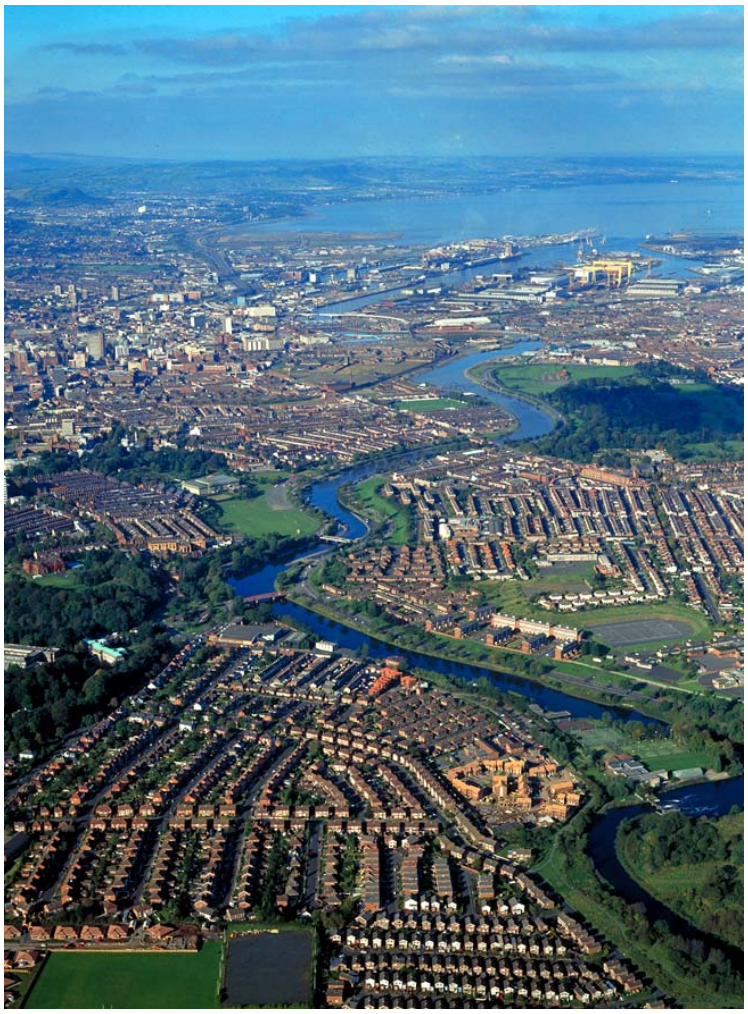
Water Framework Directive

Summary Report of the characterisation and impact analyses required by Article 5

Northern Ireland



March 2005

Contents

Contents

List of Tables

List of Figures

Executive Summary

We are modernising the way we manage and protect the water environment as required by the 2000 Water Framework Directive. The Directive requires man-made pressures on the water environment to be assessed and managed in an integrated way across all waters ('source to sea').

This report is a comprehensive description of the pressures affecting the water environment in Northern Ireland. The Environment and Heritage Service has undertaken the work with partner organisations including Geological Survey of Northern Ireland.

Work has also been carried out on a cross-border basis led by the Department of the Environment in Northern Ireland and the Department of the Environment, Heritage and Local Government in the Republic of Ireland. The Department's have delineated three international river basin districts (IRBDs) within which appropriate administrative arrangements will be put in place to ensure water management is co-ordinated in accordance with the Directive.

The Directive sets out a planning cycle for river basin management, which consists of four main parts:

- **characterisation** of river basin districts;
- environmental **monitoring** programmes informed by the river basin characterisation;
- setting environmental **objectives**;
- designing and carrying out an action plan or a **'programme of measures'** to achieve the Directive's environmental objectives.

This report covers the initial **characterisation** part of the cycle, which involves a description of the natural characteristics of Northern Ireland waters and an assessment of the pressures and impacts. This will help to determine the monitoring we need to do and provides a starting point for the design of a programme of measures.

The main steps of characterisation are to:

- identify water bodies and their physical characteristics;
- identify protected areas;
- assess the pressures and impacts on rivers, lakes, transitional waters, coastal waters, groundwaters and wetlands.
- provide a social and economic analysis of water uses (this is presented in a separate report).

To be able to manage and report on the water environment, it is divided into **water bodies**. These units are identified mainly using natural features. There are 550 river, 24 lake, 7 transitional (estuarine), 20 coastal and 67 groundwater bodies wholly or partly within in Northern Ireland.

The physical and chemical nature of these water bodies is described and each water body assigned to one of a small number of **types**. The type indicates, in very general terms, the sorts of

plants and animals likely to be present. The type is important because it affects what the environmental objectives mean for the different types of water.

The next step is to identify water-related **protected areas**. These are designated mainly under a number of other European directives because they require special protection. Examples include bathing waters and areas identified for the protection of water-dependent species and habitats. Establishing a register of protected areas helps to ensure water bodies are managed in a way that meets the protected area objectives.

The main part of the characterisation is the **assessment of pressures and impacts** on the water environment. The assessment identifies those water bodies, including those with protected areas, which are at risk of failing the environmental objectives set out in the Directive. The results will be used to prioritise both our environmental monitoring and those water bodies for which improvement action is required.

The following pressures were examined for their impacts on water bodies:

- **point source pollution** – such as effluent from waste water treatment works and industrial discharges;
- **diffuse source pollution** – including run-off from farmland and urban areas;
- **abstraction and flow regulation** – including abstractions for manufacturing processes, regulation of water for navigational purposes, and abstraction and flow regulation for public water supply;
- **morphological alterations** – for example, river straightening, land claim for ports or housing, structures for coastal protection;
- **invasive species** – also known as alien species, which can result in a loss of natural biodiversity.

The initial characterisation assessment indicates that overall about 90 per cent of water bodies in Northern Ireland are at risk of not meeting the Directive's environmental objectives, including 538 rivers, 23 lakes, 7 transitional, 19 coastal and 15 groundwater bodies.

In Northern Ireland, diffuse pressures from both agricultural and urban sources are the most common causes of surface and groundwater bodies being at risk of failing environmental objectives. Surface waters are also at risk from morphological and point source pressures. These pressures reflect the predominant agricultural land use in Northern Ireland, and the concentrations of urban areas around the main estuaries.

Further stages in the pressure and impact assessment are likely to reduce the number of waters at risk of failing the Directive's objectives as further information becomes available and practical constraints allowed for in the Directive (for example, the technical feasibility of improvement actions) are taken into account.

Further information on the Water Framework Directive is available on the Environment and Heritage Service's website http://www.ehsni.gov.uk/environment/waterManage/wfd/wfd.shtml.

Future work

This assessment is only the first step towards improving our water environment through integrated river basin management. Information will continually be improved and reviewed, which will make the next cycle of characterisation more realistic than this first assessment.

Environment and Heritage Service will use the information in this report to help establish an environmental monitoring programme. We will work in partnership with other organisations and sectors that contribute to the risks to the environment to design and carry out a programme of measures to achieve the environmental objectives of the Directive.

Future water management will be implemented, and reported to Europe, at the river basin district scale. This is being facilitated by a major cross-border water management consultancy project, **N**orth **S**outh **Sh**ared **A**quatic **Re**sources (NS SHARE) which commenced on 1 August 2004 and will continue until March 2008. The project is being funded by INTERREG IIIA (programme supported by the European Union) and the local governments in Northern Ireland and Republic of Ireland. The aim of the project is to develop and implement working tools for water management in relation to shared waters with the Republic of Ireland.

Further stages of the Water Framework Directive requires integration of economic and environmental information. The economic work in Northern Ireland has been taken forward through NS SHARE and will be further supported by Departmental involvement in the United Kingdom Collaborative Research Programme on the Economic Analysis for River Basin Planning.

1. Introduction

1.1 Overview

The Water Framework Directive (WFD), (the Directive)[1]which came into force on 22 December 2000 establishes a new framework for the management, protection and improvement of the quality of water resources across the European Union (EU). The Directive is transposed in Northern Ireland via the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003[2],

The purpose of the Directive is to protect all waters, including rivers, lakes, estuaries, coastal waters and groundwater, to:

- prevent further deterioration and enhance the status of aquatic ecosystems and associated wetlands;
- promote sustainable water use;
- protect and improve the aquatic environment;
- ensure the progressive reduction of pollution of groundwater and prevent its further pollution; and
- help reduce the effects of floods and droughts.

.

Carlingford Lough, County Down

[1] A copy of the Water Framework Directive is available at http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_327/l_32720001222en00010072.pdf

[2] A copy of the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003 is available at: http://www.northernireland-legislation.hmso.gov.uk/sr/sr2003/20030544.htm

The Directive covers a much wider range of indicators than is currently taken into account by existing water management practices, which focus on pollution pressures. Other pressures such as abstraction, as well as the physical structure of our waters will now be addressed. As a result, we will be able to manage our waters in a much more holistic and integrated way.

The overall requirement of the Directive is to achieve 'good status' in all natural surface waters and groundwater by 2015 unless there are grounds for derogation. Good status means that certain standards have been met for the ecology, chemistry and quantity of waters. In general terms 'good status' means that water only shows slight change from what would normally be expected under undisturbed conditions. There is also a general 'no deterioration' provision to prevent deterioration in status.

To put the Directive into practice we will have to change our approach to the management of the water environment. Implementation of the Directive is to be achieved through the river basin management (RBM) planning process which requires the preparation, implementation and review of a river basin management plan (RBMP) every six years for each river basin district (RBD) identified. This requires an approach to river basin planing and management that takes all relevant factors into account and considers them together. There are four main elements of the process:

- **environmental** and **economic assessment**[3] or **'characterisation'** of the river basin district and the pressures and impacts on the water environment;
- environmental **monitoring** based on river basin characterisation;
- setting of environmental **objectives**; and
- design and implementation of a **programme of measures** to achieve environmental objectives.

A timetable for the Directive's main requirements is shown below in Table 1.

Within the European Union there are many river basins which are shared between Member States. An important feature of the Directive is a planning mechanism, referred to as international river basin plans, by which Member States can co-operate to ensure that water quality targets are met.

Implementation of the Directive in Northern Ireland (NI) and the Republic of Ireland (RoI) requires co-operation to ensure sustainable management of our water environment. The Department of the Environment (DOE) in Northern Ireland and the Department of the Environment, Heritage and Local Government (DEHLG) in the Republic of Ireland, have delineated three international river basin districts (IRBDs) within which appropriate administrative arrangements will be put in place to ensure water management is co-

[3] The economic assessment is presented in a separate report http://www.ehsni.gov.uk/pubs/publications/article5ecoreport.pdf

ordinated in accordance with the Directive. Map 1 shows the boundaries of the river basin district and international river basin districts within Northern Ireland.

Table 1: Water Framework Directive implementation timetable

Year	Requirement
2000	• Directive entered into force
By 2003	• Transpose Directive into domestic law • Identify river basin districts (RBDs), International River Basin Districts (IRBDs) and Competent Authorities empowered to implement the Directive
By 2004	• Complete first characterisation and assessment of impacts on RBDs • Complete first economic analysis of water use • Establish a register of protected areas in each RBD
By 2005	• In the absence of a groundwater daughter directive (Article 17) being agreed at European Commission (EC) level, establish criteria for: - assessment of good groundwater chemical status; and - identification of significant upward trends and starting points for trend reversal
By 2006	• Establish water monitoring programmes • Publish a timetable and work programme for producing the first River Basin Management Plans (RBMPs) including consultation measures • Establish environmental quality standards for priority substances and controls on principal sources
By 2007	• Publish, for consultation, interim overview of the significant water management issues in each RBD
By 2008	• Publish draft RBMP for consultation
By 2009	• Publish first RBMP to include: - Environmental objectives - Programme of measures - Monitoring networks - Register of protected areas - Heavily modified and artificial water designations
By 2010	• Ensure water pricing policies meet WFD requirements
By 2012	• Ensure programme of measures is operational • Publish timetable and work programme for second RBMPs • Report progress in implementing measures
By 2013	• Review for the first RBMP: - Characterisation assessments - Economic analysis • Consult on significant water management issues overview for second RBMP
By 2015	• Achieve environmental objectives of first RBMP • Publish second RBMP and thereafter every six years

This report is a summary of the first stage of the river basin "characterisation" process outlined above, including an assessment of pressures and impacts on Northern Ireland waters. These have been divided into basic management and reporting units called water

bodies. A water body may be a river, lake or stretch of coastline. In accordance with the Directive, this report includes all water bodies including those which, although within IRBDs, lie wholly within Northern Ireland. Water bodies outside Northern Ireland, which are part of the shared IRBDs, will be reported by the Republic of Ireland.

1.2 Co-ordination between Northern Ireland and Ireland

Arrangements for the implementation of the WFD in Northern Ireland and Ireland are co-ordinated at Ministerial level between the Minister with responsibility for the Environment (North) and the Minister for the Environment, Heritage and Local Government (South). The Ministers are assisted in their task of co-ordination by the North South Working Group on Water Quality which meets on a quarterly basis.

In addition, the working group establishes from time to time technical, advisory and other expert groups as it considers necessary to support its work. Irish and UK officials participate in meetings with both the UK and Irish technical groups.

Both jurisdictions, North and South, must ensure co-ordination in river basin planning for each IRBD, with a co-ordinated programme of measures for the whole of each District.

