Foyle Water Quality Management Plan

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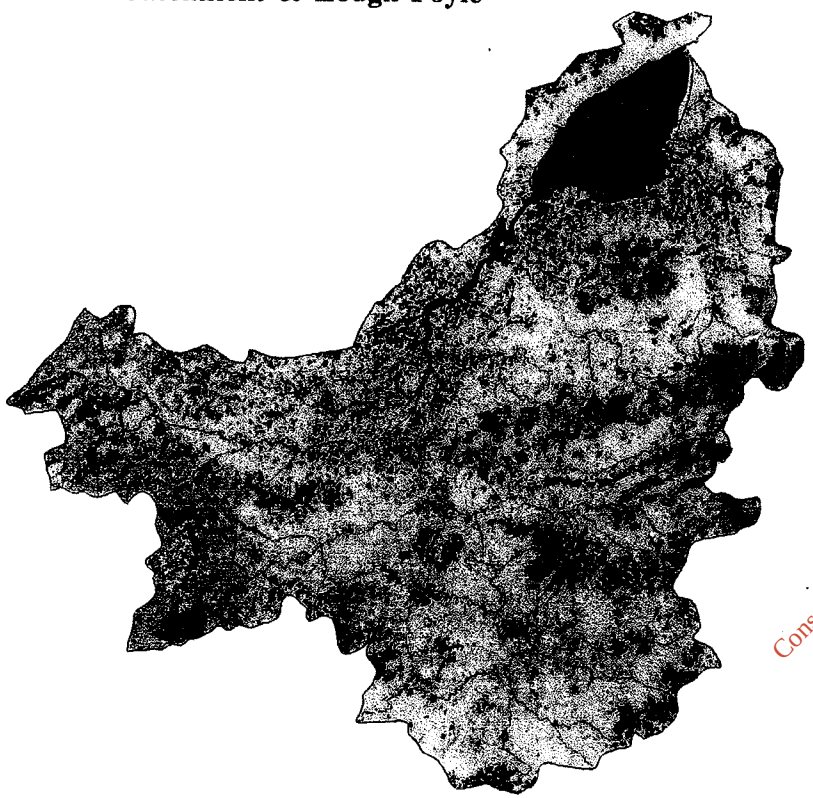
Proposals for a Water Quality Management Strategy for the Foyle Catchment & Lough Foyle



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SECTION A

INTRODUCTION

A1. THE CONCEPT OF CATCHMENT MANAGEMENT

A1.1 CATCHMENT PLANNING

Catchment management planning is the process by which the problems and opportunities resulting from catchment uses are assessed and action is proposed to optimise the overall future well-being of the water environment. A catchment use is defined as a direct use of the water environment or an activity which impacts on it. Catchments are defined as discrete geographical units with boundaries derived primarily from surface water considerations and comprise one or more hydrometric subcatchments.

The catchment is seen as the natural management unit for integration of the work programmes of all national and local government agencies relating to water quality, water resources and ecosystem management. Catchment plans summarise relevant data and include an agreed action programme to optimise environmental protection. The catchment planning process is seen as a medium for promoting discussion, resolving conflict, assigning priorities, and setting targets by which progress on key issues can be monitored.

In Northern Ireland, and throughout the United Kingdom, catchment plans have no formal status in the statutory planning process. They are intended to make a positive input to regional and district plans. Catchment planning has been practised in one form or another by the Department of the Environment for Northern Ireland, and by other regional water authorities in the UK. In 1990, the National Rivers Authority in England commenced a programme for catchment planning using standard methods and nomenclature.

The Republic of Ireland made statutory provision for catchment planning in the Water Pollution Act of 1977. The term used is water quality management plan. Plans have been adopted on eight catchments and estuaries and many more are in draft form. The most recent plan was adopted in 1993, in which the approach of the earlier plans was considerably widened to encompass all uses of the watercourses including amenities and habitat protection.

A1.2 OBJECTIVES OF CATCHMENT MANAGEMENT ON THE FOYLE

In transboundary regions, the concept of catchment planning as a coordinated effort among government agencies is particularly appropriate. In the Foyle Catchment and in Lough Foyle, there are many similarities in the management practices in Northern Ireland and the Republic of Ireland. Much of the specialised environmental legislation arises from European Community Directives which are common to both jurisdictions. In the past, the high level of consultation and copperation among government agencies has led to improved environmental protection and enhancement.

These proposals for a water quality management plan are intended to provide a focus for the coordination of future environmental protection.

The objectives of the management plan for the Foyle Catchment and Lough Foyle have been determined by both Departments of Environment as follows:

1. To prevent and abate pollution of waters.

2. To safeguard public health.

3. To protect and, where necessary, improve the ecology of the waters.

4. To ensure that the waters are of sufficiently high quality to satisfy the requirements in respect of their various uses, particularly:

   - abstraction for domestic, industrial and general uses,
   - fishery,
   - recreation, and tourism,
   - wildlife conservation and habitat protection,

5. To identify and protect the major aquifers from pollution.

6. To provide a framework for water quality management on the basis of which the development of the catchment can proceed in a balanced and sustainable manner.

