood risk management responsibilities into the new Department for Infrastructure will assist in this collaborative process. The recent changes in Planning and the new 2-tier Planning process will also play a key role in managing development and flood risk. Development of the Living with Water Programme will unfold during this Plan cycle and will highlight the capital investment needs particularly in Belfast to deliver not only flood risk objectives but also an improved water and economic environment.

These FRMPs will now be recognised as being a key source of information in taking forward the business of flood risk management in Northern Ireland and driving the activities necessary to manage the risk. It will also help provide focus in bidding for resources and setting targets.

During the 6 year life of these Plans our knowledge and understanding of flood risk will continue to change and improve as new information emerges and new technologies are embraced. This will inform the development and delivery of the associated measures and objectives of these FRMPs and will help us to start to repeat the process towards the delivery of the 2nd 6 year cycle of Flood Risk Management Plans by 2027.

Appendices

List of consultees

General

Association of British Insurers	Lough Neagh Sand Traders Association
Ballinderry Fish Hatchery	Loughs Agency
Bann Systems Ltd	Met Office
Belfast City Centre Management	National Trust
Belfast Harbours Commission	NI Authority for Utility Regulation
Canoe Association of NI	NI Chamber of Trade
Chartered Institution of Water and Environmental Management(CIWEM)	NI Environment Link
Coleraine Harbour Commissioners	NI Fire and Rescue
Council for Nature Conservation and the Countryside	NI Tourist Board
Countryside Alliance	NIPSA Trade Union
DCAL Inland Fisheries	Northern Ireland Agriculture Producers Association
DOE NI Ireland Environment Agency	Northern Ireland Housing Executive
Drainage Council	Northern Ireland Water
DRD Water Policy Unit	OFMDFM Civil Contingencies Policy
DSD Weir Manager	PSNI
Federation of Lough Neagh and Lough Beg Wildfowlers	Public Health Agency
Engineers Ireland	River Bann and Lough Neagh Association
Freshwater Taskforce	Royal Yacht Association
GMB (Trade Union)	RSPB
HSENI	Rural Development Council
Inland Waterways Association	Rural Support
Institution of Civil Engineers	Shaftesbury Estate of Lough Neagh
Invest NI	Sports Council NI
Irish Amateur Rowing Union	Strangford Lough Wildfowlers and Conservation Association
Irish Water Ski and Wakeboard Association	The Honourable The Irish Society
Kilrea Angling Club	Ulster Angling Federation
Lands Tribunal	Ulster Coarse Fishing Federation
Lough Neagh Fisheries Co-operative Society	Ulster Farmers Union
Lough Neagh Rescue	Ulster Wildlife Trust
	Waterways Ireland
	World Wildlife Trust

OFMDFM GUIDANCE

Belfast Solicitors Association
CBI
Citizens Advice Bureau
Civil Law Reform Division
Departmental Library
District Judge (Magistrates Court)
Equality Commission
Federation of Small Businesses
General Consumer Council
HM Council of County Court Judges
Human Rights Commission
Law Centre
Law Society
Legal Deposit Libraries
National Library of Ireland
NI Chamber of Commerce and Industry
NI Council for Voluntary Action
NI Court Service (2)
NI Local Government Association
Northern Ireland Law Commission
Northern Ireland Ombudsman
Northern Ireland Publications

Resource (NIPR).
Queen's University, School of Law
University of Ulster, School of Law
The British Library.
The Executive Council of the Inn of Court of NI
The Library, Queen's University Belfast.
TSO Bibliographic Department.
Food Standards Agency
NIC/ICTU (Trade Union)
Society of Local Authority Chief Executives
HM Revenue & Customs
Ministry of Defence
Northern Ireland Judicial Appointments
Commission
Catholic Bishops of Northern Ireland
Community Relations Council
Participation and the Practice of Rights Project

District Councils (26)

NI Executive

OFMDFM
Dept of Social Development
Dept of Enterprise Trade and Investment
Dept of Education
Dept of Regional Development
Dept of Employment and Learning
Dept of Environment
Dept of Health, Public Safety and Social Services
Dept of Agriculture and Rural Development
Dept of Culture, Arts & Leisure
Dept of Finance and Personnel
Dept of Justice

The Speaker of the Assembly
Assembly Departmental Committee
Assembly Business Office
Members of the Northern Ireland Assembly
Assembly Bill Office
Northern Ireland Assembly Library
Office of the Legislative Counsel
Northern Ireland Affairs Committee
Northern Ireland Office
Central Management Unit (CMU)
Legislative Programme Secretariat
Machinery of Government Division