Future water management will be implemented, and reported to Europe, at the River Basin District scale. A North South cross border water management consultancy project, **N**orth **S**outh **Sh**ared **A**quatic **Re**sources (NS SHARE), which commenced on 1 August 2004 and will continue to March 2008, will facilitate co-ordinated implementation and delivery of technical tasks required by the Directive (Map 2). The project is being funded by INTERREG IIIA (programme supported by the European Union) and the relevant government departments in Northern Ireland and Ireland. The project is led by Donegal County Council (in Ireland) on behalf of the competent authorities in both national jurisdictions.

1.3 Purpose of report and approach used

The purpose of this report is to:

- satisfy the requirements of Article 5 (Characterisation) and Article 6 (Register of Protected Areas) of the WFD and fulfil (in part) the Department's reporting obligations to the EC in early 2005 under these articles.
- present summary information on work carried out to date to interested stakeholders.

The approach used for characterisation uses the best currently available information, techniques and approaches. Where data is unavailable or unsuitable, expert opinion has been applied. If necessary, new monitoring data and techniques will be used to update the report in future planning cycles.

Further stages of the Water Framework Directive require integration of economic and environmental information. The economic work in Northern Ireland has been taken forward through NS SHARE and will be further supported through Departmental involvement in the United Kingdom Collaborative Research Programme on the Economic Analysis for River Basin Planning.

Most of the terminology used in this report is that of the Directive. This will ensure consistency when the reports are submitted to Europe, and will also allow other Member Sates to use the document more easily because they will be familiar with this terminology. In some instances where particular Directive requirements are presented, estuaries may be referred to as transitional waters.

This summary report should be read in conjunction with the technical reports referred to throughout the document. The technical reports provide more detail on methods, tools and data used for characterisation.

Stakeholder acknowledgements

The need for public involvement is an important feature of the WFD and, in certain areas, such as development of the RBMP, is statutory. The Department intends to devise an approach to WFD public participation that has consultation and access to information at its core but that also includes wider active involvement where this is necessary to help meet the requirements of the WFD.

The preliminary results of the pressures and impacts review were published on the Department's website in October 2004, giving stakeholders the opportunity to contribute to the characterisation process. In line with this review, a stakeholder conference was held in early October 2004, focusing on the results of the first phase of characterisation work, along with an overview of the economic analysis element of the characterisation report. The conference included presentations by key stakeholders on their perspective of WFD, including the potential impact on their respective interests.

The next steps with regard to implementation of the Directive, as outlined in Table 1, will involve a continued stakeholder engagement.

2. Northern Ireland River Basin Districts

River Basin Districts (RBDs) will be the main areas used to co-ordinate the management of the water environment. They comprise river basins and their associated transitional waters, coastal waters and groundwaters. If a river basin extends across international boundaries the Water Framework Directive (WFD) specifically requires it to be assigned to an International River Basin District (IRBD).

One RBD (North Eastern) and three IRBDs (North Western, Shannon and Neagh Bann) have been identified within Northern Ireland as illustrated in Map 3. The RBD and IRBDs include appropriate coastal waters as defined by the Directive, i.e. to a distance of one nautical mile from the baseline from which the extent of territorial waters is measured. They also include their associated groundwater.

A brief introduction to the RBD and IRBDs within Northern Ireland is given below. Map 3 summarises physical features relating to the Districts.

North Eastern RBD

The North Eastern RBD (NERBD) covers an area of 3,074 km^2. It is bounded to the north and north east by the North Channel. The Antrim Mountains and Glens of Antrim also lie to the north and north east. The Mourne Mountains are situated in the south east and include Slieve Donard, the highest peak in Northern Ireland.

The major rivers include the River Lagan and the River Bush. The River Lagan flows north eastwards, entering the sea at Belfast Lough. Belfast Lough is one of the largest sea inlets, along with Strangford Lough.

To the north of the NERBD, Palaeogene basalts underlain by Cretaceous chalk predominate along with an area of older metamorphic basement rocks in the north east. Permian and Triassic sandstones and mudstones underlie the Lagan and Enler valleys, with older Ordovician / Silurian greywackes and mudstones forming most of the remaining area to the south and east, including the Ards peninsula. Granites forming the Mourne Mountains can be found in the very south. There is an extensive coverage of superficial deposits, mainly glacial till.

The NERBD includes the most densely populated area of Northern Ireland, the Belfast urban area. This encompasses the capital city, Belfast, and Lisburn. The population to the north is rural and widely dispersed. The main land use in the north is agriculture with some fish farming, and there is highly productive farmland in the Lagan valley. Industry is mainly concentrated around the Belfast urban area. The climate is relatively mild and moist with extremes of temperature rare.

Neagh Bann IRBD

The Neagh Bann IRBD (NBIRBD) covers an area of 7,900 km^2 of which 5,740 km^2 are in Northern Ireland. It is bounded to the north by the North Channel and to the south by the Uplands of Armagh and the Republic of Ireland. The Sperrin Mountain range runs along a portion of the western boundary, while the Antrim Mountains run along a small portion of the eastern boundary.

The NBIRBD includes the land area of the Lough Neagh and Bann river basins together with a number of small river basins draining to Carlingford Lough and Dundalk Bay. Lough Neagh is located in the centre of the IRBD and at 396 km^2, is the largest freshwater lake in the British Isles.

Palaeogene basalts underlie the majority of the northern and central area of the IRBD. Significant areas of Palaeogene clays and silts surround southern Lough Neagh with Ordovician / Silurian greywackes and mudstones, intruded by younger granites, occurring further south. In the west of the IRBD a variety of Devonian and Carboniferous mudstones, limestones and sandstones occur along with areas of Permo-triassic sandstones. There is extensive coverage of superficial deposits, mainly till but also sand and gravels.

The main population centres within Northern Ireland are Coleraine and Ballymena to the north and Craigavon, Armagh and Newry to the south. The land around the Lough Neagh basin is typified by improved pasture but also includes some important wetland habitats. North of Lough Neagh, the Lower Bann River valley is very fertile and supports highly productive farmland. To the south of Lough Neagh the landscape is dominated by drumlins that stretch across the south of Northern Ireland. Agriculture is also predominant here. The climate is temperate with annual rainfall less than 750 mm per year on average.

North Western IRBD

The North Western International River Basin District (NWIRBD) covers an area of approximately 12,265 km^2, with approximately 4,785 km^2 falling within Northern Ireland. It is bounded to the west and south by the Republic of Ireland and to the north by the major sea inlet of Lough Foyle and Portstewart Bay.

The Sperrin mountain range runs along the eastern boundary of the NWIRBD, while the major freshwater lakes of Upper and Lower Lough Erne lie to the south of the district.

Metamorphic basement rocks dominate the northern portion of the district although younger Carboniferous and Triassic sandstones and mudstones occur to the east. Carboniferous and Devonian mudstones, limestones and sandstones form the majority of the southern portion including the area around the Lough Erne system. To the south east,

older Ordovician / Silurian greywackes and mudstones occur. There is extensive coverage of superficial deposits, mainly glacial till, but also sand and gravels.

The main population centres within this district are Derry, Omagh and Enniskillen. The rest of the district has a low population density that is mainly rural in nature. Towards the north west, the fertile Foyle basin and valley support intensive and arable farming. Further south, the landscape is mountainous and supports coniferous plantations with mainly sheep and some cattle grazing. The climate is temperate with greater rainfall, approximately 1600 mm per year, occurring in the mountainous regions.

Shannon IRBD

The Shannon International River Basin District (SHIRBD) covers an area of 19,452 km^2. Approximately 2.5 km^2 are in Northern Ireland in the vicinity of Killykeeghan, County Fermanagh. The district comprises the land area of the River Shannon basin, including associated coastal waters and groundwaters, together with related small coastal river basins in counties Clare and Kerry. The small proportion of the SHIRBD within Northern Ireland comprises sandstones and limestones.

The River Shannon rises in the north west of County Cavan and flows approximately 260 km in a southerly direction to enter the Atlantic Ocean south of Limerick. The principal land use in the SHIRBD is agricultural grassland. The district is not notably industrialised but within this sector the agri-food industry predominates. There are also small areas of forestry and peat bog. The main population centres are Athlone and Limerick.

3. Surface waters: water bodies, typology and reference conditions

3.1 Water bodies

The WFD requires that surface waters within each river basin district be differentiated into water categories: rivers, lakes, transitional waters and coastal waters. These waters are then further sub-divided depending on their type, based on natural factors (such as altitude, longitude, geology and size) that might influence ecological communities. This division forms the basis of water bodies. Water bodies are the basic management units for reporting and assessing compliance with the Directive's environmental objectives

Surface water bodies have been identified taking into account known pressures and existing water quality information[4]. This has resulted in Northern Ireland's surface waters being subdivided into 550 river, 24 lake, 7 transitional and 20 coastal water bodies.

The Directive applies to all waters, but, to aid management, size thresholds taken from the Directive have been used to identify river and lake water bodies. The European thresholds, which are 0.5 km^2 for the surface area of lakes and 10 km^2 for stream catchment area, have been used to define what is termed the baseline set of freshwater water bodies. Although not included within this summary report, considerable progress has been made with regard to the identification and risk assessment of small water bodies in Northern Ireland[5]. More work is needed on refining information about the small rivers and lakes and this will be taken forward in further characterisation. Numbers presented throughout this report refer only to baseline water bodies. The length of baseline streams is measured to their source mapped at 1:50,000 scale.

3.2 Typology and reference conditions

Typology is the means by which surface water bodies are differentiated according to their physical and physico-chemical characteristics. The resulting types will indicate, in very general terms, the sorts of plants and animals that are likely to be present. For example, the sorts of animals and plants that are found in shallow, exposed coastal waters are very different from those found in deep sea loughs.

The task of establishing types is important because reference conditions are established in relation to types. Reference conditions (which equal high status) represent nearly undisturbed conditions and provide the base on which the quality status classification scheme will be built. The classification scheme will consist of five classes ranging from high to bad. Further details on reference conditions are given below.

[4] More detailed information on the guiding principles followed can be found in the European guidance paper http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/identification_bodies&vm=detailed&sb=Title

[5] See http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5420/view for more detailed information on small water bodies

River typology

The typology of natural rivers in Northern Ireland has been produced using system A typology defined in Annex II of the WFD. System A uses altitude, catchment size and geology to define river types. This typology creates 36 potential types, but in practice many of the types do not exist in Northern Ireland. Application of this typology has identified 12 significant types in Northern Ireland as described in Table 2, and shown in Map 4.

Table 2: Typology of rivers

Type Number	Type Description (altitude, size, geology)	Number of Water Bodies
17	Low (<200 m), small (10 to 100 km^2), calcareous	237
25	Low (<200 m), small (10 to 100 km^2), siliceous	120
18	Low (<200 m), medium (>100 to 1,000 km^2), calcareous	41
33	Mid (200 to 800 m), small (10 to 100 km^2), organic	33
13	Mid (200 to 800 m), small (10 to 100 km^2), calcareous	35
5	Mid (200 to 800 m), small (10 to 100 km^2), siliceous	28
26	Low (<200 m), medium (>100 to 1,000 km^2), siliceous	21
9	Low (<200 m), small (10 to 100 km^2), organic	15
19	Low (<200 m), large (>1000 to 10,000 km^2), calcareous	12
14	Mid (200 to 800 m), medium (>100 to 1,000 km^2), calcareous	4
34	Mid (200 to 800 m), medium (>100 to 1,000 km^2), organic	3
6	Mid (200 to 800 m), medium (>100 to 1,000 km^2), siliceous	1
Total number of typed river water bodies		**550**

Freshwater experts within Ecoregion 17 (Ireland and Northern Ireland) have agreed to pursue a more ecologically relevant system B typology which uses hardness as a surrogate descriptor for geology (if available), slope and river discharge. At present biological and physico-chemical data from a selection of rivers is being collected to enable the application of system B to Northern Ireland rivers as part of work carried out in future years under further characterisation[6].

River reference conditions

Reference conditions[7] for the river types in Northern Ireland describe the macrophyte assemblages, macroinvertebrates, fish, and physico-chemical conditions that would be expected to occur in natural or nearly natural conditions. Reference condition descriptions have been established using available monitoring data and expert opinion. Northern Ireland has a reasonably large monitoring network consisting of primary,

[6] More detailed information on river water body identification (including small water bodies) and typing can be found at: http://www.ehsni.gov.uk/pubs/publications/RiverTypology.pdf and http://www.ehsni.gov.uk/pubs/publications/FreshSmallWB.pdf
[7] Descriptions of river reference conditions can be found at: http://www.ehsni.gov.uk/pubs/publications/RiverRefCon.pdf

secondary and minor sampling sites. Sites showing only minor disturbance were used to help define reference conditions for the types they populated. The river types that had very few monitoring sites showing minor disturbance had reference conditions derived using a combination of expert judgement and use of available data.

Lake typology

The typology of lakes in Northern Ireland has been produced using system A typology defined in Annex II of the WFD. System A uses altitude, depth, size (based on surface area) and geology. In relation to depth, it should be highlighted that due to a lack of reliable bathymetry data, 3-15 m has been assumed for all lakes in Northern Ireland. This system creates 24 potential types, but in practice some of the types do not exist in Northern Ireland. Application of this typology to Northern Ireland lakes has identified 20 types[8]. As previously mentioned in section 3.1, the European threshold for reporting lakes is surface area greater than 0.5 km. There are 24 lake water bodies that meet this size threshold hence only 5 lake types are reported in Table 3 below and shown in Map 5.