7. To ensure that monitoring and information systems are adequate and sufficient to support water quality management decisions.

8. To ensure that financing of pollution control programmes is based on efficient and effective strategies.

9. To identify the needs for investment in public and private waste water treatment facilities.

10. To facilitate the implementation of relevant EC legislation.

A1.3 CONSULTANT'S REPORT ON PROPOSALS

This report presents the initial stage in the development of a water quality management plan for the catchment.

It has been produced on the basis of existing information and information obtained from monitoring or other investigations undertaken by public authorities in recent years. Apart from some extra chemical and biological monitoring put in place by DoE (NI) and Donegal County Council no specific sampling and analysis programmes were undertaken for the purpose of this report and no detailed studies were made in areas where the information was considered deficient.

This Consultant's Report is an interim document, intended to provide proposals

for consideration by both Departments of the Environment. The proposals may be used to inform users of the catchment, interested organisations or individuals on the state of the catchment and on management options. Based on this information, users and interested parties should be able to form a view, reach a consensus and adopt a common policy on different catchment uses and on corresponding environmental objectives.

The work of the consultants was co-ordinated by the Foyle Catchment Technical Working Group, comprising representatives of various government agencies, chaired by the Department of the Environment for Northern Ireland. The group prepared a brief:

"The proposals will include the following main elements in so far as they apply to the waters of the catchment, having regard to the finances available for the project and the priority attached to the elements listed:-

1. A description of the administrative and legislative framework relating to water quality management in both jurisdictions and of water quality protection policies and legislation, particularly as they relate to quality objectives, standards, guidelines and codes of practice.

2. A general description of the catchment, including its geomorphology, landuse, urban settlements, industry and agriculture, fisheries and port development.

3. An inventory of existing and proposed water abstractions.

4. A description of fishery resources, including shell fisheries.

5. A description of recreation and amenity resources.

6. A general description of nature conservation and cultural heritage resources.

7. An analysis of the hydrological and hydrometric characteristics of the catchment.

8. An inventory and assessment of the main pollution loads, both point source and diffuse.

9. Recommendations in respect of water quality objectives.

10. An assessment of water quality.

11. A comprehensive and integrated monitoring system for the catchment and cost estimates for same.

12. Recommendations in respect of criteria for the setting of standards for sewage and industrial effluents.

13. Recommendations in respect of needs for investment in public and private wastewater treatment facilities.

14. An assessment of management options for the protection and enhancement of water quality."

The area included in the proposals is the freshwater zone and estuary, and Lough Foyle. The scope is limited to the watercourses and lakes shown on the 1958 Ordnance Survey map of Ireland entitled: "Rivers and their Catchment Basins". Groundwater studies are limited to the collation and assessment of existing information on groundwater quality, and to the identification of major aquifers and aquifers at risk.

The outward geographical limit of the Lough has been taken as being represented by an imaginary line from Magilligan Point to the Martello Tower at Greencastle.

A2. THE LEGISLATIVE FRAMEWORK

A2.1 INTRODUCTION

Environmental policy in Northern Ireland and the Republic of Ireland has evolved over a long period through a series of legislative, institutional and programme developments.

This section provides an overview of the major enactments in the areas of public health, water pollution, physical planning and wildlife protection. Recent specialised environmental legislation arises from European Union (EU) Directives and these are considered first. The specific national legislation relevant to water quality is then outlined.

Appendix A2.1 lists the important European Directives, National Legislation and International Conventions which relate to water quality management. The objective of each piece of legislation is reviewed and summarised separately in the appendix, in chronological order. A table of water quality standards derived from the legislation is also presented in Appendix A2.2.

Certain limitations of the legislative framework arise in the development of a management strategy for the Foyle Catchment. These are discussed later in the sections dealing with the various uses in the management options.

A2.2 INTERNATIONAL LEGISLATION

A2.2.1 European Union

It is clear that the European Union has a continued interest in developing regulations and procedures on issues which relate directly to catchment management. The Fifth EC Programme of Policy and Action in Relation to the Environment and Sustainable Development sets out the overall objectives on water quantity and water quality to be realised in the long term, targets to be reached by the year 2000 and activities needed in the short term.

There are several types of legislation that come from the European Union, set out in article 189 of the Treaty of Rome, although the term legislation does not actually appear in the Treaty. These are known as Regulations, Directives, Decisions and Recommendations/Opinions.