All Political Parties in NI Assembly

All Political Parties not represented in NI Assembly

All Northern Ireland MPs and MEPs who are not MLAs

All Political Parties Spokespersons

All MLAs

Section 75 Groups

Floods Directive Steering Group Members

Local Flood Forum Members

Appendix B

Changes to draft FRMP & SEA arising from the Public Consultation Exercise		
	Issue Raised	Change to FRMP
1	It is unclear from the stated Plan objectives regarding the reduction of economic losses if this includes the cost of flood damage to infrastructure.	Plan objectives revised to make it clear the cost of flood damage to infrastructure is included in the objective to reduce economic losses.
2	The Plans do not reflect the recently introduced changes to the development planning system in Northern Ireland	Plan substantively revised to reflect the fundamental reforms to the planning system which were introduced on 1 April 2015. The new two-tier planning system saw the vast majority of the planning functions (including individual applications and Local Development Plans) transfer from DOE to the 11 Councils with DoE retaining responsibility for planning legislation, oversight and guidance , regional planning policy and regionally significant applications.
3	Lack of clarity around the purpose of Sustainable Drainage Infrastructure Programme, the Strategic Investment Infrastructure Programme and the Flood Investment Planning Group and the linkages.	Plan revised to ensure that the linkages between the various flood management groups and programmes are more clearly defined.
3	The Plan does not contain adequate reference to the use of SuDS .	Plan revised to clearly describe the current position with SuDS and outline the ongoing work to promote and support their wider use.
4	It was suggested that the Plan would benefit from the inclusion of a single table that summarises the key flood risk data and mitigation measures proposed for each of the SFRA.	Plan includes an Appendix within each plan that contains a summary table as suggested.
5.	Para 2.3.1. on Page 11 of draft Plan incorrectly states that Natural Flood Management is 'key feature' of the Directive.	The Floods Directive does not state that ' <i>Promoting the use of natural measures</i> ' should be a ' <i>key feature</i> ' of the Flood Risk Management Plans (FRMPs). The actual wording in Article 7.3. of the Floods Directive (which is reflected in the NI Regulations) is that ' <i>Flood Risk Management Plans shall address all aspects of flood risk management</i>

Changes to draft FRMP & SEA arising from the Public Consultation Exercise		
	Issue Raised	Change to FRMP
		<i>focusing on prevention, protection and preparedness and may include the promotion of sustainable land practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.'</i> As there is no specific reference to, or requirement to promote natural flood management. This misleading statement on page 11 has been revised to reflect the actual requirements of the Directive.
6.	Plan does not contain enough detail in regard to Natural Flood Management (NFM).	Plan updated to include details of the current position in relation to potential contribution that NFM measures could make within the sustainable catchment based approach to flood risk management.
7.	Plan refers to role of the Local Government Emergency Management Group which apparently no longer exists.	Plan revised to ensure that it accurately reflects the current position in relation to Government's emergency planning structures and any changes that flow from the ongoing review of the local government civil contingencies arrangements.
8.	Plan infers that work to develop community emergency plans relates only to warning and informing. This description is insufficient and doesn't adequately reflect other important aspects this work including education and awareness.	Plan revised to ensure that all of the important elements and benefits of community emergency planning are more fully described within the Plan.
9.	Plan does not contain sufficient detail or commitments in relation to flood warning and informing.	Plan revised to include commitments in relation to publishing contemporaneous water-level data on Rivers Agency's website and exploring options for extending text alert services to additional at risk communities where appropriate.
10.	Public should be able to access capital works and flood study programmes so that they can have some appreciation of the time it takes to develop and implement solutions and the prioritisation	Revise Plan to commit to the publication of Rivers Agency's Capital Works and Flood Study Programmes on the website. Text inserted to describe how projects are developed and prioritised and a web-link to the Programmes provided.

Changes to draft FRMP & SEA arising from the Public Consultation Exercise		
	Issue Raised	Change to FRMP
	process.	
11.	Plan should identify and explain the rationale for the 49 Areas for Further Study.	Plan changed to identify the locations of the 49 Areas for Further Study (AFS) and explain how they were selected and have been modelled and mapped to the same standards as the SFRA. Plans commit to reassess the level of risk within these areas on the basis of the new mapping and, where it can be justified and resources permit, flood studies will be undertaken to determine if flood mitigation measures (including flood defences) are appropriate. Where appropriate, some AFS may be elevated to SFRA status in the next plan cycle.
12.	Due to the time that has lapsed since the publication of the draft Plan, it doesn't reflect fully reflect the progress of the Connswater Community Greenway Project. The benefits of the scheme and in particular the reduction in flood risk to residential housing should be more explicit.	Plan details in respect of the ongoing Connswater Community Greenway Project have been revised to reflect progress at the time of its publication and the planned outcomes/benefits more clearly described.
13.	Due to the time that has lapsed since the publication of the draft Plan, it does not record details of flooding that occurred in 2014/15	Plan updated to include details of any significant flooding that occurred in 2014/15
14.	Plan does not make it clear that the Lagan Weir was not constructed as a flood control structure.	Plan revised to describe the reason for the construction of the Lagan Weir and highlight the limited role that it plays in reducing fluvial flooding through its current operating regime.
15.	Difficult to navigate document without page numbers	Insert page numbers – review and update index
16.	Plan doesn't make it clear if and when, the Homeowner Flood Protection Grant Scheme will be introduced and the level of funding that will be	Provide greater detail on Grant Scheme, date it will be introduced, funding levels and annual targets.

Changes to draft FRMP & SEA arising from the Public Consultation Exercise		
	Issue Raised	Change to FRMP
	available.	
STRATEGIC ENVIRONMENTAL ASSESSMENT COMMENTS AND REVISIONS		
17.	Table 5 in Clause 4.2 does not list the significant sources of information on baseline fishery data (i.e. DCAL, Loughs Agency and AFB)	Table 5 updated to identify significant sources for baseline fishery data.
18.	The pages which relate to the Republic of Ireland are blank	Information for ROI is included in SEA.

Department of Agriculture and Rural Development

Equality and Human Rights Screening Template

December 2014

DARD Equality and Human Rights



Screening Template

DARD has a statutory duty to screen. This includes our strategies and plans, policies, legislative developments; and new ways of working such as – the introduction, change or end of an existing service, grant funding arrangement or facility. This screening template is designed to help business areas consider the likely equality and human rights impacts of their proposed decisions on different groups of customers, service users, staff and visitors.

Before carrying out an equality screening exercise it is important that you have received the necessary training first. To find out about the training needed, contact - equalitybranch@dardni.gov.uk. All screening exercises must be supported by evidence and cleared at Grade 3 level.

The accompanying [Screening Guidance](#) note provides straightforward advice on how to carry out equality screening exercises. Detailed information about the Section 75 equality duties¹ and what they mean in practice is available on the Equality Commission's website.