Table 3: Typology of lakes

Type Number	Type Description (altitude, depth, size, geology)	Number of Water Bodies
5	Low (<200 m), depth 3-15 m, >50 ha, calcareous non peat	16
11	Low (<200 m), depth 3-15 m, >50 ha, siliceous non peat	4
12	Low (<200 m), depth 3-15 m, >50 ha, siliceous peat	2
18	Mid (>200 m), depth 3-15 m, >50 ha, calcareous peat	1
23	Mid (>200 m), depth 3-15 m, >50 ha, siliceous non peat	1
Total number of typed lake water bodies		**24**

Freshwater experts within the Ecoregion 17 (Ireland and Northern Ireland) have agreed to pursue a more ecologically relevant system B typology which uses alkalinity as a surrogate descriptor for geology. At present additional biological and physico-chemical data are being collected to enable application of system B to Northern Ireland lakes. This work will be carried out in future years as part of further characterisation.

Lake Reference Conditions

Reference conditions[9] for lake types in Northern Ireland describe the macrophyte assemblages, invertebrate fauna, phytobenthos, phytoplankton and fish that would be expected to occur in natural or nearly natural conditions. Monitoring and sampling have generally been restricted to the larger lakes in Northern Ireland with some other studies on smaller lakes being carried out. Reference conditions for the Northern Ireland lake

[8] More detailed information on lake water body identification (including small water bodies) and typing can be found at: http://www.ehsni.gov.uk/pubs/publications/LakeTypology.pdf and http://www.ehsni.gov.uk/pubs/publications/FreshSmallWB.pdf
[9] Descriptions of lake reference conditions can be found at: http://www.ehsni.gov.uk/pubs/publications/LakeRefCon.pdf

types were derived using all available data, with gaps in the data augmented by expert opinion.

Transitional waters typology

Under the Directive, Northern Ireland transitional waters are located within Ecoregion 1 (Atlantic Ocean). The typology of transitional waters in Northern Ireland has been produced using System B typology defined in Annex II of the WFD[10]. System B requires that the obligatory factors, latitude, longitude, tidal range and salinity, be used. In addition, the optional factors of wave exposure, mixing characteristics, depth, substratum and intertidal area were also used to determine typology of transitional waters. This resulted in a total of 6 types being produced for transitional waters, of which one is present in Northern Ireland, as summarised in Table 4, and illustrated in Map 6.

Table 4: Typology of transitional waters

Type Number	Type Description	Number of Water Bodies
TW2	Estuaries that are generally partly mixed or stratified, with a tendency for salinity to be mesohaline or polyhaline. They are strongly mesotidal. They are sheltered, intertidal or shallow subtidal estuaries that have a predominantly sand and mud substratum.	7
Total number of typed transitional water bodies		**7**

Coastal waters typology

According to the WFD, Northern Ireland coastal waters are also located within Ecoregion 1 (Atlantic Ocean). The typology of coastal waters in Northern Ireland has been produced using System B typology defined in Annex II of the WFD. System B requires that the obligatory factors, latitude, longitude, tidal range and salinity, be used. In addition, the optional factor of wave exposure was used to determine typology. This resulted in a total of 12 types being produced for coastal waters (of which 3 are present in Northern Ireland), and transboundary coastal water bodies, as summarised in Table 5 and illustrated in Map 7.

[10] More detailed information on transitional and coastal water typology can be found at:
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5312/view.
Information on marine small water bodies can be found at:
http://www.ehsni.gov.uk/pubs/publications/MarineSmallWB.pdf

Table 5: Typology of coastal waters

Type Number	Type Description (salinity, tidal range, exposure)	Number of Water Bodies
CW2	Euhaline, mesotidal, exposed	3
CW5	Euhaline, mesotidal, moderately exposed	6
CW8	Euhaline, mesotidal, sheltered	11
Total number of typed coastal water bodies		**20**

Transitional and coastal reference conditions

It is not possible to represent the diverse array of habitats within a coastal or transitional water with one physical type due to the complex mosaic of marine habitats. Since typology is the basis of defining reference conditions and an anchor for high status and classification, the consequence of adopting these types is that reference conditions will cover a wide range of habitats within each type. To overcome this difficulty, habitat specific reference conditions within broader physical types defined under the WFD Annex II factors have been agreed in the United Kingdom (UK) as the way forward[11]. Deriving habitat specific reference conditions allows the development of appropriate reference conditions for each quality element within each type.

3.3 Artificial and heavily modified water bodies[12]

Artificial water bodies

Artificial water bodies (AWBs) are bodies of surface water created by human activity. There are a number of reasons why AWBs are important including:

- Many AWBs currently or potentially support important aquatic ecosystems;
- Some AWBs may have a significant impact on non-AWBs and it is beneficial to manage them to protect the non AWBs;
- Many AWBs are important for water supply reasons and it is important to manage their water quality and hydrology for the purposes of satisfying the WFD requirements;
- Many AWBs have secondary uses other than for the reason they were designed (e.g. artificial reservoirs are often used for recreation), which requires the water quality, ecological or water quantity to be managed appropriately;
- AWBs have been designed to support specified uses, which provide valuable social and economic benefits, which should be allowed to continue within a framework of sustainable management;

[11] Descriptions of reference conditions for transitional and coastal waters can be found at: http://www.wfduk.org/tag_guidance/Article_05/Type%20specific%20reference%20conditions/view

[12] More information on provisional AWB and HMWB can be found at http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/modified_guidance&vm=detailed&sb=Title

- Many AWBs support wider environmental interests such as wetlands and heritage features.

A separate classification scheme will be developed for AWBs that need to attain good ecological potential, as opposed to good ecological status.

As part of the characterisation work we have identified provisional AWBs (see section 6.5). Canals have been identified as provisionally artificial, but not split into specific water bodies yet. This work will be developed in the near future as typology and classification schemes are developed.

Heavily modified water bodies

Sometimes it is not possible for a water body to achieve good status because of substantial alterations made for specified purposes such as navigation, water storage, flood defence and land drainage. The Directive recognises that the benefits of such water uses need to be retained and allows these water bodies to be designated as heavily modified water bodies (HMWBs).

The presence of physical alterations does not lead automatically to designation and neither does designation necessarily mean that mitigation measures will not be acquired. Designation enables objectives to be set that allow the benefits of the use to be maintained while ensuring that other pressures can be managed and, where possible, the adverse effects of the physical alterations mitigated. A separate classification scheme will be developed for HMWBs that need to attain good ecological potential, as opposed to good ecological status.

As part of the characterisation work we have identified provisional HMWBs. See section 6.5 for further information.

4. Groundwaters: water bodies and characteristics

4.1 Water bodies and characteristics

Groundwater can be found beneath much of Northern Ireland, in places interacting with rivers, lakes and wetlands. The groundwater is contained within a variety of geological strata which have different characteristics and form different aquifer types. To assist with delineating groundwater bodies, the aquifers have been classed according to their potential to support groundwater abstraction (aquifer productivity) and on the nature of groundwater flow through them.

The way water flows through, and is stored in, an aquifer determines the potential for dilution and attenuation of any contaminant that enters the aquifer and how rapidly that contamination may be transferred to hydraulically linked wetlands and surface waters. It can also influence the degree of local impact on the water table from groundwater abstraction.

Across Northern Ireland, groundwater flow is mainly through fractures which offer limited potential for attenuation. In some areas, such as in County Fermanagh, karstic conditions are developed. Here, natural solution of the rock has created enlarged fractures and preferential flow pathways where groundwater concentrates and passes through to discharge points such as springs much more quickly than in the surrounding rock. This rapid transfer of water from inflow areas to discharge points allows for very limited attenuation of pollutants. In addition to the above types of flow, some aquifers, such as within the Lagan and Enler valleys exhibit a component of intergranular flow which has contrasting implications for groundwater quality within them. Although the intergranular nature allows more opportunity for attenuation and dilution, it also allows increased storage of contaminants. This also applies to all of the superficial aquifers which only have intergranular flow.

The potential for groundwater within an aquifer to be impacted by surface or near surface activities, is strongly dependent upon the nature and type of any overlying strata as well as, in certain aquifer types, the depth to the water table. An assessment of this 'vulnerability' of groundwater has been undertaken across Northern Ireland, using soil, geological and hydrogeological data. Map 8 illustrates the results of this assessment.

Groundwater bodies represent geographically distinct management units for which an assessment of the status of groundwater contained within them can be undertaken. They have been delineated across Northern Ireland based mainly upon the class of aquifer. For more productive aquifers, boundaries have been defined primarily on the basis of geology. For less productive aquifers, surface water catchments, taken to broadly reflect underlying groundwater divides, have generally been used. The bodies are predominantly bedrock aquifers but they also incorporate areas of overlying, more permeable, superficial deposits.

There are 67 groundwater bodies currently defined wholly or partly within Northern Ireland[13]. Map 9 shows the boundaries of the groundwater bodies to the border. In border areas, groundwater bodies commonly extend into Ireland to the nearest, appropriate hydrogeological boundary. Further characterisation of groundwater bodies may result in some future redefining of body boundaries.

4.2 Terrestrial ecosystems and surface water bodies dependent on groundwater

The environmental objectives for groundwater relate to both groundwater within the aquifer itself and other associated receptors where groundwater provides a significant component of water. These receptors are groundwater dependent terrestrial ecosystems (GWDTE) such as wetlands and surface waters (rivers and lakes). The ecosystems have been identified using predictive tools and existing surveyed data[14].

River and lake water bodies have been identified as having significant groundwater dependency where they interact with the more productive aquifers. The assessment of where this occurs has been based mainly upon regional geological and hydrogeological data. Terrestrial ecosystems dependent upon groundwater (Map 10) have been identified using geology / hydrogeology and type of vegetative communities.

Initially only sites designated at a European level have been considered, as these have already, by their designation, been classed as high value. Further characterisation will assess other nationally and locally important sites.

Interaction between groundwater and surface waters and dependent terrestrial ecosystems is complex and not well understood. This, together with the limited amount of data available to support this characterisation phase means that our current understanding of the links is limited. It is planned to improve these assessments in studies as part of further characterisation.

[13] Further background to the delineation of groundwater bodies can be found at: http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5312/TAG2003 WP6a %2802%29/view and http://www.ehsni.gov.uk/pubs/publications/GWbodydelineation.pdf

[14] More information on the identification of groundwater dependent terrestrial ecosystems can be found at http://www.ehsni.gov.uk/pubs/publications/GWDTE.pdf

5. Protected Areas

5.1 Introduction

Protected areas are those areas lying within river basin districts designated as requiring special protection under specific community legislation, either for the protection of their surface water or groundwater or for the conservation of habitats and species directly depending on those waters.

The Directive requires that a register of protected areas be established. This will help to ensure that the management of the relevant water bodies is geared towards achieving the protected area objectives. Protected areas are being captured under the WFD in order to bring all EC water related legislation under one umbrella. The Northern Ireland register details the relevant protected areas[15]. Maps are presented in this report (Maps 11-14)[16].

5.2 Waters used for the abstraction of drinking water

This is a new category of protected area which will replace the system of drinking water protection currently provided by the Surface Water Abstraction Directive (75/440/EEC) and will also incorporate groundwaters. This older Directive will be repealed at the end of 2007. Map 11 shows the surface water and groundwater bodies identified as Drinking Water Protected Areas.

5.3 Areas designated to protect economically significant aquatic species

These are protected areas established under earlier EC directives aimed at protecting shellfish (79/923/EEC) and freshwater fish (78/659/EEC). Map 12 shows the areas of water identified.

5.4 Recreational Waters

These are bathing waters designated under the Bathing Water Directive (76/160/EEC). Map 12 shows areas of water identified.

5.5 Nutrient Sensitive Areas

These comprise nitrate vulnerable zones designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive under the Urban Waste Water Treatment Directive (91/271/EEC). Map 13 shows the areas of water identified.

[15] The protected area register for Northern Ireland is available at:
http://www.ehsni.gov.uk/environment/waterManage/wfd/register/RegProtArea.shtml
[16] For more detailed information please see http://www.ehsni.gov.uk/pubs/publications/RegProtArea.pdf

5.6 Areas designated for the protection of habitats or species

These are areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection. These are designated under the Birds Directive (79/409/EEC) and the Habitats Directive (92/43/EEC). Map 14 shows the relevant protected areas[17].

5.7 Assessment of protected area objectives

Under the future WFD classification scheme for surface waters, good status will mean that at least mandatory standards need to be met for the following protected areas: freshwater fish, shellfish growing waters, bathing waters, nitrate vulnerable zones and areas designated as sensitive under the Urban Waste Water Treatment Directive. Objectives for drinking water protected areas and Natura 2000 sites will also need to be met. Therefore, where existing mandatory protected area objectives are not being met we have identified relevant water bodies as at risk.

There is no assessment for drinking water protected areas as these are new protected areas established by the WFD and no objectives have yet been set.

[17] More detailed information on how these areas were selected please see http://www.wfduk.org/tag_guidance/Article_06-07/

6. Pressure and impact analysis

6.1 Introduction

The pressure and impact analysis reviews the impact of human activity on surface waters and on groundwaters and identifies those water bodies that are at risk of failing to meet the Directive's environmental objectives. Annex 1 summarises the environmental objectives and discusses the issues and difficulties surrounding the assessments. The assessment is important because it will provide a starting point for integrated catchment management through the river basin planning process and will inform monitoring programmes.