The primary instruments are the Directives. Although they are binding, they set out the results to be achieved leaving the methods of implementation up to the individual member states. A directive will also specify a date by which formal implementation is required, or when objectives should be attained. Directives tend to be flexible instruments which can be accommodated within the different national procedures and administrative structures. Related Directives have been grouped and are summarised as follows:

A2.2.1.1 Use Related Standards

The most important Directives which set water quality standards are Council Directive No. 78/659/EEC on the quality of freshwaters needing protection or improvement in order to support fish life, Council Directive No. 79/923/EEC on the quality required of shellfish waters and Council Directive No. 76/160/EEC concerning the quality of bathing water. These specify use-related standards for a wide range of parameters. National Governments designate areas where standards apply.

A2.2.1.2 Pollution Control

Council Directive No. 76/464/EEC on pollution caused by certain dangerous substances into the aquatic environment of the community is a framework directive which establishes methods for eliminating the pollution caused by certain substances due to their toxicity, persistence and bioaccumulation and controlling other substances through emission standards and reduction programmes. Council Directive No. 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances provides for authorisations of discharges and monitoring of the receiving groundwater environment.

Council Directive No. 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (commonly referred to as the Nitrates Directive) is concerned with control of polluting nitrates from agricultural sources and consequently it may have implications for intensively farmed areas.

Council Directive No. 91/271/EEC on Urban Waste Water Treatment fixes standards for sewage treatment which vary according to the size of discharge and the nature of the receiving water. In general, secondary treatment is required as the norm for larger discharges; tertiary treatment may be required for sensitive areas and primary treatment for less sensitive areas. The Directive also requires the phasing out of sewage sludge disposal to surface waters by the end of 1998.

A draft Landfill Directive has also been prepared, which provides for extensive monitoring and control of landfill operations, including aftercare on closure.

A2.2.1.3 Ecosystem Protection

Programmes for wildlife protection are included in EU Directives, most notably Council Directive No. 79/409/EEC on the Conservation of Wild Birds (commonly referred to as the Birds Directive) and Council Directive No. 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (commonly referred to as the Habitats Directive). Where species and habitats are designated, action plans to protect habitats must be developed and reports made regularly by member states of the European Union.

A2.2.1.4 Access to Information

In 1990, the EU adopted a Directive on Freedom of Access to Environmental Information; this will make a wide range of information available as of right. This emphasises the need to intensify environmental awareness and information programmes so that people know how they can help protect the environment.

A2.2.2 International Conventions

International conventions have been adopted by the Governments of the United Kingdom and the Republic of Ireland, relating to water quality. These cover a wide spectrum of issues, most notably plant protection, preservation of wetlands, marine pollution and wildlife and habitats. Many of these conventions require identification and designation of sensitive areas and development of protection programmes.

Relevant conventions include the 1951 International Plant Protection Convention (Rome), the 1971 Convention on Wetlands of International Importance especially as Waterfowl Habitat (commonly known as the Ramsar Convention), the 1972 Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (commonly known as the Oslo Convention), the 1974 Convention for the Prevention of Marine Pollution from land-based sources (commonly known as the Paris Convention), and the 1979 Convention on the Conservation of European Wildlife and Natural Habitats (commonly known as the Berne Convention).

Both the UK and ROI intend ratifying the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) in the near future. This Convention will replace the Oslo and Paris Conventions and addresses all sources of pollution of the marine environment and the adverse effects of human activity upon it.

A major United Nations initiative on Environment and Development was undertaken in 1992. A preparatory conference was held in Dublin in January 1992 to consider the sustainable management of freshwater resources. The resulting publication known as "The Dublin Statement" sets forth a framework which is an important reference for catchment management.

A2.3 NORTHERN IRELAND

Northern Ireland's environment is protected by a wide range of legislation which provide controls in the areas of water and air pollution; water resources; water supplies; sewerage services; disposals at sea; fisheries; land drainage; town and country planning; environmental impact assessment; licensing of waste disposal; the storage and disposal of radioactive substances; the conservation and enhancement of the landscape; flora and fauna and their habitats; the protection, recording and conservation of historic monuments and buildings and public health which includes nuisance and noise controls.

A2.3.1 Existing Enactments

The legal basis for the protection of the aquatic environment is contained in a number of Acts and Orders-in-Council and in regulations which have been made to transpose into Northern Ireland law and requirements of various EC Directives. Orders-in-Council made under the Northern Ireland Act 1974 have the same force and effect as an Act of Parliament.

The Water Act (Northern Ireland) 1972 places a duty on the Department of the Environment for Northern Ireland to promote the conservation of water resources and the cleanliness of inland and tidal waters and underground strata. Powers are also available in the Act to licence water abstraction but as yet the ample natural supplies of water has made it unnecessary to introduce general abstraction licensing.

The supply of water and sewerage services is the Department's responsibility under The Water and Sewerage Services (Northern Ireland) Order 1973, as amended. Regulations have been made for quality standards for public and private water supplies which give effect to the EC Drinking Water Directive. Other regulations transpose into Northern Ireland law the requirements of the EC Directives on the use of sewage sludge in agriculture and on urban waste water treatment.