The screening template has 4 sections to complete. These are:

Section A - asks you to provide details about the policy / decision that is being screened.

Section B - has 4 key questions that require you to outline the likely impacts on equality groups, and all supporting evidence.

Section C - has 4 key questions in relation to obligations under the Disability Discrimination Order and the Human Rights Act.

Section D - is the formal record of the screening decision.

¹ ECNI 'Section 75 of the NI Act 1998: A Guide for Public Authorities' April 2010. www.equalityni.org

Section A

Details about the policy / decision to be screened

Title of policy / decision to be screened:- Draft Flood Risk Management Plans

These policy proposals will help meet the Programme for Government, Priority3: Protecting our People, Environment and Creating Safer Communities by contributing to the Floods Directive building block supporting this priority.

Brief description of policy / decision to be screened:-

The Draft Flood Risk Management Plans are part of the process towards the implementation of the European Directive on the Assessment and Management of Flood Risks (2007/60/EC). The Draft Plans apply only to areas within NI that have been identified as being at significant flood risk. The Draft Plans set objectives for the purpose of managing flood risk and then identify a range of measures/actions that can be taken to achieve these objectives.

Aims and objectives of the policy / decision to be screened:-

The Draft Plans objectives are aimed at reducing the risk to human health, the environment, cultural heritage and economic activity. The Draft Plans measures fall into 3 main headings, Flood Prevention through the implementation of appropriate land use planning policies; Flood Protection by structural and non-structural measures and Flood Preparedness through flood forecasting, flood warning and emergency response procedures. Coordination with the Water Framework Directive and engagement with interested parties and the public is also a requirement of the Directive.

On whom will the policy / decision impact?

Consider the internal and external impacts (both actual or potential)

- Staff
- service users
- rural community
- other public sector organisations
- voluntary / community groups / trade unions
- others, please specify

The implementation of the policy will mainly impact on government departments who have roles and responsibilities for managing flood risk.

The Draft Plan measures when applied will reduce the impact of flooding to all communities that have been identified as being within significant flood risk areas in NI, irrespective of their type or background.

Are there linkages to other NI Departments / NDPBs?

Yes. There are a number of other NI Departments and public bodies that have flood risk management interests and responsibilities. These include DRD – NI Water, Transport NI; DOE – Northern Ireland Environment Agency, Planning NI; DHSSPS – Blue Light Services, OFMDFM – Civil Contingencies Planning and Local Councils.

Throughout the implementation of the Directive, these bodies have attended informal stakeholder group meetings with their views/information reflected in the Draft plans proposals.

Section B

1. What is the likely impact on equality of opportunity for those affected by this policy, for each of the Section 75 equality categories? What is the level of impact?

Section 75 category	Details of likely impact	Level of impact? Minor/Major/None
Religious belief	Flooding is indiscriminate. The plans provide flood mitigation measures to predicted flooding from the 4 main sources of flooding, rivers, seas, surface water and reservoirs. The measures undertaken will reduce the flood risk to people and property, irrespective of the Section 75 category, living or working in the flooded area. The plans therefore do not make any distinction between the different Groups.	None
Political opinion	As above	None
Racial group	As above	None
Age	As above	None
Marital status	As above	None
Sexual orientation	As above	None
Men and women generally	As above	None
Disability	As above	None
Dependants	As above	None

2. Are there opportunities to better promote equality of opportunity for people within the Section 75 equalities categories?

Section 75 category	If Yes, provide details	If No, provide reasons
Religious belief		There is no opportunity in the Draft Plans proposals to better promote equality of opportunity.
Political opinion		As above

Racial group		As above
Age		As above
Marital status		As above
Sexual orientation		As above
Men and women generally		As above
Disability		As above
Dependants		As above

3. To what extent is the policy likely to impact on good relations between people of different religious belief, political opinion or racial group? What is the level of impact?

Good relations category	Likely impact?	Level of impact? Minor/Major/None
Religious belief	None	None
Political opinion	As above	As above
Racial group	As above	As above

4. Are there opportunities to better promote good relations between people of different religious belief, political opinion or racial group?

Good relations category	If Yes, provide details	If No, provide reasons
Religious belief	The plans may have a positive impact on good relations through the reduction in flooding by recommending flood protection measures and the opportunity for people to work together through community engagement and planning to manage the threat of flooding.	
Political opinion	As above	
Racial group	As above	

Available evidence

What evidence / information (both qualitative and quantitative) have you gathered to inform this policy? Set out all evidence below along with details of the different groups you have met and / or consulted with to help inform your screening assessment.

Section 75 category	Details of evidence / information and engagement
Religious belief	None. The Plan measures are applied to all people and properties at flood risk and take no account of any or all of the Section 75 Groups.
Political opinion	As above
Racial group	As above
Age	As above
Marital status	As above
Sexual orientation	As above
Men & women generally	As above
Disability	As above
Dependants	As above

No evidence held? Outline how you will obtain it:

The Draft Plan proposals and this initial screening document will be subject to the public consultation process. All Section 75 groups will have the opportunity to make comment and to influence the proposed measures outlined. The consultation will be take place over a 6 month period in the first half of 2015.

Section C

DARD also has legislative obligations to meet under the [Disability Discrimination Order](#) and [Human Rights Act](#) (insert links) Questions 5 -9 relate to these two areas.

Consideration of Disability Duties

5. Does this proposed policy / decision provide an opportunity for DARD to better **promote positive attitudes** towards disabled people?

Explain your assessment in full **Yes**

The measures on preparedness in regard to flood resilience to property and emergency access and egress will give designers and community planners the opportunity to consider suitable arrangements for disabled people.