The central question of the pressure and impact analysis is 'which water bodies are at risk of failing the environmental objectives set out in the Directive?' Therefore, throughout this report, 'at risk' means that:

- the pressure and impact assessment shows that there is a likelihood that a water body will fail to meet the Directive's environmental objectives by 2015 unless appropriate management action is taken.

'At risk' does not necessarily mean that the water bodies are already suffering poor status, but it does highlight areas where appropriate management actions should be applied to ensure that good status is maintained or to ensure it is achieved in the future. It is important to note that the assessments represent an **initial** characterisation of water bodies, with the Directive requiring **further characterisation** for 'at risk' and cross-border water bodies. Where more detailed assessments are undertaken, the risk category may subsequently change. Transitional, coastal and groundwater bodies are typically very large and may be identified as being at risk due to localised pressures affecting only small portions of a water body. It should also be noted that the assessments cover activities and pressures not previously considered or reported in the management of the water environment in Northern Ireland e.g. abstraction and alterations to the physical structure of our waters.

A key challenge in carrying out this risk assessment exercise is that good status has not yet been fully and consistently defined across Europe. This task is under way and will feed into the final classification scheme to be used for further characterisation and reporting. In the meantime, and to ensure consistency within the UK, the United Kingdom Technical Advisory Group (UKTAG)[18] has set out criteria to be used in the current assessments[19].

[18] See http://www.wfduk.org for more details.
[19]More detailed guidance on the general principles for the pressure and impact analysis can be found at http://www.wfduk.org/tag_guidance/Article _05/Folder.2004-02-16.5332/view.
Information on how the criteria has been applied in Northern Ireland can be found at: http://www.ehsni.gov.uk/environment/waterManage/wfd/characterisation/techreports/Pressures_Impacts.shtml

Although the Directive requires reporting of water bodies as either at risk or not at risk, we feel that for UK purposes a further prioritisation is helpful. This more detailed categorisation will enable us to focus our efforts in the first round of river basin management planning. For the first analysis, effort has been concentrated on identifying the most significant risks[20].

For cross-border groundwater bodies, the risk assessment reported for the portion of the body within Northern Ireland takes in to consideration the output from similar risk assessments undertaken by the Ireland for the portion of the body within their jurisdiction.

In order to help prioritise future action, results are reported using the following agreed UK categories shown in Table 6.

Table 6: Agreed UK reporting categories and subsequent action

Directive reporting category	UK reporting category	Action
At risk	(1a) Water bodies at significant risk of failing objectives.	Consideration of appropriate measures can start as soon as practicable.
	(1b) Water bodies probably at significant risk of failing objectives but for which further information is needed to make sure this view is correct.	Focus on more detailed risk assessments to determine whether or not the water bodies in this category are at significant risk in time for the interim overview of significant water management issues in 2007.
Not at risk	(2a) Water bodies probably not at significant risk of failing objectives, or limited data available.	Focus on improving quality of information in time for second pressure and impact analysis report in 2013.
	(2b) Water bodies not at significant risk of failing objectives.	Review for next pressure and impact analysis report in 2013 to identify any significant changes in the situation.

The pressure and impact analysis has used a variety of methods and datasets reflecting differences in availability and quality of data in Northern Ireland. Some assessments have used data recording environmental impacts, e.g. water quality and flora and fauna populations from current monitoring programmes, while others have used the presence of pressures on the environment, e.g. water abstraction sites and locations of physical structures such as weirs, which may lead to an environmental impact. Where water bodies are identified as 'at risk' due to impact data, the most likely pressures and sectors believed to be leading to the impacts have been recorded.

[20] http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/WP7a%2801%29%20Draft%20Guidance%20on%20general%20principles%20for%20risk%20assessment%20%28PR2v6.19-01-04%29/view

These different approaches reflect the nature of the data and information available to these first assessments. The extent and quality of available data and information will improve in future cycles making later assessments more comprehensive and robust. This will include ensuring compatibility of assessments in cross-border water bodies and catchments as work progresses on the island of Ireland. Nevertheless, we believe that this first analysis provides a sound basis from which to develop monitoring programmes and the river basin management planning process.

6.2 Point source pollution and assessment of impact

Potential point source pollution, such as effluent from waste water treatment plants and industrial discharges, has been controlled in Northern Ireland for many years. This means that information has been available to inform assessments of point source pollution for surface waters. Information on compliance of significant discharges with set discharge standards and on levels of treatment and anticipated capital improvements due to start by 2005 have all been used to identify surface water bodies at risk. Compliance with EC Directives for Bathing Waters and Shellfish Waters has also been considered. Less information exists in relation to groundwaters. The methods of assessment are therefore more predictive and present a relatively simple approach to indicate where impacts on groundwater may occur.

'Priority substances', (as per Annex 10 of the Directive), such as cadmium and mercury have been included in the point source pollution assessment. The EC has identified a list of 33 priority substances based on their toxicity, persistence and liability to bioaccumulate. Surface water bodies are considered as being at risk of not achieving good status if there is a risk that Environmental Quality Standards (EQS) are exceeded for any of these substances. Assessments are predominantly based on existing EHS monitoring data. The EC list of priority substances includes many for which there is little discharge or environmental data available in Northern Ireland as they have not been suspected of causing ecological downgrading, or even of being present in the water environment.

Map 15 shows some examples of the significant point source pressures that have been considered in carrying out the risk assessments. Many of these point sources are already subject to controls and are not believed to be causing any damage to the water environment. Those surface water bodies affected by point source pollution pressures are shown in Map 16. No groundwater bodies are currently believed to be at risk from point source pollution pressures.

For each water body considered to be at risk, we have recorded the nature of the pressure and the general industry sector to which this pressure can be attributed. Summary information is provided in the following tables and pie charts.

Table 7: River water bodies affected by point source pollution

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	51	9.3	1,588	10.7
	1b	76	13.8	2,425	16.4
	2a	423	76.9	10,768	72.9
	2b	0	0	0	0
Total		550	100	14,781	100
Total predicted at risk	1a+1b	127	23.1	4,013	27.1

Figure 1 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 1: General industry sectors affecting 1a and 1b river water bodies (point source pollution)

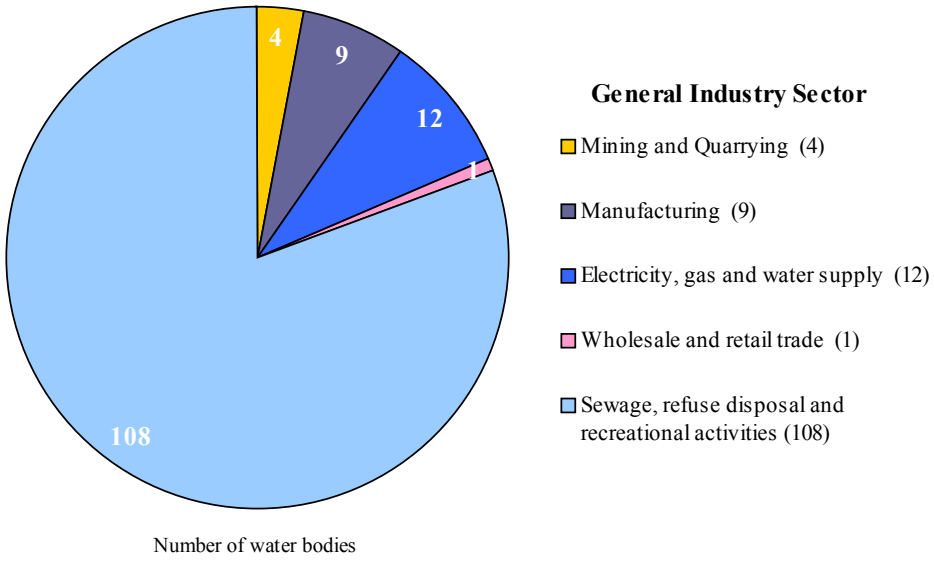


Table 8: Lake water bodies affected by point source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	1	4.2	161	29.6
	1b	2	8.3	150	27.5
	2a	21	87.5	233	42.9
	2b	0	0	0	0
Total		24	100	544	100
Total predicted at risk	1a+1b	3	12.5	311	57.1

Figure 2 shows the general industry sectors affecting lake water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 2: General industry sectors affecting 1a and 1b lake water bodies (point source pollution)

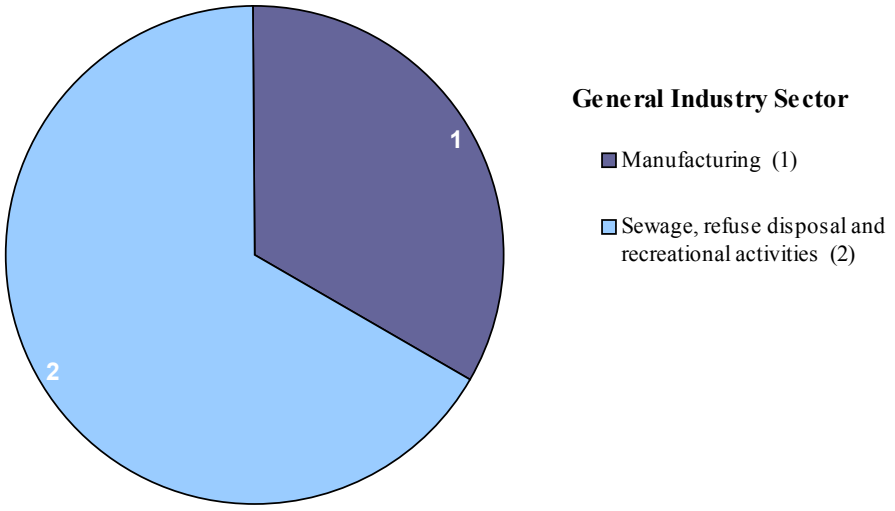


Table 9: Transitional water bodies affected by point source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	2	28.6	0.4	1.0
	1b	4	57.1	39.9	97.1
	2a	1	14.3	0.7	1.9
	2b	0	0	0	0
Total		7	100	41	100
Total predicted at risk	1a+1b	6	85.7	40.3	98.1

Figure 3 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 3: General industry sectors affecting 1a and 1b transitional water bodies (point source pollution)

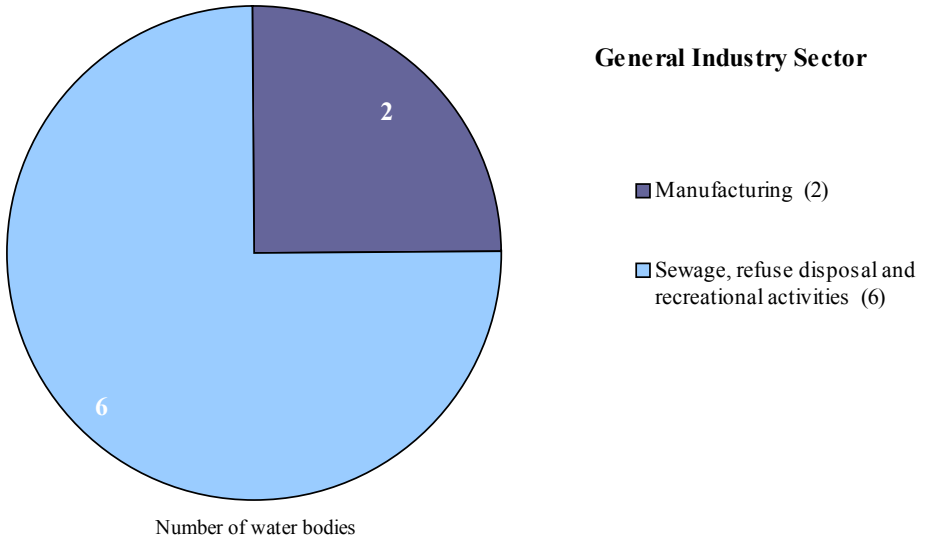


Table 10: Coastal water bodies affected by point source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	10	50.0	764	59.0
	1b	7	35.0	441	34.0
	2a	2	10.0	60	4.7
	2b	1	5.0	30	2.3
Total		20	100	1,295	100
Total predicted at risk	1a+1b	17	85.0	1,205	93.0

Figure 4 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 4: General industry sectors affecting 1a and 1b coastal water bodies (point source pollution)

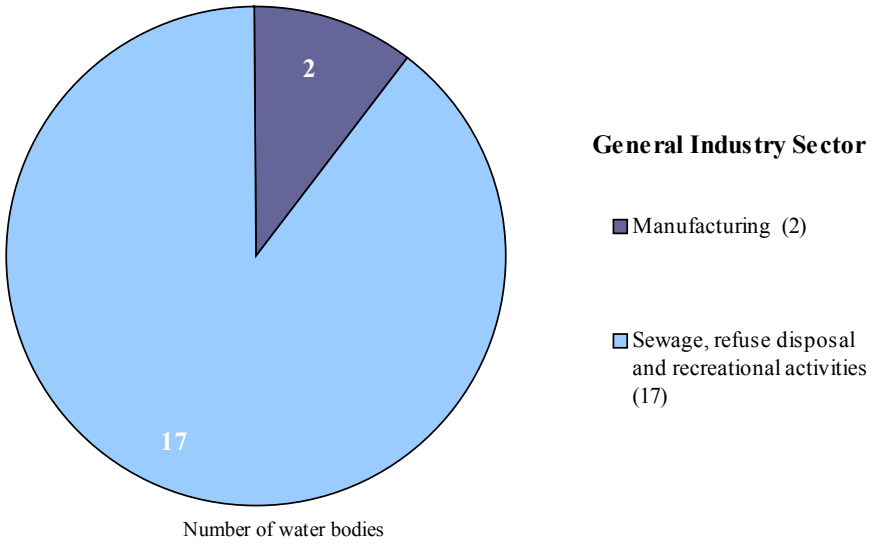


Table 11: Groundwater bodies affected by point source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Groundwater	1a	0	0	0	0
	1b	0	0	0	0
	2a	49	73.0	13,202	97
	2b	18	27.0	385	3
Total		67	100.0	13,587	100
Total predicted at risk	1a+1b	0	0	0	0

6.3 Diffuse source pollution and assessment of impact

Diffuse pollution arises from widespread activities with no one discrete source. Such pollution may result from land use activities, both rural and urban, which, although they may be dispersed across a catchment can collectively have a significant environmental impact. There is a wide variety of diffuse sources of various pollutants to aquatic systems. Examples include the transport of nutrients, pesticides and sediment from farmland, acid rain, and urban run-off to both groundwater and surface waters. Diffuse pollution is often associated with heavy rainfall when pollutants are flushed into watercourses.