The Foyle Fisheries Act (Northern Ireland) 1952 was enacted in parallel with the Foyle Fisheries Act 1952 in the Republic of Ireland to authorise an agreement on fishing rights in the tidal waters of the Lough and River Foyle and its tributaries. These Acts established a Foyle Fisheries Commission to manage certain fishing rights and conserve and improve fisheries in the Foyle Area in both jurisdictions. The Northern Ireland Act, which has since been amended on a number of occasions, provides powers for the Commission to take prosecutions for water pollution offences. Other relevant enactments indict the Fisheries Act (NI) 1966 and the subsequent Amendment Orders of 1968 and 1991.

Various EC Directives deal with water quality standards for specific uses of water, for example, surface water for drinking, bathing water, freshwater fish, shellfish and water for human consumption. Other Directives require controls over the discharge of dangerous substances to groundwater and inland and coastal waters, the discharge of urban waste water and pollution caused by nitrates from agricultural sources and from asbestos. Regulations have already been made or are being drafted to give effect to these Directives in Northern Ireland. In some instances the Regulations set more stringent standards than are required in the Directives.

The Pollution Control and Local Government (Northern Ireland) Order 1978 introduced licensing by district councils of waste disposal sites. These licences do not provide for water-pollution control which is regulated by the statutory consent system under the Water Act (Northern Ireland) 1972. Regulations prescribed waste licensing requirements, controls over the movement of special (dangerous or difficult) wastes and the transhipment of hazardous waste. The

latter give effect to EC Directives 78/319, 86/279, 85/469 and 87/112. New primary legislation on litter came into effect in 1994.

The current development control legislation is the Planning (Northern Ireland) Order 1991. The Department is the planning authority and planning permission is required for all new development and for material changes of use. Regulations provided for permitted development, minor changes of use and give effect to the EC Directive on environmental impact assessment. Planning applications are advertised in local newspapers inviting representatives from the public. District councils have a statutory right to be consulted before decisions are taken. Applicants have a right of appeal against refusals of planning permission and planning conditions.

The Watercourse Management Division of the Department of Agriculture for Northern Ireland is responsible for drainage and flood protection under The Drainage (Northern Ireland) order 1973.

A2.3.2 Proposed Legislation

Consultation papers has been published in Northern Ireland seeking comments on proposals for new primary legislation on integrated pollution control, waste management and a review of the Water Act.

Integrated pollution control regulates the most polluting emissions to air, water and land. The aim of integrated pollution control is to require, at the planning stage, the provision of technology to minimise waste (the best available technology not entailing excessive cost (BATNEEC)) and to require the discharge to be made to the environmental medium which will be least detrimental (best practical environmental option (BPEO)).

The proposed waste management legislation will provide the statutory basis for compliance with the EC Waste Framework Directive by encouraging the minimisation of waste and recycling and introducing the duty of care and licensing of waste carriers. Powers will also be taken to enable waste regulation responsibility to be centralised.

The proposed review of the Water Act (Northern Ireland) 1972 will take account of scientific advances, increase public environmental awareness and make provision for a charging system for discharge consents to implement the "polluter pays" principle.

A2.4 REPUBLIC OF IRELAND

A2.4.1 Existing Enactments

Major enactments have been in operation for many years in the areas of public health, physical planning, national monuments and wildlife protection. This has evolved into more specialised environmental legislation in recent years.

The primary legislative framework regarding water pollution control and water quality management is provided by the Local Government (Water Pollution) Acts 1977 and 1990 together with the Local Government (Water Pollution) Regulations 1978 and 1992. These provide wide powers for the protection of water of all kinds including inland waters, aquifers and tidal waters. Trade effluent and sewage effluent discharges are subjected to a licensing regime. Statutory powers rest principally with the local and sanitary authorities. The 1977 Act provides for the determination of a water quality management plan by a local authority.

The Environmental Protection Act of 1992 and associated regulations SI 84, 85 and 86 of 1994 make further provision for the protection of the environment, the control of pollution and the establishment of the Environmental Protection Agency. The functions of the agency are outlined later in the administrative framework. They include licensing of scheduled activities, including intensive farming, on the basis of integrated pollution control. The Agency may also prepare water quality management plans, if required by the Minister.

Regulations have recently (1994) been made under the Environmental Protection Agency Act implementing the Urban Wastewater Treatment Directive.

Of particular relevance to the Foyle catchment is the Foyle Fisheries Act of 1952 which authorised an agreement with respect to the fishing rights in the tidal waters of the Lough and the River Foyle and its tributaries. It provides for the management, conservation, protection and improvement of the fisheries in the Foyle area and established the Foyle Fisheries Commission.