The policy should indirectly increase the safety of all Section 75 Groups including disabled people.

6. Does this proposed policy / decision provide an opportunity to actively **increase the participation** by disabled people in public life?

Explain your assessment in full **Yes**

The plans measures when implemented should give disabled people the opportunity to participate in community engagement and contribute to local emergency flood plans and resilient construction measures. The policy should increase the safety of all Section 75 Groups.

Consideration of Human Rights

7. The Human Rights Act (HRA) 1998 brings the European Convention on Human Rights (ECHR) into UK law and it applies in N Ireland. Indicate below (place an X in the appropriate box) any potential *adverse impacts* that the policy / decision may have in relation to human rights issues.

Right to Life	Article 2	<input type="checkbox"/>
Prohibition of torture, inhuman or degrading treatment	Article 3	<input type="checkbox"/>
Prohibition of slavery and forced labour	Article 4	<input type="checkbox"/>
Right to liberty and security	Article 5	<input type="checkbox"/>
Right to a fair and public trial	Article 6	<input type="checkbox"/>
Right to no punishment without law	Article 7	<input type="checkbox"/>
Right to respect for private and family life, home and correspondence	Article 8	<input type="checkbox"/>
Right to freedom of thought, conscience and religion	Article 9	<input type="checkbox"/>
Right to freedom of expression	Article 10	<input type="checkbox"/>
Right to freedom of peaceful assembly and association	Article 11	<input type="checkbox"/>
Right to marry and to found a family	Article 12	<input type="checkbox"/>
The prohibition of discrimination	Article 14	<input type="checkbox"/>
Protection of property and enjoyment of possessions	Protocol 1 Article 1	<input type="checkbox"/>
Right to education	Protocol 1 Article 2	<input type="checkbox"/>



Consideration of Human Rights (cont)

8. Please explain any adverse impacts on human rights that you have identified.

None

9. Please indicate any ways which you consider the policy positively promotes human rights

The plan positively promotes human rights. Protocol1, Article 1 and Article2 ; Protection of property and the enjoyment of possessions and the Right to Life will be enhanced through the reduction in the flooding impact. Implementation of the Draft Plans will ultimately protect people and property from the risk of flooding through Prevention, Protection and Preparedness measures.

Monitoring Arrangements

Section 75 places a requirement on DARD to have equality monitoring arrangements in place in order to assess the impact of policies and services etc; and to help identify barriers to fair participation and to better promote equality of opportunity.

Outline what data you will collect in the future in order to monitor the impact of this policy / decision on equality, good relations and disability duties.

Equality	Good Relations	Disability Duties
No specific data will be collected	No specific data will be collected	No specific data will be collected

Section D

Formal Record of Screening Decision

Title of Proposed Policy / Decision being screened – Floods Directive Draft Flood Risk Management Plans.

I can confirm that the proposed policy / decision has been screened for –

<input checked="" type="checkbox"/>	equality of opportunity and good relations
<input checked="" type="checkbox"/>	disabilities duties; and
<input checked="" type="checkbox"/>	human rights issues

On the basis of the answers to the screening questions, I recommend that this policy / decision is –

*place an X in the appropriate box below

<input type="checkbox"/>	*<u>Screened In</u> – Necessary to conduct a full EQIA
--------------------------	---

<input checked="" type="checkbox"/>	<p>*<u>Screened Out</u> – No EQIA necessary (no impacts)</p> <p>The Draft Flood Risk Management Plans identify a range of measures, namely Prevention, Protection and Preparedness that aim to remove or reduce the impact of flooding to people and property. All these measures would be considered as having a positive effect on people and are applied indiscriminatingly to all areas that are at significant flood risk across NI, and irrespective of what Section 75 equality group that people belong to.</p>
-------------------------------------	--

<input type="checkbox"/>	* <u>Screened Out</u> - Mitigating Actions (minor impacts)
--------------------------	---

Formal Record of Screening Decision (cont)

Screening assessment completed by (Staff Officer level or above) -

Name: Alan Reddick


Grade: 7



Date: 24th November 14

Branch: Rivers Agency

Signature:

A scanned image of the handwritten signature "Alan Reddick." in black ink on a light grey background.

Screening decision approved by (must be Grade 3 or above) -

Name: Gerry Lavery

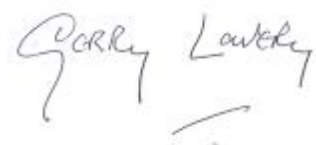
Grade: 3



Date: 25 November 2014

Branch: Central Services Group

Signature: please insert a scanned image of your signature below

A scanned image of the handwritten signature "Gerry Lavery" in black ink on a light grey background.

Please save the final version of the completed screening form in the TRIM container below as soon as possible after completion and forward the TRIM link to Equality Branch at equalitybranch@dardni.gov.uk. The screening form will be placed on the DARD website and a link provided to the Department's Section 75 consultees.



Strategic Management DARD - Equality Promotion & Implementation - Equality Schemes - Equality Screening of Departmental Policies.tr5

For more information about equality screening, go to -

http://dardintranet/coord_intranet/EqualityBranch/index.shtml

Or contact –

DARD Equality Branch
Room 509
Dundonald House
Upper Newtownards Road
Belfast BT4 3SB
Telephone 028 9052 4435
Textphone 028 9052 4420

equalitybranch@dardni.gov.uk.



Department of
**Agriculture and
Rural Development**

www.dardni.gov.uk

AN ROINN

**Talmhaíochta agus
Forbartha Tuaithe**

MÁNNYSTRIE O

**Fairms an
Kintra Fordèrin**

Flood Warning and Informing initiatives for Northern Ireland

Flood warning and informing activities suitable for Northern Ireland commenced in 2013. Northern Ireland does not have a flood forecasting centre, unlike the rest of the UK. The reason for this is that catchments here are smaller and any warning time would be much shorter. This would greatly reduce the benefit of such a centre in Northern Ireland. However there are improvements in this area that have been made.