Current knowledge of diffuse source pressures in Northern Ireland is primarily based on a combination of water and sediment quality monitoring data and expert judgement for

rivers and lakes, supplemented with a screening tool method where impact data was limited or absent. The screening tool method uses a suite of models to assess the risks from diffuse pollution based on pollutant inputs to the land surface and outputs to water bodies. Landscape factors, such as land use, climate, topography, geology and soils, which affect the source and location of potential pollutants, have been compiled in a database. This information is used alongside land management practice data, such as pesticide usage surveys, numbers of livestock, maps of atmospheric deposition and population density, to estimate pollutant loads from diffuse sources to surface waters. Model results have also been used in the groundwater assessments.

For the nutrient nitrogen assessment, in the absence of an operational regulatory standard relating to the environmental impact of nitrate in surface fresh waters, and the absence of agreement of the groundwater daughter directive, a 50 mg/l risk threshold has been used as providing an initial basis for assessment of risk of not meeting the environmental objectives of the Water Framework Directive

Water monitoring data indicate where pollution pressures are impacting water quality, regardless of whether the pressures are from point or diffuse sources. The screening tool and water monitoring data in combination with expert judgement have been used in the risk assessments for rivers and lakes. The screening tool was developed only for freshwaters, and has not been applied to transitional and coastal waters. These were assessed on the basis of comparing monitoring data to national and European criteria.

Map 17 shows land use in Northern Ireland, which is a significant component in assessment of diffuse source pollution pressures. Water bodies affected by diffuse source pollution pressures are shown in Maps 18 (surface waters) and 19 (groundwaters).

For each water body considered to be at risk, we have recorded the nature of the pressure and the general industry sector to which this pressure can be attributed. Summary information is provided in the following tables and pie charts.

Table 12: River water bodies affected by diffuse source pollution

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	271	49.3	8,152	55.2
	1b	248	45.1	5,859	39.6
	2a	31	5.6	770	5.2
	2b	0	0	0	0
Total		550	100	14,781	100
Total predicted at risk	1a+1b	519	94.4	14,011	94.8

Figure 5 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 5: General industry sectors affecting 1a and 1b river water bodies (diffuse source pollution)

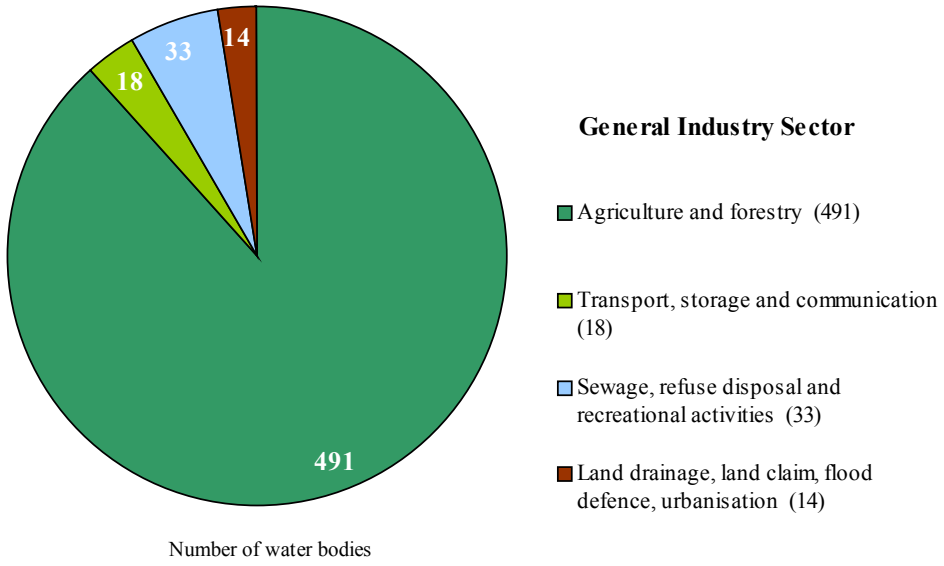


Table 13: Lake water bodies affected by diffuse source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	10	41.7	522	95.9
	1b	10	41.7	12	2.2
	2a	4	16.6	10	1.9
	2b	0	0	0	0
Total		24	100	544	100
Total predicted at risk	1a+1b	20	83.4	534	98.1

'Agriculture and forestry' is the only industry sector affecting 1a and 1b lake water bodies for diffuse pollution.

Table 14: Transitional water bodies affected by diffuse source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	4	57.1	3	8.5
	1b	3	42.9	38	91.5
	2a	0	0	0	0
	2b	0	0	0	0
Total		7	100	41	100
Total predicted at risk	1a+1b	7	100	41	100

Figure 6 shows the general industry sectors affecting transitional bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 6: General industry sectors affecting 1a and 1b transitional water bodies (diffuse source pollution)

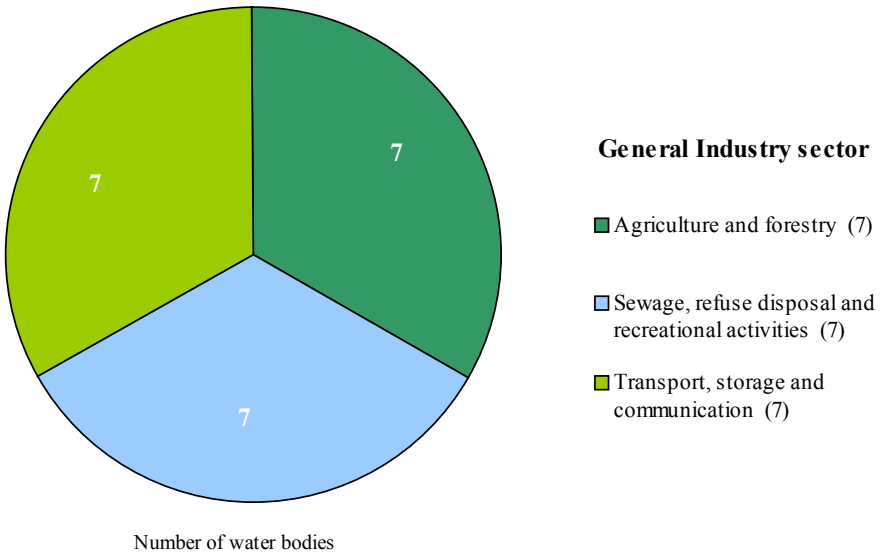


Table 15: Coastal water bodies affected by diffuse source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	3	15.0	191	14.7
	1b	8	40.0	542	41.8
	2a	7	35.0	546	42.1
	2b	2	10.0	17	1.4
Total		20	100	1,295	100
Total predicted at risk	1a+1b	11	55.0	733	56.5

Figure 7 shows the general industry sectors affecting coastal bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 7: General industry sectors affecting 1a and 1b coastal water bodies (diffuse source pollution)

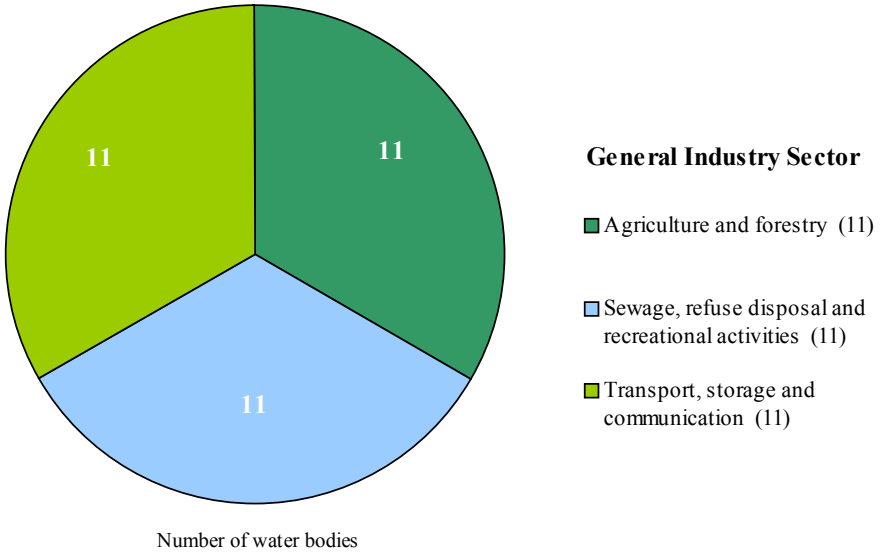
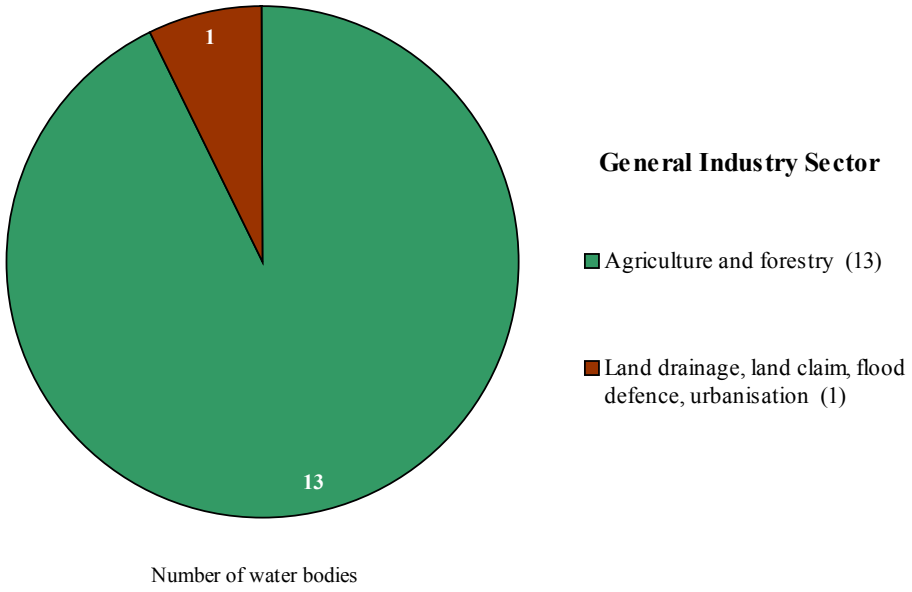


Table 16: Groundwater bodies affected by diffuse source pollution

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Groundwater	1a	1	1.5	180	1.3
	1b	12	17.9	4,906	36.1
	2a	22	32.8	7,235	53.3
	2b	32	47.8	1,266	9.3
Total		67	100	13,587	100
Total predicted at risk	1a+1b	13	19.4	5,086	37.4

Figure 8 shows the general industry sectors affecting groundwater bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 8: General industry sectors affecting 1a and 1b groundwater bodies (diffuse source pollution)



6.4 Abstraction and flow regulation and assessment of impact

Abstraction of water and regulation of flow are activities that occur on Northern Ireland's water bodies. These activities are necessary in order to meet the demands for public water supply and for agricultural and industrial processes. They are also needed for flood defence, navigation, fish farming and hydroelectric schemes.

These abstraction and flow regulation activities are pressures that can impact on the aquatic environment, and under the WFD require a risk assessment to be carried out. The risk assessment identifies and locates the pressures from abstractions, controlled discharges and impoundments acting within a body of water, and measures the impact by calculating any deviation found from the natural hydrological regime of that water body.

In Northern Ireland the pressures from abstraction and regulation of flow have never been fully assessed before and new datasets are required to understand the distribution and degree of pressures acting on identified water bodies. Available data have been collected from core stakeholders and government departments who contribute to the management of water resources in Northern Ireland including the Water Service, Rivers Agency, Environment and Heritage Service and the Geological Survey of Northern Ireland.

The datasets have been used to build a database of abstractions, discharges and impoundments. With the help of expert knowledge and opinion, and guidance from UKTAG, water bodies have been risk assessed on the basis of how much deviation

occurs from natural flow, and the risk being categorised according to ecological threshold values.

For surface waters, the first assessment has been based on a simple map-based presence and absence approach. Water bodies containing significant abstractions and impoundments are identified as probably at risk (1b), and only those water bodies containing no identified pressures are categorised not at risk with high confidence (2b). All other water bodies fall within the category not at risk with low confidence (2a). Water balances have been carried out to refine these assessments in line with UKTAG guidance. Estimates of natural flows were compared to estimated, artificially influenced flows where the sum of all discharges and abstractions acting on a water body were considered.