Important anti-pollution provisions are also contained in Sections 171 and 172 of the Fisheries (Consolidation) Act, 1959. Detailed specifications are presented for fisheries protection, such as sizes of fish screens, and powers of prosecution are granted to fisheries boards for pollution impacts on fisheries.

The origins of the vast majority of water quality standards are the various Directives of the European Union which specify the quality required of waters for different uses. The actual standards in force are the Regulations made by the Minister of the Environment which give legal effect to the European Directives. All of the major directives relating to catchment management have been implemented. Regulations may contain stricter standards than the Directives and they take precedence over the Directives. Quality standards are in operation for inter-alia bathing waters, salmonid waters, drinking waters and groundwater. Effluent standards have been prescribed in relation to a number of substances including cadmium and asbestos.

Irish waste legislation has been developed principally to transpose the requirements of relevant EU directives, although comprehensive domestic legislation exists in relation to litter. Regulations which make the major local authorities responsible for the planning, organisation, licensing and supervision of waste disposal operations have been in force since 1979. Further regulations deal more specifically with control of hazardous wastes.

Regulations were made in 1991 implementing the Directive on use of sewage sludge in agriculture, which prescribes standards relating to the soil environment.

The Local Government (Planning and Development) Act, 1963 established a comprehensive authorisation procedure for new developments by which all new developments are subject to planning permission requirements. Applications for permission have to be assessed by reference to considerations of proper planning and development. The latter concept includes environmental as well as land use considerations. Irish planning law recognises the need for public participation in decision making, through the existence of a universal third party right of appeal on development proposals and other mechanisms.

The development and maintenance of flood defence and drainage is provided for in the 1945 Arterial Drainage Act. The Commissioners of Public Works are responsible for major schemes carried out on a comprehensive catchment basis.

A2.4.2 Proposed Enactments

Legislation has been drafted to amend the Wildlife Act, 1976; this will provide for more effective arrangements for the protection of habitats and species. Regulations to give effect to the Habitat Directive are to be introduced in 1995.

Comprehensive legislation on waste has been prepared to provide an improved framework for Irish waste management. This legislation, in the form of the 1995 Draft Waste Bill is currently before the Dáil. The timescale for implementation is not known.

A2.4.3 Rural Environment Protection Scheme

As part of the reform of the Common Agricultural Policy agreed at the Council of Ministers in 1992 an agri-environment programme has been adopted to complement the changes to the market organisation rules. Financing of this programme is 75% from the EU and 25% from the National Exchequer. Under the agri-environment programme, aid may be paid to farmers under a new scheme to be known as the Rural Environment Protection Scheme (REPS). The objectives of REPS are to:

- Establish farming practices and controlled production methods which reflect the increasing concern with conservation, landscape protection and wider environmental problems.

- Protect wildlife habitats and endangered species of fauna and flora.
- Produce quality food in an extensive and environmentally friendly manner.

Farmers who wish to join REPS must have an agri-environment plan prepared by an approved agency which will take into account the management of his farm. Other measures which could significantly affect water quality include adherence to waste management, liming and fertilisation plans in order to reduce farmyard and field losses to water resources, the protection and maintenance of watercourses and wells, the obligation to retain wildlife habitats including wetlands and the cessation of use of herbicides, pesticides and fertilisers in and around hedgerows, lakes, rivers and streams etc. except with the consent of the Minister for Forestry and Rural Development.

A supplementary provision in the REPS scheme relates to long-term set aside. This measure is designed to encourage farmers to set aside a riparian zone for at least 20 years in order to protect fishing rivers, streams, lakes, etc.

A3. THE ADMINISTRATIVE FRAMEWORK

A3.1 NORTHERN IRELAND

The administrative framework for Northern Ireland is illustrated in Figure A3.1.

The United Kingdom Government is fully committed to the concept of "sustainable development" and has established two committees, comprising ministers and senior officials respectively, to consider the environmental impact of all new policies. These committees examine new policy proposals to ensure that environmental issues are given full weight in Government decisions.

A3.1.1 Department of Environment

The main responsibility for environmental policy issues and administration rests with the Department of the Environment for Northern Ireland, which is also the water and sewerage services authority, the planning authority and the roads authority. An independent Planning Appeals Commission decides planning appeals. Environmental health matters including waste management and air pollution control, are functions of the 26 district councils.