Flood Warning and Informing provision suitable for Northern Ireland is being progressed via 4 stage strategy summarised as follows:-

- I. Formal engagement with the Met Office in a 'partnering' approach to better inform the impact assessment of National Severe Weather Warnings for heavy rainfall.

An MOU between Rivers Agency and Met Office has been established. This MOU allows for contact between the Met Office and Rivers Agency at the consideration stage of a severe weather warning for heavy rainfall. Consideration is given to river levels and ground saturation conditions which enables a better assessment of the potential flood impacts of a significant rainfall event and informs the level and detail of the heavy rain warning. This allows communities and responders to tailor their responses.

- II. Ensuring adequate 'Informing' in relation to flood risk to enable responders and the public to be effective in dealing with flooding.

In order to ensure that the 'Informing' aspect of this initiative is delivered effectively, a standardised, regional strategy is necessary. This involves input from a wide range of public and voluntary sector organisations and, to this end, the Regional Community Resilience Group (RCRG) has been formed. This Group is co-chaired by Local Government and Rivers Agency. Detail on the work of the RCRG is found in Appendix E.

Through the auspices of the RCRG, work is now complete in relation to:-

- Identification of communities, using pre- agreed criteria, to be initially engaged in relation to flood warning and informing;
- Preparation of standard community resilience plans and household pack templates;
- Agreement on information to be communicated e.g. sharing of weather warning and river level information, assistance in relation to Individual Property Protection initiatives, and education on the limitations of any flood warning capability, response provision and infrastructure capacity.

III. Public dissemination of water level information. This includes the use of River level text warnings, where these are likely to be beneficial.

Following the successful pilot with community groups, the third stage will be to provide flood alert station and gauging station data as close to real time as possible on the Rivers Agency website.

IV. Review and Development

Stage 4 will involve a review of progress and the effectiveness of the 3 previous stages and will also consider the need for further refinement, taking into account national advances in this area and feedback from community groups and the wider public.

These staged improvements will be of benefit mainly in terms of river flood warning and informing to both responders and the public. The limitations of any flood warning needs to be recognised. Effective warning for heavy thundery downpours, which often result in surface water flooding, is not yet possible.

Regional Community Resilience Group and Outline of Group Activities

Despite the improvements made in developing emergency plans and in providing improved levels of response during significant flood events, because of finite resources, the emergency response of Government and the emergency services can become over-stretched. This means that not all calls for assistance during a major flood event may be responded to in a timely manner. With this in mind it is important that households and communities, that are subject to known flood risk, are better prepared to deal with flooding.

To facilitate this, a pilot Regional Community Resilience project was carried out during 2014 to engage with flood risk communities to help them be better prepared for flooding. A review of the pilot project was carried out by the Consumer Council and Red Cross which recommended that the work of the RCRG to should continue. The RCRG is preparing to engage with a further 6 of the communities identified in Appendix I during 2016, and the Group plans to engage with the remaining communities on the list over the period of the Flood Risk Management Plans. **This Community Resilience work is not Government withdrawing from any undertaking to respond in emergencies but an additional layer of support to ensure Government Departments and the public work together to reduce the overall impacts of flooding.**

The detail of preparedness actions including flood warning and informing activities planned from a regional perspective are in Appendix D.

Regional Community Resilience Group

The Regional Community Resilience Group (RCRG) was formed in January 2013 under the Joint Chairmanship of Rivers Agency and Local Government to bring partner organisations together to develop a Community Resilience Delivery Programme across the region. The membership of the Group includes Rivers Agency and Sub Regional Civil Emergency Preparedness Group (SCEP) (Joint Chairs); Belfast City Council; the four district council groupings responsible for civil contingencies matters at a sub-regional level (EPCOs); Belfast Resilience; PSNI; NIFRS; NI Water; the Met Office; Transport NI; Red Cross, the Consumer Council, MoD and NIE.

The purpose of the RCRG is to work on a multi-agency basis to facilitate consistent, prioritised and focussed planning and preparation for community response and recovery activities that will help pre-identified

communities deal with emergency incidents. The Group has adopted flood risk as the initial topic on which to engage communities but will look to address a broader range of risks as their work develops.

Experience shows that the benefits of this type of initiative are to help individuals and communities to be better prepared and more self-reliant during emergencies. In that context, enhanced community resilience has the potential to contribute significantly to the overall effectiveness of the response and to wider resilience to the impacts of civil emergencies.

A four stage Community Engagement Plan has been developed with the objectives of:-

- explaining the potential and limitations of Community Resilience to communities;
- raising awareness in communities on available information such as Met Office warnings or watercourse level text alerting and the facilitation of self-help initiatives.
- reviewing and validating all elements of the community engagement activities.

Reservoirs Bill – Background and Legislative Development

Background

1. The Floods Directive requires member states to identify, manage and assess potential flood risks. The resulting preliminary flood risk assessment for Northern Ireland estimated that 66,000 people would be at risk from total dam failure of the 156 impounding reservoirs capable of holding 10,000m³ or more of water. The number of reservoirs has since been revised downwards to 132.
2. The Northern Ireland Executive at its meeting on 11 November 2011 agreed that the Minister for the Department of Agriculture and Rural Development should bring forward primary legislation to regulate reservoir safety in Northern Ireland. This primary legislation completed the Northern Ireland Assembly legislative process on 24th June 2015, received Royal Assent one month later on 24th July, and is known as the Reservoirs Act (Northern Ireland) 2015.