For groundwaters, the balance between the overall abstraction from a water body against water input (recharge) and the needs of dependent surface waters and ecosystems was assessed. In addition, potential local impacts around sensitive ecosystems and the possibility of saline intrusion in coastal areas have also been considered.

Map 20 shows some examples of the significant pressures that have been identified in carrying out the risk assessments. Those water bodies which are affected by abstraction and flow regulation pressures are shown in Maps 21 (surface waters) and 22 (groundwaters).

For each water body considered to be at risk, we have recorded the nature of the pressure and the general industry sector to which this pressure can be attributed. Summary information is provided in the following tables and pie charts.

Table 17: River water bodies affected by abstraction and flow regulation

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	9	1.6	182	1.2
	1b	63	11.5	2,006	13.6
	2a	104	18.9	2,907	19.7
	2b	374	68.0	9,686	65.5
Total		550	100	14,781	100
Total predicted at risk	1a+1b	72	13.1	2,188	14.8

Figure 9 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 9: General industry sectors affecting 1a and 1b river water bodies (abstraction and flow regulation)

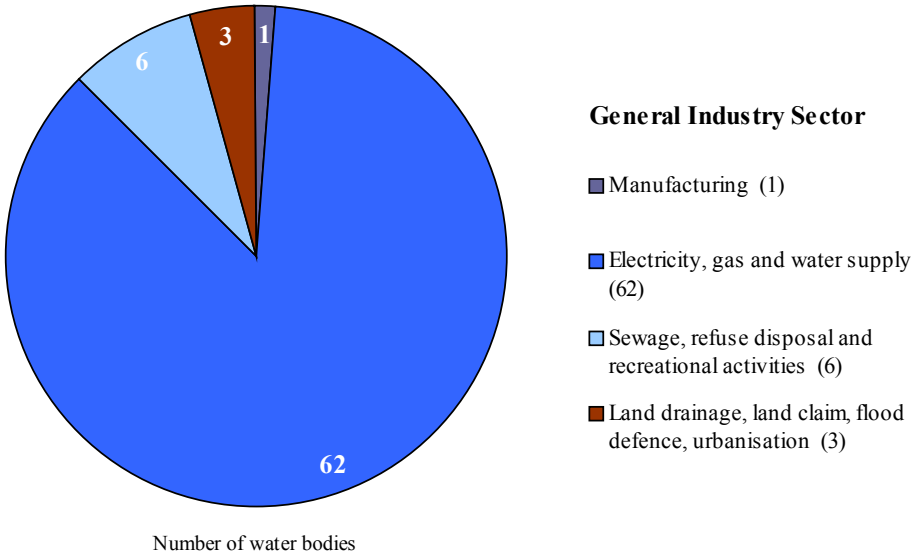


Table 18: Lake water bodies affected by abstraction and flow regulation

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	5	20.8	3	0.6
	1b	3	12.5	7	1.2
	2a	5	20.8	485	89.2
	2b	11	45.9	49	9.0
Total		24	100	544	100
Total predicted at risk	1a+1b	8	33.3	10	1.8

Figure 10 shows the general industry sectors affecting lake water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 10: General industry sectors affecting 1a and 1b lake water bodies (abstraction and flow regulation)

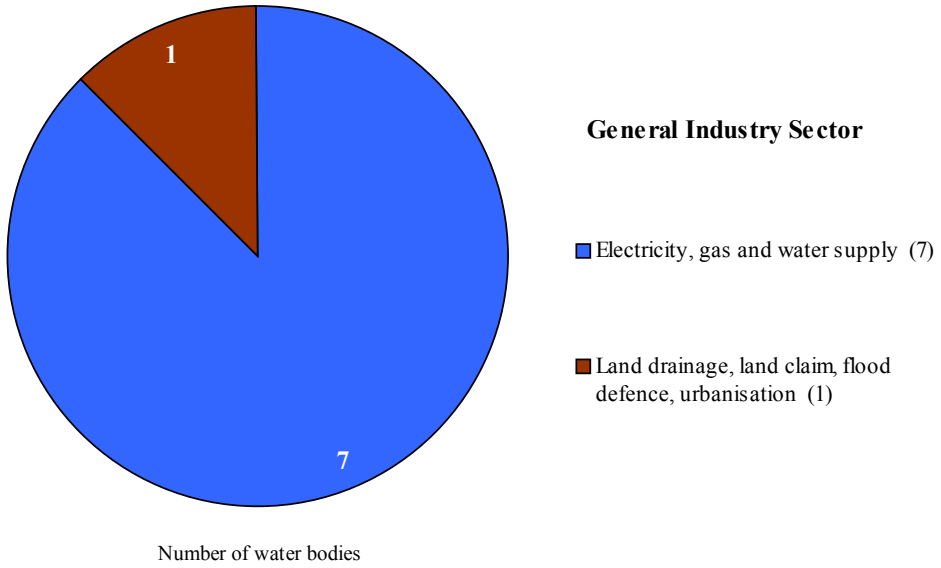


Table 19: Transitional water bodies affected by abstraction and flow regulation

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	0	0	0	0
	1b	1	14.3	2.5	6.1
	2a	0	0	0	0
	2b	6	85.7	38.6	93.9
Total		7	100	41	100
Total predicted at risk	1a+1b	1	14.3	2.5	6.1

'Land drainage, land claim, flood defence, urbanisation' is the only sector affecting 1b transitional water bodies for abstraction and flow regulation.

Table 20: Coastal water bodies affected by abstraction and flow regulation

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	0	0	0	0
	1b	0	0	0	0
	2a	0	0	0	0
	2b	20	100	1,295	100
Total		20	100	1,295	100
Total predicted at risk	1a+1b	0	0	0	0

Table 21: Groundwater bodies affected by abstraction and flow regulation

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Groundwater	1a	2	3	183	1.4
	1b	4	6	2,253	16.6
	2a	3	4.4	1,950	14.3
	2b	58	86.6	9,201	67.7
Total		67	100	13,587	100
Total predicted at risk	1a+1b	6	9	2,436	18

'Electricity, gas and water supply' is the only industry sector affecting 1a and 1b groundwater bodies for abstraction and flow regulation.

6.5 Morphological alterations and assessment of impact

Morphological alterations arising from anthropogenic sources can cause significant changes in ecology. Examples of activities causing morphological alterations which can lead to damage or loss of habitats are listed below:

- dredging for navigation causing disturbance to the substrate;
- construction of flood walls or embankments for flood defence;
- construction of impounding structures such as dams and weirs for water supply and hydro-electric power, regulating tidal intrusions;
- land-use pressures from agriculture and urbanisation such as straightening, channelisation and culverting of rivers;
- land claim for agriculture, housing or industry;
- fishing and aquaculture in transitional and coastal waters;
- shoreline reinforcement;
- dredge spoil disposal.

The overall goal of the WFD is for Member States to achieve "good ecological and chemical status" in all surface water bodies by 2015. Some water bodies may not achieve this because of some of the activities listed above. The Directive recognises the benefits of such activities and permits Member States to identify and designate such water bodies as either artificial water bodies (AWB) or heavily modified water bodies (HMWB). The presence of physical alterations does not lead automatically to designation and nor does designation mean that mitigation measures will not be required.

Where a water body is substantially changed in character as a result of physical alterations it may be designated as a HMWB. Water bodies created by human activity such as canals may be designated as AWBs. Instead of "good ecological status", the environmental objective for HMWBs and AWBs is good ecological potential (GEP), which has to be achieved by 2015, and a separate classification scheme will be developed.

As part of the morphological risk assessment, provisional HMWBs and AWBs have been identified. Final designations are not required until 2009. A European guidance paper[21] proposes an eleven step approach to the identification and designation of HMWBs and AWBs. Work carried out to date, represents the first few steps of this process.

The morphological risk assessment was conducted using a number of datasets. River Habitat Survey (RHS) information was used to assess approximately 50% of Northern Ireland's water bodies. In addition, a map-based approach was used to identify additional pressures such as river straightening, land-use pressures, shoreline reinforcement and land reclamation. Future monitoring and regulation for morphological pressures will enable more comprehensive assessments to be carried out.

Map 23 shows examples of significant pressures that have been considered in carrying out the risk assessments. Those water bodies which are affected by morphological pressures are shown in Map 24 (surface waters).

For each water body considered to be at risk, we have recorded the nature of the pressure and the general industry sector to which this pressure can be attributed. Summary information is provided in the following tables and pie charts.

Table 22: River water bodies affected by morphological alterations

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	65	11.8	1,837	12.4
	1b	315	57.3	8,369	56.6
	2a	163	29.6	4,441	30.0
	2b	7	1.3	134	0.9
Total		550	100	14,781	100
Total predicted at risk	1a+1b	380**	69.1	10,206	69.1

**A total of 148 and 11 river water bodies have been provisionally identified as HMWB and AWB respectively.

Figure 11 shows the general industry sectors affecting river water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

[21] http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/modified_guidance&vm=detailed&sb=Title

Figure 11: General industry sectors affecting 1a and 1b river water bodies (morphological alterations)

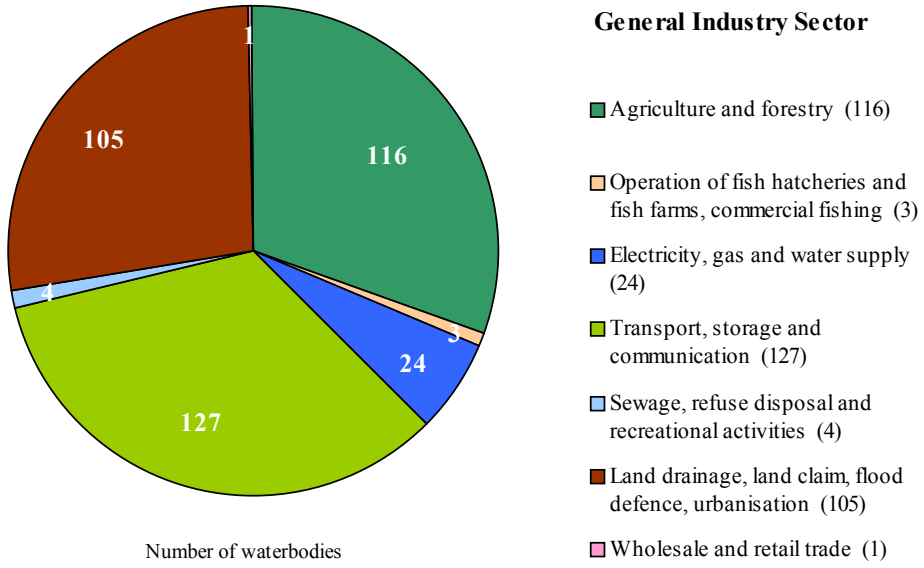


Table 23: Lake water bodies affected by morphological alterations

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	7	29.2	5	0.9
	1b	8	33.3	523	96.1
	2a	5	20.8	7	1.3
	2b	4	16.7	9	1.7
Total		24	100	544	100
Total predicted at risk	1a+1b	15**	62.5	528	97.0

** A total of 15 lake water bodies have been provisionally identified as HMWBs

Figure 12 shows the general industry sectors affecting lake water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 12: General industry sectors affecting 1a and 1b lake water bodies (morphological alterations)

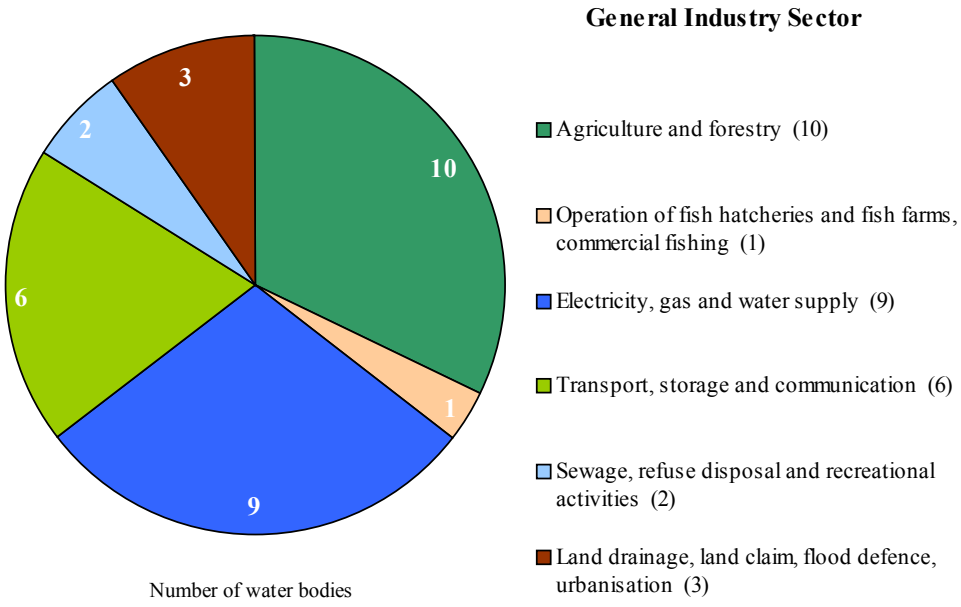


Table 24: Transitional water bodies affected by morphological alterations

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	1	14.3	0.3	0.8
	1b	6	85.7	40.7	99.2
	2a	0	0	0	0
	2b	0	0	0	0
Total		7	100	41	100
Total predicted at risk	1a+1b	7**	100	41	100

** A total of 7 transitional water bodies have been provisionally identified as HMWBs.

'Land drainage, land claim, flood defence, urbanisation' is the only industry sector affecting 1a and 1b transitional water bodies for morphological alterations.