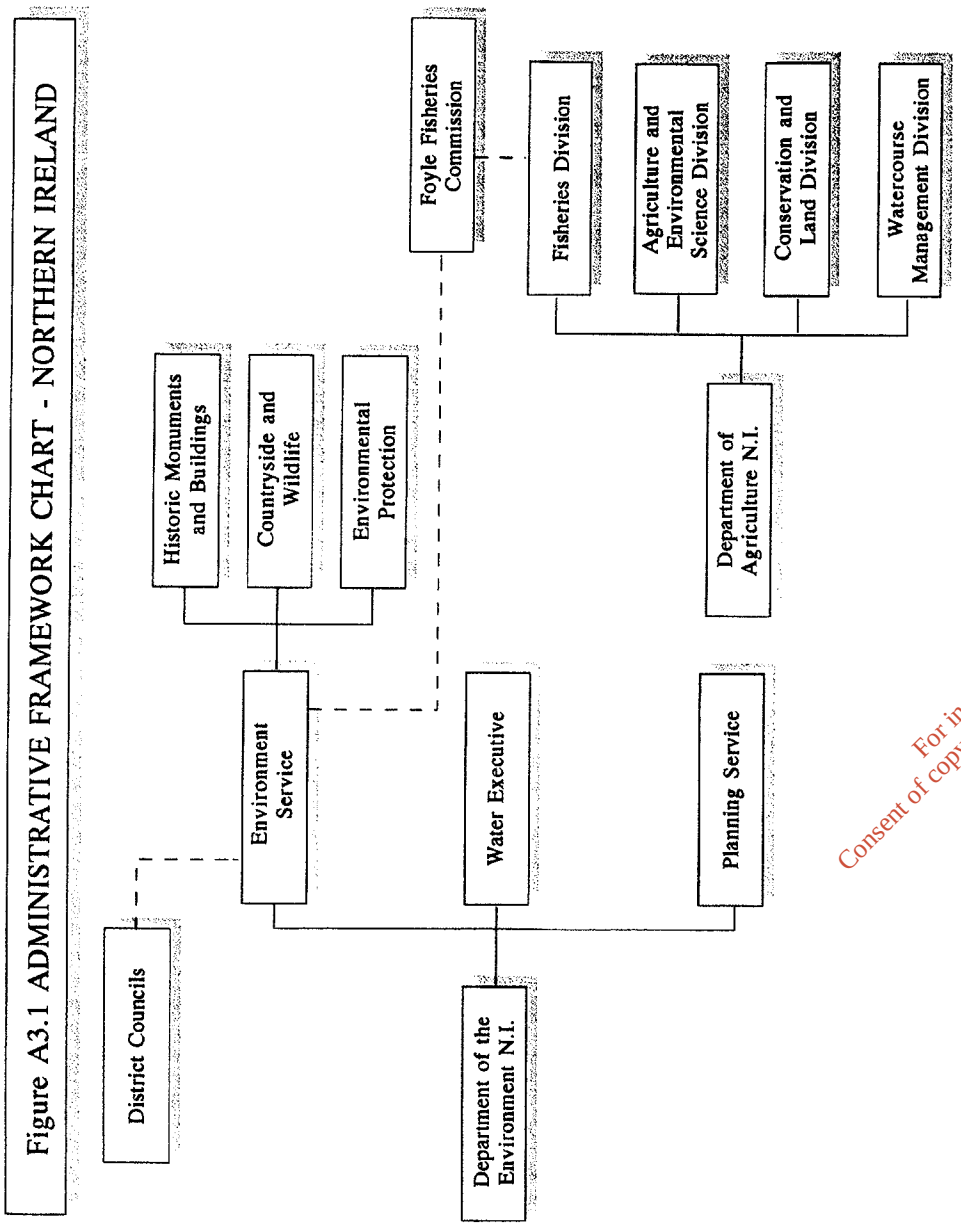
The Environment Service of the Department is responsible for the control of major industrial air pollution, water pollution and the use and disposal of radioactive substances, the conservation of water resources and the countryside and wildlife and the preservation of historic monuments and buildings. The Service also exercises a general overview of the district council environmental health function.

Under the Water Act (Northern Ireland) 1972, Environment Service operates a consent system to control discharges of trade effluent, sewage and other polluting matters to inland and coastal waters and underground strata. Stringent conditions are imposed on consents and discharges are regularly monitored. The Service has a strong enforcement policy and operates a 24 hour pollution emergency response from 14 local centres. Appeals against consent decisions lie to the independent Water Appeals Commission.

The Water Executive is an integral part of the DoE. Its principal functions are to provide a potable water supply for the Province and to provide certain facilities for waste water management.

Environment Service also regulates compliance by the Department's Water Executive with the EC Drinking Water Directive and sets standards for discharges from the Executive's Water and sewerage treatment works. Environment Service is preparing standards for all Executive discharges and account will be taken of the requirements of the EC Urban Waste Water Directive. The standards will be available for inspection on a public register.

In addition, Environment Service has responsibility for conserving and enhancing the natural environment. Areas of Special Scientific Interest (ASSIs) are declared



to protect a range of habitats and sites of interest for their rare specifies or geology. Areas of Outstanding Natural Beauty have been designated to conserve the landscape and seven Country Parks have been established. Another function of Environment Service is the protection, recording and conservation of historic monuments and buildings. The Service also licences excavations of archaeological sites.