Reservoirs Bill – Main Components

3. The main components of the Reservoirs Act are as follows:
 - **Controlled Reservoirs**

The Act will introduce the term ‘controlled reservoirs’. The definition of a ‘controlled reservoir’ will include structures or areas designed or used for collecting and storing water, artificial or partly artificial lakes, or other artificial areas which are capable of holding 10,000 cubic metres or more of water above the natural level of any part of the surrounding land.
 - **Reservoir Managers**

Responsibility for managing or operating a controlled reservoir will be placed on persons or organisations referred to as ‘the reservoir manager’. Controlled reservoirs may be managed by one or more reservoir managers.
 - **Registration**

Reservoir managers will be required to register a controlled reservoir with the Department. The Department will maintain this register and make it available for public inspection. The register will include the name and location of the reservoir, its maximum capacity, the name and address of the reservoir manager as well as copies of any reports or certificates relating to the reservoir.

➤ **Reservoir Designation**

The Department will be required to give a controlled reservoir a designation as soon as reasonably practicable after the reservoir is registered. The Department will also be required to undertake a periodic re-assessment of the reservoir's designation. Controlled reservoirs will be designated as High Consequence, Medium Consequence, or Low Consequence depending on the impact that an uncontrolled release of water from the reservoir would have on people, economic activity, the environment, or cultural heritage.

➤ **Reservoir Supervision**

The Act provides for controlled reservoirs that are designated as either High or Medium Consequence to be supervised by a reservoirs engineer. The engineer will be required to give the reservoir manager an annual written statement of the steps that they have taken together with any measure taken by the reservoir manager, in the interests of safety.

➤ **Reservoir Inspection**

A High Consequence reservoir will be inspected within one year of the date on which its designation takes effect and every 10 years thereafter unless an earlier inspection is recommended by a supervising or inspecting engineer.

A Medium Consequence reservoir will be inspected within one year of the date on which its designation takes effect. Further inspections will only take place if recommended by the supervising or inspecting engineer.

Inspection of reservoirs designated as Low Consequence is not required.

➤ **Reservoir Construction**

The construction or alteration of controlled reservoirs will be regulated by a requirement on the reservoir manager to appoint a construction engineer to supervise any works carried out on a controlled reservoir and by imposing a system of reporting and certification in respect of the works. This will apply to all controlled reservoirs regardless of their reservoir designation.

➤ **Incident Reporting**

The Department will make provision in regulations for reporting incidents which may affect the safety of controlled reservoirs. The Act provides an indicative list of the contents of the Incident Report.

➤ **Flood Plans**

The Department will make provision in regulations for the preparation of flood plans for controlled reservoirs. These plans will set out the action which the reservoir manager will take to

control or mitigate the effects of flooding likely to result from any escape of water from the reservoir. The Act provides an indicative list of the contents of Flood Plans.

➤ **Emergency Powers**

The Act contains provision that allows the Department to take emergency action to protect people or property against an escape of water from a controlled reservoir that may cause harm. When required the Department will commission a reservoirs engineer to make recommendations regarding actions to be taken and to supervise the required works.

➤ **Stop Notices**

The Act contains provision that allows the Department, by regulations, to permit the serving of a stop notice on a reservoir manager. A stop notice is a notice prohibiting the carrying on of an activity, or permitting the carrying on of an activity by another until such steps as specified in the notice have been taken. The Act lists the conditions the Department must meet before exercising its power under the regulations.

➤ **Powers of Entry**

The Act contains provision that allows the Department to authorise any person to enter land for the purposes of carrying out its functions under the legislation.

Civil Contingencies Multi-Agency Preparedness Structures with a role in Flooding Emergencies

The Civil Contingencies Group (NI) is the principal strategic emergency preparedness group for the public sector and provides strategic leadership in relation to civil contingencies policy and strategy on cross cutting issues on a multi-agency basis.

The Group has a corporate governance function, identifying and agreeing civil contingencies priorities for action.

In addition there are five Sub-Regional Civil Emergency Preparedness Groups (EPGs). These multi-agency groups agree a joint approach to emergency preparedness and response for their respective areas.

Taken together these groups consider a wide range of civil contingencies issues including flooding.

When necessary, the EPGs will cooperate with neighboring emergency planners in the Republic of Ireland in preparing for and responding to emergencies of a cross-border nature.

Flood Risk Management Plans – Objectives and Measures Template

Objectives	Objectives Activities	Measures	Measures Type	Measures Activities
Economic Activity	<ul style="list-style-type: none"> Reduce economic damages to properties. Reduce economic costs on business caused by the disruption to essential infrastructure and services. Optimise economic return on Flood Risk Management investment. 	Flood Prevention	Keep new development outside Flood Risk Areas.	<ul style="list-style-type: none"> Try to ensure that new zonings are located outside flood risk areas. Try to ensure that individual applications are located outside flood risk areas.
			Ensure new development within Flood Risk Areas is suitably constructed.	<ul style="list-style-type: none"> In accordance with PPS 15 try to ensure that any development which is located “by exception” in flood risk areas is appropriately built with flood resistance/resilience measures. All proposed development applications are accompanied by a Flood Risk or Drainage Assessment.
			Surface Water Management.	<ul style="list-style-type: none"> Promote the application of SuDS to all new developments.
		Maintenance of the Existing Drainage and Flood Defence Network.	<ul style="list-style-type: none"> Continue to inspect and maintain designated watercourse grilles as appropriate and as funding allows. Continue to regularly inspect the condition of all drainage and Flood Defence Assets. Continue to implement a prioritised programme of works for the maintenance of all Drainage and Flood Defence Assets. Continue to implement a prioritised programme of works for the maintenance of public sewers schemes. 	
Human Health and Social	<ul style="list-style-type: none"> Reduce the risk to life. Raise awareness of the consequences of flood risk. Reduce risk to health and wellbeing. Reduce the impact on people caused by the disruption to essential Infrastructure and services. Improve recreation and public amenities. 	Flood Protection	New Flood Alleviation Schemes	<ul style="list-style-type: none"> Continue to carry out feasibility studies to identify viable solutions. Continue to implement a prioritised programme of works of flood defence and culvert alleviation schemes. Continue to implement a prioritised programme of works of integrated surface water drainage schemes. Continue to implement a prioritised programme of works to separate surface water systems from combined sewer systems.
			Catchment Based Management	<ul style="list-style-type: none"> Look for opportunities to work with others through partnership arrangements.
		Flood Preparedness	Flood Emergency Response	<ul style="list-style-type: none"> We will continue to engage with other responsible bodies on identifying local flooding hotspots and co ordination of response procedures along with Blue Light responders. We will continue to prepare and engage with other responders on multi Agency flood emergency response plans to those areas at known flood risk, eg coastal flood response plans. We will continue to test emergency response plans through Multi Agency