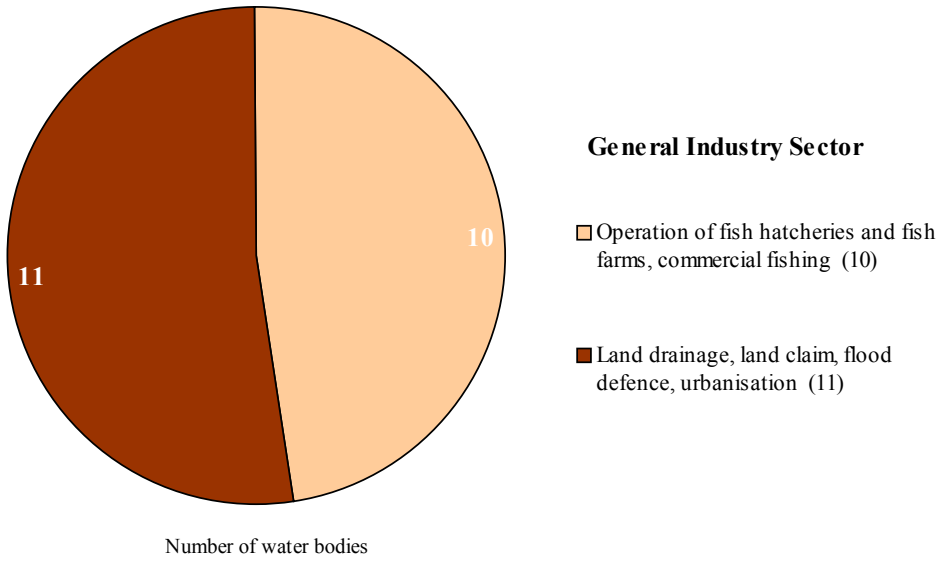
Table 25: Coastal water bodies affected by morphological alterations

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	4	20.0	150	11.6
	1b	12	60.0	845	65.2
	2a	4	20.0	300	23.2
	2b	0	0	0	0
Total		20	100	1,295	100
Total predicted at risk	1a+1b	16**	80.0	995	76.8

**A total of 16 coastal water bodies have been provisionally identified as HMWBs

Figure 13 shows the general industry sectors affecting coastal water bodies in categories 1a and 1b. A water body may be affected by more than one sector, and can therefore be counted more than once in the pie chart.

Figure 13: General industry sectors affecting 1a and 1b coastal water bodies (morphological alterations)



6.6 Other human pressures and assessment of impact

Invasive species (also referred to as 'alien species') are organisms which successfully establish themselves in a locality and then overcome otherwise intact, pre-existing, native ecosystems. There is growing evidence that invasive species can pose a major threat to native flora and fauna. Many invasive species have been deliberately or accidentally introduced by humans as a result of increased global trade and travel.

They can result in loss of natural biodiversity and may have significant economic impact. It is the damage that invasive species cause to native flora and fauna that is the focus of concern in the assessments carried out for the Water Framework Directive. The risk assessment carried out for this report has focused on seven species which have been selected because of the known severity of their impact and because of data availability about their presence in Northern Ireland.

Those water bodies which are affected by alien species are shown in Map 25 (surface waters). In the future other human pressures will be included in the assessment.

Table 26: River water bodies affected by alien species

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	0	0	0	0
	1b	6	1.1	305	2.1
	2a	12	2.2	372	2.5
	2b	532	96.7	14,104	95.4
Total		550	100	14,781	100
Total predicted at risk	1a+1b	6	1.1	305	2.1

Table 27: Lake water bodies affected by alien species

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	3	12.5	134	24.7
	1b	7	29.2	392	72.0
	2a	2	8.3	9	1.6
	2b	12	50.0	9	1.7
Total		24	100	544	100
Total predicted at risk	1a+1b	10	41.7	526	96.7

Table 28: Transitional water bodies affected by alien species

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	0	0	0	0
	1b	0	0	0	0
	2a	7	100	41	100
	2b	0	0	0	0
Total		7	100	41	100
Total predicted at risk	1a+1b	0	0	41	100

Table 29: Coastal water bodies affected by alien species

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	0	0	0	0
	1b	9	45.0	546	42.2
	2a	11	55.0	749	57.8
	2b	0	0	0	0
Total		20	100	1,295	100
Total predicted at risk	1a+1b	9	45.0	546	42.2

6.7 Summary of water bodies affected by all pressures

Sections 6.2 to 6.6 have presented information about the different types of pressures acting on water bodies. Many of the water bodies are affected by more than one type of pressure and this section shows an overall summary. Map 26 (surface waters) and Map 27 (groundwater) show all water bodies predicted to be at risk from all pressures of failing the Directive's environmental objectives.

The tables below show that the majority of our surface waters are predicted to be 'at risk' of failing to meet the Directive's environmental objectives. For rivers, 59% are 'at risk' and 39% are 'probably at risk'. The risks can be attributed to a range of pressures: point source pollution, especially by sewage; diffuse source pollution, especially from agriculture; and morphological alterations. This represents 99% of the land area of Northern Ireland. Our lakes, of which 63% are 'at risk' and 33% are 'probably at risk' are similarly affected by these pressures.

Our estuaries (transitional water bodies) have provided important sites for industrial and urban development, and, as such, have over the years been subjected to extensive morphological alterations, and also ongoing activities. Water quality problems are also significant as water drains to the sea from our rivers and from more local discharges. These assessments have identified 57% as 'at risk' and 43% as 'probably at risk'.

Coastal waters are at risk from point source discharges because of inadequate levels of sewage treatment, and activities leading to morphological alterations, giving 60% as 'at risk' and 35% as 'probably at risk'.

While only a relatively small percentage (22%) of groundwater bodies are identified as 'at risk' or 'probably at risk', this represents 44 % of the land area. This is predominantly due to intensive agriculture around Lough Neagh and Strangford Lough, and urbanisation and concentrated abstraction in the area around Belfast. The method for delineating groundwater bodies, based on hydrogeological considerations, means that in border areas some groundwater bodies extend into Ireland. For those cross-border bodies, consideration has also been given to risk assessment results available for the portion of the body falling within Ireland.

Table 30: River water bodies affected by all pressures

	Reporting category	Number of water bodies	% of number	Length (km)	% of length
Rivers	1a	323	58.7	9,670	65.4
	1b	215	39.1	4,849	32.8
	2a	12	2.2	262	1.8
	2b	0	0	0	0
Total		550	100	14,781	100
Total predicted at risk	1a+1b	538	97.8	14,519	98.2

Table 31: Lake water bodies affected by all pressures

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Lakes	1a	15	62.5	525	96.5
	1b	8	33.3	15	2.7
	2a	1	4.2	4	0.8
	2b	0	0	0	0
Total		24	100	544	100
Total predicted at risk	1a+1b	23	95.8	540	99.2

Table 32: Transitional water bodies affected by all pressures

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Transitional	1a	4	57.1	3	8.5
	1b	3	42.9	38	91.5
	2a	0	0	0	0
	2b	0	0	0	0
Total		7	100	41	100
Total predicted at risk	1a+1b	7	100	41	100

Table 33: Coastal water bodies affected by all pressures

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Coastal	1a	12	60.0	898	69.4
	1b	7	35.0	367	28.3
	2a	1	5.0	30	2.3
	2b	0	0	0	0
Total		20	100	1,295	100
Total predicted at risk	1a+1b	19	95.0	1,265	97.7

Table 34: Groundwater bodies affected by all pressures

	Reporting category	Number of water bodies	% of number	Area (km^2)	% of area
Groundwater	1a	2	3	183	1.4
	1b	13	19.4	5,826	42.9
	2a	39	58.2	7,298	53.7
	2b	13	19.4	280	2.0
Total		67	100	13,587	100
Total predicted at risk	1a+1b	15	22.4	6,009	44.3

6.8 Groundwater bodies for which lower objectives may be specified

Sections 2.4 and 2.5 of Annex II of the Directive require member states to identify those bodies of groundwater for which lower objectives are to be specified under Article 4 including where achieving good groundwater chemical and quantitative status is infeasible or disproportionately expensive.

Based upon guidance being developed by UKTAG, only one groundwater body is currently considered to potentially require less stringent objectives set, due primarily to water quality issues associated with both agriculture and industrial land use. This body is located beneath the Greater Belfast area.

This provisional identification is based on a hydrogeological expert assessment of whether remedial action will be sufficiently effective by 2027 and the likelihood of remedial action being disproportionately expensive.[22]

The identification of such bodies of groundwater should be regarded as preliminary. It is based on the best available information at the present time. However, the gaps in current information and the uncertainties include:

- A daughter directive on groundwater, which will clarify the approach to 'good status' has yet to be agreed;
- Standards to be applied in setting 'good status' have yet to be established;
- Uncertainties remain on the meaning of ecological and chemical status for surface waters, on which the definition of good groundwater status is dependent;
- Consideration (at EU and UK level) of how exemptions including lower objectives should operate in accordance with Article 4 are at an early stage. The identification of bodies of groundwater likely to require such exemptions at this stage pre-empts much of this ongoing work;
- No consideration of socio-economics has yet been undertaken;

Further characterisation will provide more information about groundwater characteristics and pressures and impacts. This work, together with progress establishing the approaches to good status, setting lower objectives and considering socio-economic factors, should address uncertainties listed above. Consequently revisions may be made to the number bodies of groundwater likely to require lower objectives included in this report, when the time comes to identify such groundwater bodies in River Basin Management Plans in 2009.

[22] http://www.wfduk.org

6.9 General trends and future pressures

General trends and future pressures have not been taken into account in the risk assessments carried out on individual water bodies. In many cases the trend and future pressure information is uncertain.

Changes in land use, coastal use, future development pressure and the increased use of renewable energy sources are some examples of pressures that may result in risks to the water environment. While new pressures will be regulated to ensure that no deterioration in status occurs, it is important to consider these future pressures during the river basin management planning process. Some of these foreseeable pressures may require a more strategic regional approach to prevent damage to the water environment, rather than measures confined to individual water bodies.

Land use changes

Following the Biodiversity Convention at the Earth Summit in Rio de Janeiro in 1992, the UK Biodiversity Action Plan set out a programme of action to conserve and enhance biological diversity throughout the UK. A classification of 'broad habitats' was defined as a context for priority habitats and species requiring conservation, and to facilitate habitat comparison within the UK. A study was conducted by EHS to determine the net changes in broad habitats between the early 1990s and 1998. The main changes in Northern Ireland broad habitats in the 1990s were an increase in the area of Improved Grassland, and decreases in the areas of Natural Grassland and Arable and Horticulture habitats. To assess changes at a regional Northern Ireland scale and to inform decisions on sustaining biodiversity, Primary Habitats were also assessed. There was no net change in Agricultural Grassland and Crops but the area of Semi-natural Vegetation decreased, while Woodland and Scrub increased. Buildings and Roads cover increased, particularly in upland landscapes, built primarily over Agricultural Grassland and Crops. This was indicative of urban and rural land use change.

The common agricultural policy (CAP) has been the major influence on land use changes over the last 30 years. The increased stocking levels and pesticide and fertiliser use associated with agricultural intensification has resulted in increased pressures and impacts on the water environment. CAP reform will become effective in 2005 and may lead to benefits for water quality, landscape and biodiversity. The resulting changes in farming patterns and management practices are likely to reduce overall water pollution levels. However, the changes may lead to fewer, larger enterprises, particularly in the dairy sector, that could have negative effects on the water environment, unless measures are in place to ensure that no deterioration occurs.

Land use decisions and management practices can affect water quality. Diffuse pollution can arise from urban areas, roads, forestry and agricultural land. Many of these problems are currently being addressed through, for example, sustainable urban drainage systems and agricultural best management practices. In areas where these types of land use

changes continue, measures will need to be put in place to ensure that no deterioration in status occurs.

Coastal Use Changes

A number of pressures in the coastal environment have potential implications for future implementation and compliance with the Directive in transitional and coastal waters. Coastal development in response to population expansion is likely to increase, particularly in the region of Belfast, which may include expansion of ports and harbours. Northern Ireland's coastal waters have seen a large and rapid expansion in aquaculture in the last five years. This is particularly evident for bottom culture of mussels (*Mytilus edulis*) and Pacific oysters (*Crassostrea gigas*). Future expansion, and husbandry techniques are likely to influence ecological status in areas subject to aquaculture. Fisheries techniques that have the potential to impact benthic communities may change as other species are exploited. Alternatively, new dredging and trawling techniques may be developed that have less impact. Changes in land use practise will result in variation in the quantity and composition of sediment, nutrients and contaminants that ultimately are transported to transitional and coastal waters.

Future Development Pressures

A review of current Area Development Plans and strategy documents was carried out to determine proposed future regional development. The Planning Service is currently engaged in a substantial development plan programme, with thirteen plans either published or under review. Some plans are at an early stage and as such do not provide any information on future development.

Northern Ireland has one of the fastest population growth rates in Europe and it is estimated that there will be a regional need for an additional 160, 000 dwellings by 2015. These are expected to be concentrated in the Belfast metropolitan area, around Londonderry, and to a lesser extent in the Antrim, Ards, Down, and Newry and Mourne areas.

There are also a number of strategic road improvements indicated by the Proposed Regional Strategic Network Transport Plan 2015. The schemes include proposed bypasses, link roads, slip roads and junction improvements.