A3.1.2 Department of Agriculture

Watercourse Management Division of the Department of Agriculture has responsibility for arterial drainage and flood defence. It also has certain navigation functions and powers to undertake minor works to develop the water recreation potential of waterways. The Fisheries Division of the Department deals with freshwater and marine fisheries throughout Northern Ireland and it has joint responsibility with the Department of the Marine to the Republic of Ireland for the Foyle Fisheries Commission. The Department also has responsibility for the Fisheries Conservancy Board for Northern Ireland which operates outside the Foyle area. The Commission and the Board act as agents for Environment Service in investigating water pollution incidents.

The Agricultural and Environmental Science Division of the Department provides research and development, analytical and diagnostic services, specialist advice and tertiary education in agricultural and environmental sciences.

A3.1.3 District Councils

The local district councils administer a small range of development proposals in the industrial and tourism areas and they operate waste disposal facilities. They have limited regulatory power in the area of environmental management - their principal regulatory authority relates to the licensing of landfills. Other powers include the enforcement of "special waste" provisions, nuisance powers, together with existing and forthcoming powers in relation to discharges to the atmosphere.

Environmental Health in Northern Ireland, outside Belfast is organised into four Groups. The Western Group comprises 5 Councils - Derry, Fermanagh, Limavady, Omagh and Strabane. A new employment order came into force on 1 April 1995. Since that date within the Western Group each District Council directly employs the Environmental Health Officers to carry out duties within its Council area. Environmental Health Officers are also employed to carry out functions on an agency basis for the Department of the Environment, Northern Ireland Housing Executive and Area Health and Social Services Board. The Chief Administrative Environmental Health Officer reports to a Group Committee which consists of two elected members from each constituent Council.

The District Environmental Health Departments carry out the core functions of Flood Control, Health and Safety, Consumer Safety, Pollution Control and general Public Health, with the support and co-ordination of the Group Headquarters staff.

A3.2 REPUBLIC OF IRELAND

The Republic of Ireland administrative framework is illustrated in Figure A3.2.

A3.2.1 Department of Environment

The leading policy role in the Republic of Ireland in relation to the environment is exercised by the Minister for the Environment who was assigned general responsibility in 1978 to promote the protection and improvement of the physical environment and provide support and advisory services for the Government and Local Authorities. Donegal County Council is the principal implementing agency in the Foyle Catchment for the purposes of environmental policy and regulations. It operates under the coordination and supervision of the Department of Environment.

Two other centralised agencies also operate under the auspices of the Department of the Environment: the Planning Appeals Board, an independent tribunal which adjudicates appeals on planning permissions and air and water pollution licences; and the new Environmental Protection Agency.

The Environmental Protection Agency is responsible for licensing all activities with a major polluting potential on the basis of integrated pollution control. In addition, the Agency provides advisory and support services for local and other public authorities, and coordinates environmental monitoring and research.