				'Exercising'. We will continue to work with Co responders in line with Flood Emergency Response "Best Practice Guidelines".
			Flood Warning and Forming suitable for NI	<p>4 Stage Approach</p> <ul style="list-style-type: none"> Formal engagement with the Met Office in a 'partnering' approach to better inform the impact assessment of National Severe Weather Warnings for heavy rainfall. Ensuring adequate 'Informing' in relation to flood risk to enable responders and the public to be effective in dealing with flooding. Public dissemination of water level information. This includes the use of River level text warnings, where these are likely to be beneficial. Review and Development.
Environmental (including cultural heritage)	<ul style="list-style-type: none"> Consider the impact of Climate Change Under the Water Framework Directive, support the achievement of good ecological potential/status for water bodies. Reduce the risk of pollution. Avoid or mitigate impact on priority species and habitats. Avoid or mitigate impact on designated environmental areas, including those of cultural heritage importance. 		Community Engagement	<ul style="list-style-type: none"> Rivers Agency is working with the other drainage agencies, the emergency services, local government, NIHE, Red Cross, Consumer Council, Met Office, etc, to develop and establish a consistent approach to flood warning and informing activities across Northern Ireland.
			Communication of Flood Risk	<ul style="list-style-type: none"> We will continue to engage with communities to facilitate the informing aspect of 'Flood Warning and Information' proposals. We will continue to update and improve flood risk information on the Flood Maps (NI). We will continue to improve information on flooding on the NI Direct Website. We will continue to work with NI Direct in the development of the Flooding Incident Line (FIL). Continue to consult and hold flood forums with stakeholders and others to make them aware of their role and responsibilities in assessing and managing flood risk. Seek to issue timely media messages to inform the Public of significant flooding events.
			Individual Property Protection	<ul style="list-style-type: none"> A proposed scheme for grant aiding Individual Property Protection is currently being progressed. Eligibility will be assessed on the likelihood of future flooding and the frequency of past flooding events. The introduction of such a scheme would be a significant step forward and be a key 'building block' in enhancing community resilience to flooding.
			Flood Recovery, Welfare and Insurance Issues	<ul style="list-style-type: none"> We will continue to carry out and contribute to post flood investigations to gather information and improve knowledge and action on future flood events. We will continue to work with Councils and local communities at flood risk in providing advice and information to aid recovery after a flood event. We will continue to engage and work with voluntary section organisations such as the Red Cross in providing Welfare Support. We will continue to work with the insurance industry to assist them in introducing "FloodRe" to NI to help address long term flood insurance affordability issues.

Appendix I

Areas considered suitable for a programme of community engagement to deliver Flood Warning and Informing

	River Basin District	Significant Flood Risk Area	Description	Engagement
1	North East	Belfast	Clarawood Park area	
2	North East	Belfast	Stockmans Lane	
3	North East	Belfast	Finaghy Road North area	Ongoing
4	North East	Belfast	Gilnahirk Road / Kingsway Park area	
5	North East	Belfast	Greystown Avenue / Finton Gardens area	
6	North East	Newcastle	Bryansford Avenue / Shimna Road	
7	Neagh Bann	Antrim	Abbeyview and Alexandra Park	Ongoing
8	North East	Belfast	York Park / Pittsburg Street area	
9	North East	Belfast	Loopland Park area	
10	North East	Belfast	Montgomery Road	
11	Neagh Bann	Antrim	Riverside & Masserene Street	Ongoing
12	Neagh Bann	Lurgan	Westwood / Sperrin Drive	
13	Neagh Bann	Newry	Bridge Street / Cleary Crescent area	Ongoing
14	North West	Omagh	Town Centre	Ongoing
15	North East	Dundonald	Dunlady Park / Canberra Park area	
16	Neagh Bann	Lurgan	Knockramer Meadows / Silverwood Leaves	
17	Neagh Bann	Portadown	Park Road area	
18	Neagh Bann	Ballymena	Ballymoney Road	
19	Neagh Bann	Ballymena	Leighinmohr Avenue / Phoenix Fields	Ongoing
20	Neagh Bann	Glengormley & Mallusk	Sandholme Park / Sandyknowes Park	

Existing RCRG Pilot Project Communities – 2014

	River Basin District	Flood Risk Area
1	North East	Sydenham
2	North East	Sicily Park
3	North West	Fintona
4	North West	Beragh
5	North East	Branial / Whincroft
6	North East	Cregagh
7	Neagh Bann	Broughshane
8	Neagh Bann	Ahoghill
9	Neagh Bann	Coalisland
10	Neagh Bann	Banbridge