These future development pressures, such as those shown in Map 28, will need to be considered when programmes of measures are established.

Increased Renewable Energy Sources

Following the Framework Convention on Climate Change, 1997 (the Kyoto Protocol), the UK Government set a target for the increased use of renewable energy sources. The target set is that 10% of electricity should be generated from renewable energy sources by the end of 2010, with the figure rising to 20% by 2020. The publication of 'Vision 2010

– Energy Action Plan' indicated that Northern Ireland would be contributing to the UK targets. The target set for Northern Ireland is that by 2012, 12% of all electricity consumed is generated from renewable sources.

For Northern Ireland this contribution may come from a number of renewable sources such as terrestrial and offshore wind farms, tidal current turbines, and solar, geothermal and biomass based technologies.

Northern Ireland has significant wind resources, especially along its coastline. However, due to construction difficulties in water depths greater than 20 m, there are only a small number of sites potentially available for offshore wind power generation.

The future scope of offshore wind farms will depend on the development of second-generation technology that can utilise deep water sites. However, the potentially high construction costs associated with deep water sites could rule this out.

Northern Ireland has significant potential energy resources bound up in tidal currents around its coastline. This energy could be harnessed through underwater turbine technologies. Locations such as the Strangford Lough Narrows, off the Copeland Island, Fair Head, Torr Head to Runabay Head, Carlingford Lough and off Rathlin Island have currents strong enough to be exploited. Again, as with offshore wind farms, there are construction problems because of water depth, and only second-generation turbines would be suitable for the majority of the above locations.

Climate Change

Climate change is likely to impact the water environment. However, it is uncertain as to what the exact impacts will be and where they will occur. The United Kingdom Climate Impacts Programme (UKCIP) has published a number of scenarios for climate change over the next 80 years. These are based on low, medium and high levels of greenhouse gas emissions, with high levels representing the worst case scenario.

It is predicted that the average annual temperature will increase, with the increases greatest in summer and autumn. Winter precipitation is likely to increase and summers to become drier. In addition, the frequency of intense weather incidents is likely to be higher. Relative humidity may decrease slightly and there is likely to be a large decrease in winter snowfall. The wind speed is also likely to decrease, especially on the east coast.

Increased temperatures could lead to raised surface water temperatures, resulting in changes in the rate of biochemical processes that determine water quality. There would be an impact on dissolved oxygen, biochemical oxygen demand and nutrient levels in the water leading to detrimental impacts on indigenous flora and fauna. The problem would be further exacerbated in nutrient rich water bodies due to increased algal growth. Drier summers would increase the periods of low river flows, reducing the capacity to dilute

effluent discharges. This would necessitate more stringent effluent discharge consents. There could be a greater risk of stratification in lakes and reservoirs due to increased temperatures and incident solar radiation, and slightly reduced wind driven mixing in spring. This could encourage algal growth and changes in the rates of biochemical processes as for rivers. In all surface waters, the increase in temperatures could lead to changes to biological populations suited to warmer waters.

Increases in autumn and winter precipitation intensities would increase the risk of physical damage to river channels. The resultant soil erosion and sedimentation could adversely affect invertebrate and fish populations. Increased heavy precipitation events could also cause combined sewer overflows to operate more frequently. This would result in spills of highly polluting sediments built up during periods of drier weather. Changes in precipitation patterns may have implications for groundwater resources influencing when and how much recharge occurs and what loadings of contaminants leach from soils to the underlying water table. The risk of saline intrusion into coastal aquifers would be increased by a future rise in sea level.

In some cases, for example increased rainfall, it may be more likely that environmental objectives will be achieved, as pollutants will receive more dilution. Conversely, it may be more difficult to achieve objectives if there are prolonged periods of drier weather. The Directive states that temporary deterioration in the status of water bodies is allowable if this arises from exceptional circumstances such as extreme floods and prolonged droughts but less severe weather changes may still impact on the water environment making it easier or harder to achieve the objectives.

7. Conclusions and next steps

This report presents the first stage in characterisation required under the WFD. It sets out the initial assessment of water bodies predicted to be at risk of not meeting the Directive's requirements by 2015. It is the start of an ongoing process, and will be subject to further refinement and review, as more information becomes available.

It is important to remember that water bodies identified as 'at risk' may not necessarily be at poor status, but that they are identified as areas where management actions may be applied to ensure good status is maintained, or to ensure that environmental objectives are met by 2015. The assessments also cover activities and pressures not previously considered in the management of the water environment in Northern Ireland, such as abstraction, flow regulation, morphological alterations and land use.

It should also be remembered that a number of programmes and actions are already underway to address some of the problems associated with pollution, and these will remain a priority under the WFD. The current assessment is therefore deliberately precautionary in nature to ensure that all areas which may be at risk are subject to ongoing investigation and management actions where necessary.

Further work now needs to be carried out and this will include:

- Review and implementation of the aquatic monitoring network by 2006, including a wider range of monitoring to meet the requirements of the Directive, and to reflect the range of pressures to be assessed.
- Water bodies assessed as 'probably at risk' will be reviewed and investigated to establish if they are at significant risk, by 2007
- Taking forward the findings of this report into the River basin Planning process. Consideration is being given on how best to involve stakeholders within river basins and views will be sought over the coming year.

Abbreviations

AWB	Artificial Water Body
CAP	Common Agricultural Policy
DoE	Department of the Environment
DEHLG	Department Environment Heritage and Local Government
EC	European Community
EQS	Environmental Quality Standards
EU	European Union
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HMWB	Heavily Modified Water Body
RBD	River Basin District
RBMP	River Basin Management Plan
UKTAG	United Kingdom Technical Advisory Group

Annex 1: Summary of environmental objectives and issues surrounding their assessment

The environmental objectives that need to be achieved under the Directive are somewhat complex but in simplified terms are:

For surface water:

- achievement of good ecological status and good surface water chemical status by 2015
- achievement of good ecological potential and good surface water chemical status for heavily modified water bodies (HMWB) and artificial water bodies (AWB)
- prevention of deterioration from one status class to another
- achievement of water related objectives and standards for protected areas
- progressive reduction in discharges of Priority Substances and a cessation of discharges of Priority Hazardous Substances.

For groundwater

- achievement of good groundwater quantitative and chemical status by 2015
- prevention of deterioration in status
- reversal of any significant and sustained upward trends in pollutant concentrations and prevention or limiting of input of pollutants to groundwater
- achievement of water related objectives and standards for protected areas

Water bodies have been identified as being at risk if they are likely to fail any of these environmental objectives. The focus of the first pressure and impact analysis has been on the risk that water bodies will fail to achieve good status by 2015. Under the future WFD classification scheme for surface waters, good status will mean that at least mandatory standards need to be met for the following protected areas: freshwater fish, shellfish growing waters, bathing waters, nitrate vulnerable zones and areas designated as sensitive under the Urban Waste Water Treatment Directive. Objectives for drinking water protected areas and Natura 2000 sites will also need to be met. Therefore, where existing mandatory protected area objectives are not being met we have identified relevant water bodies as at risk.

For groundwaters, a new directive is under negotiation which is intended to establish specific measures to prevent and control groundwater pollution including the setting of chemical standards which will define good chemical status.

The risk assessment has generally been based on the current situation and does not take into account future scenarios or planned improvements. Therefore we are assuming that if a water body is currently at risk then it is predicted to be at risk in 2015. There is one exception to this; improvements that are assumed to occur as a result of the DRD Water Service Capital Works programme commitments which are due to start by the end of 2005.

It should be noted that transitional, coastal and groundwater bodies are typically very large and may be identified as being at risk due to localised pressures affecting only small portions of a water body. Any programme of measures established will take this into account, and the potential for sub-dividing or combining bodies will also be considered. There are a number of issues which have not been resolved or addressed within the current reporting timescales. The table below sets out how we have dealt with these in the interim, and the effect this has on the assessments reported here.

Issue	**Solution**	**Effect on assessment**
Good ecological status has not yet been defined across Europe	An intercalibration exercise is being completed across Europe. We have used preliminary criteria from UKTAG in the interim	A water body 'at risk' cannot be interpreted as meaning the water body is not of 'good ecological status'
Good ecological potential, which applies to HMWBs and AWBs has not yet been defined. Also HMWBs and AWBs are not yet designated	All water bodies have been assessed in relation to good status.	Water bodies which are identified as 'at risk' and are provisionally identified as HMWBs and AWBs may meet good ecological potential in future.
The aim of the assessments is to predict achievement of good status by 2015. It is difficult to predict changes up to this date.	We have made the assumption that if a water body is at risk currently, it will still be at risk in 2015. The only exception is where planned investment in waste water treatment is due to start by 2005.	All 'at risk' water bodies will be subject to further review under the river basin planning process to determine appropriate future action.
Assessments have been carried out on the basis of information available within Northern Ireland	Action is being undertaken to establish consistency in assessments in cross-border areas with the Republic of Ireland	Some water body categories may change as a result of review of pressures and impacts in IRBDs
Drinking water protected areas have only recently been identified so we have not assessed specific objectives for these areas.	This will be considered at a later stage and reported in the next characterisation report in 2013. At present we have assessed water bodies in relation to good status	All 'at risk' water bodies will be subject to further review under the river basin planning process to determine appropriate future action.
Protected area objectives for water dependant Natura 2000 sites area based on draft 'Favourable Conditions'	Objectives will be reviewed and assessments repeated once objectives are finalised. As a minimum, we have assessed water bodies in relation to good status.	Some water body categories may change as a result of applying more stringent objectives when these are available.
Lack of nationally consistent data or absence of data	We have used the best information we have available. In the absence of data we have used alternative methods such as modelling or expert judgement	Many of the water bodies have been identified as 'probably at risk' or 'probably not at risk'. The former will be reviewed by 2007, and the latter by 2013.
Assessments have not been carried out on small water bodies	The small water body dataset will be finalised as part of further characterisation. Small water bodies will then be assessed using the same methodology as applied to the baseline water body dataset.	Additional water bodies may be identified as at risk by 2007, and will be included in the river basin planning process.

Annex 2: Sources of information

Europa: European guidance on heavily modified water bodies:

http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/modified_guidance&vm=detailed&sb=Title

Europa: European guidance on identification of surface water bodies:

http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/identification_bodies&vm=detailed&sb=Title

Europa: Water Framework Directive text:
http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_327/l_32720001222en00010072.pdf

Environment and Heritage Service: short method statements

- Small water body strategy
- River typology
- River reference conditions
- Lake typology
- Lake reference conditions
- Transitional and coastal waters typology
- Transitional and coastal waters reference conditions
- Groundwater dependent terrestrial ecosystems
- Groundwater body delineation
- Register of protected areas
- Pressures and impact analysis
- Morphology

http://www.ehsni.gov.uk/environment/waterManage/wfd/characterisation/techreports/techreports.shtml

Environment and Heritage Service: protected area register for Northern Ireland
http://www.ehsni.gov.uk/environment/waterManage/wfd/register/RegProtArea.shtml

UKTAG guidance on groundwater body delineation:
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5420/view

UKTAG guidance on groundwater dependent terrestrial ecosystems (identification):
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/TAG2003%20WP%205a-b%20%2801%29/view

UKTAG guidance on pressure and impact analysis (various papers):
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/view

UKTAG guidance on protected areas (identification):
http://www.wfduk.org/tag_guidance/Article_06-07/view

UKTAG guidance on small waters:
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5420/view

UKTAG guidance typology (lakes):
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5312/view
UKTAG guidance typology (rivers):
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5312/view

UKTAG guidance typology (transitional and coastal waters):
http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5312/view

UKTAG reference condition descriptions:

http://www.wfduk.org/tag_guidance/Article_05/Type%20specific%20reference%20conditions/view

Annex 3: Characterisation maps

See http://www.ehsni.gov.uk/environment/waterManage/wfd/characterisation/Art_5_Maps.shtml

Map (i):Typology for transitional and coastal waters for the island of Ireland (Ecoregion 1).
Map 1: Northern Ireland river basin district and international river basin districts
Map 2: NS SHARE study area
Map 3: Physical boundaries of the river basin district and international river basin districts within Northern Ireland
Map 4: Main river catchments and types
Map 5: Lake types
Map 6: Transitional water types
Map 7: Coastal water types
Map 8: Groundwater vulnerability
Map 9: Groundwater bodies
Map 10: Groundwater dependent surface water bodies and terrestrial ecosystems
Map 11: Waters used for the abstraction of drinking water
Map 12: Areas designated to protect economically significant aquatic species and bathing water directive beaches
Map 13: Nutrient sensitive areas
Map 14: Water dependent conservation areas
Map 15: Point source pressures
Map 16: Surface water bodies affected by point source pollution pressures
Map 17: Land use in Northern Ireland
Map 18: Surface water bodies affected by diffuse pollution pressures
Map 19: Groundwater bodies affected by diffuse pollution pressures
Map 20: Abstraction and flow regulation pressures
Map 21: Surface water bodies affected by abstraction and flow regulation pressures
Map 22: Groundwater bodies affected by abstraction pressures
Map 23: Morphology pressures and river habitat survey sites
Map 24: Surface water bodies affected by morphological pressures
Map 25: Surface water bodies affected by alien species pressures
Map 26: Surface water bodies affected by all pressure types
Map 27: Groundwater bodies affected by all pressure types
Map 28: Future development pressures

Please note: Northern Ireland coastal and transitional waters include shared waters associated with International River Basin Districts.

ISBN 1 905127 06 05