Rivers Agency Capital Works Programme for Significant Flood Risk Areas 2015-2021

				2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Next Cycle
Priority	SFRA	RIVERS AGENCY CAPITAL PROGRAMME KEY TO DELIVERY STAGES construction design feasibility pre-feasibility	Estimated Cost £'000	£'000	£'000	£'000	£'000	£'000	£'000	
Drainage Infrastructure										
		Small Capital Schemes	£ 3,030							
1		Culvert Upgrading								
2	NERBD	Culvert Upgrading Kinnegar & Locksley Park	£ 590							
3	NERBD	Culvert Upgrading Taughmonagh Stream	£ 1,400							
6	NWRBD	Omagh Hunter Crescent	£ 650							
6	NBRBD	Newry - Greenbank Upgrading	£ 1,600							
10	NERBD	Belfast - Shangarry Stream	£ 200							
38	NBRBD	Lower Bann - Cutts Sluices	£ 1,100							
Flood Alleviation										
		Small Capital Schemes	£ 1,800							
c	NERBD	Belfast - Culvert upgrading on the Knock & Loop Rivers - Project Management	£ 246							
c	NERBD	Belfast - Culvert upgrading on the Knock & Loop Rivers - Construction	£ 4,393							
c	NERBD	Belfast - Flood Alleviation Works integrated with the Greenway Project - PHASE II	£ 6,500							
3	NERBD	EBFAS - Glenbrook River	£ 550							
9	NBRBD	Newry - Review of flood protection	£ 3,000							
11	NERBD	Belfast - La Salle Stream Riverdale Park East	£ 50							
13	NBRBD	Antrim - Holywell Burn - Tesco	£ 150							
13	NERBD	Whiteabbey-Concrete Row	£ 1,200							
17	NBRBD	Mallusk - Rogan Manor	£ 550							
21	NERBD	Belfast - Tidal	£ 1,000							
22	NERBD	Belfast - Blackstaff Study	£ 2,000							
22	NWRBD	Omagh - Review of flood protection	£ 2,150							
25	NBRBD	Galgorm - Gallaghers Back Drainage	£ 150							
27	NERBD	Newcastle - Shimna River Flood Alleviation	£ 2,500							
29	NBRBD	Newry - Greenan Road	£ 150							
32	NBRBD	Portadown Significant Flood Risk Area	£ 100							
32	NBRBD	Bannbridge-Showgrounds Stream II	£ 600							
34	NBRBD	Lurgan Significant Flood Risk Area	£ 100							
36	NBRBD	Ballymena Significant Flood Risk Area	£ 100							
36	NERBD	Carrickfergus & Kilroot Significant Flood Risk	£ 100							
42	NWRBD	Londonderry Significant Flood Risk Area	£ 100							
42	NBRBD	Antrim - Riverside	£ 2,550							
Overall Expenditure 2015-2021			£ 35,579							
Next Plan Cycle 2021-2027										
46	NWRBD	Strabane Significant Flood Risk Area	£ 100							
50	NERBD	Dundonald Significant Flood Risk Area	£ 100							
50	NERBD	Banbridge Significant Flood Risk Area	£ 100							
50	NERBD	Bangor Significant Flood Risk Area	£ 100							
54	NBRBD	Muckamore	£ 550							
50	NERBD	Newtownabby Significant Flood Risk Area	£ 100							
50	NBRBD	Warrenpoint Significant Flood Risk Area	£ 100							
50	NERBD	Downpatrick Significant Flood Risk Area	£ 100							
59	NERBD	Carrickfergus - Sullatober Phase III	£ 500							
59	NERBD	Belfast - Ashton Park	£ 500							
60	NERBD	Newtownards Significant Flood Risk Area	£ 100							
62	NBRBD	Antrim - Meadowside	£ 500							
63	NERBD	Jordanstown - Greenisland Stream	£ 1,000							
63	NERBD	Whiteabbey-Threemile water	£ 500							
Overall Expenditure 2015-2021			£ 4,350							

Rivers Agency Capital Works Programme for Areas of Further Study and Local Flooding Problems

				2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Next Cycle
Priority	Local Flood Risk	AFS	RIVERS AGENCY CAPITAL PROGRAMME KEY TO DELIVERY STAGES construction design feasibility pre-feasibility	Estimated Cost £'000						
Drainage Infrastructure										
16	YES		Hillsborough Dam	£ 440						
31	YES		Lower Bann - Operating Regime	£ 100						
39	YES		Lower Bann - Sluice gate drum housings	£ 825						
44	YES		Dunminning Weir - Upgrading	£ 1,000						
48		YES	Limavady - Black Brae	£ 550						
Flood Alleviation										
3		YES	Limavady - River Roe	£ -						
8		YES	Lisburn - Milltown Stream	£ 100						
12		YES	Coalisland-Flood Alleviation Scheme	£ 700						
13		YES	Lisburn - Flush Bridge Stream	£ 100						
17		YES	Mayobridge	£ 650						
22		YES	Limavady - Weeling Street Drain	£ -						
29		YES	Dromara - Flood Alleviation	£ 150						
34		YES	Laurelvale - Stream II	£ 870						
39		YES	Broughshane - Flood Alleviation	£ 50						
39		YES	Ahoghill	£ 1,100						
Overall Expenditure				£ 6,635						
Next Plan Cycle										
45			Larne - Lynn River	£ 50						
46			Greenisland - Glenisland Terrace	£ 100						
48			Ballygawley - Bocketts Road	£ 500						
50			Doagh - FAS	£ 1,500						
61			Dunadry - Clady River	£ 1,500						
Overall Expenditure				£ 3,650						



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