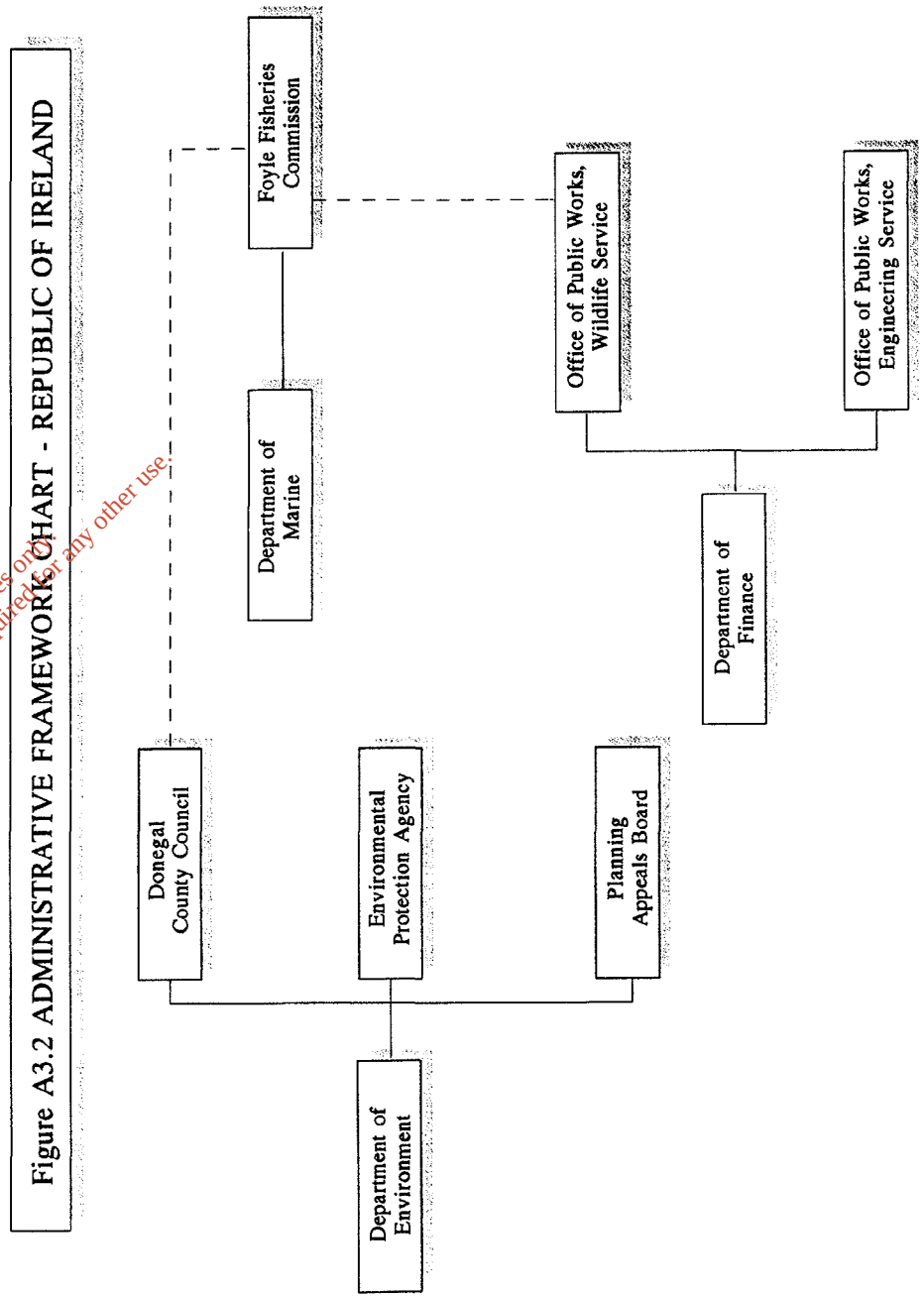
The Government's Environment Action Programme, published in 1990, explicitly commits Irish environmental policy for the present decade to the following principles:

- the principle of sustainable development
- the precautionary principle,
- the integration of environmental considerations in all policy areas.

Sustainable development, the precautionary principle and the polluter pays principle are each formally incorporated in the legislative statement of functions for the Environmental Protection Agency.

A3.2.2 Department of Marine

The Minister for the Marine has important functions in relation to conservation and protection of the marine environment, and is the licensing authority for foreshore activities and marine dumping activities. The Foyle Fisheries Commission administers the Fisheries Acts with respect to freshwater fish (including salmon and sea trout) on behalf of the Department of Marine, in consultation with the Northern Ireland authorities.



A3.2.3 Department of Finance

The Office of Public Works, which operates under the aegis of the Minister for Finance is directly responsible for wildlife, habitat and national monument protection, for the management of national parks and waterways and for catchment drainage schemes.

Responsibility for nuclear safety is assigned to the Minister for Energy, while the Minister for Enterprise and Employment is responsible for industrial safety.

A3.2.4 Department of Agriculture

The Department of Agriculture has responsibility for agricultural policy in ROI and it may therefore influence water quality through grants and research development. The Minister for Agriculture appoints the Chairman of Teagasc which is the Authority for Agriculture and Food Development in ROI. Tesgasc's responsibilities include agricultural research and development and the provision of advisory services to farmers. The emphasis of agricultural research and development is now becoming more focused on protecting the environment rather than on promoting increased production.

A3.3 TRANSBOUNDARY COOPERATION

There have been longstanding arrangements for consultation on important planning developments in the border region. These arrangements now extend, where appropriate, to formal consultation in relation to environmental impact studies carried out in accordance with the EU Directive (85/337/EEC) on the Assessment of the Effects of Certain Public and Private Projects on the Environment. Cooperation also extends to joint action by authorities North and South in development matters such as the joint programme under the EC INTERREG Initiative.

The range of issues addressed within the present legislation, administration and policy procedures provides a framework for the development of transboundary water quality management strategies. Standards and responsibilities are defined and they allow for coordination of the roles of the agencies involved.

SECTION B

GENERAL INFORMATION

B1. THE CATCHMENT

B1.1 PHYSICAL FEATURES

The combined catchment of the Foyle River and Lough Foyle is one of the largest in Ireland, covering an area of some 3,700km². It is shared between Northern Ireland (NI) and the Republic of Ireland (ROI), with about 75% of the catchment in Northern Ireland. The mean daily freshwater flow at Londonderry is approximately 7 million cubic metres. The population density, excluding Derry City, is low at about 45 persons per sq.km. The base map for the area is Map 1.

The major subcatchments in the Foyle Catchment are shown in Map 3. The Foyle river system includes a number of tributaries, the largest of which are the Mourne, which lies in Northern Ireland, and the Finn, which drains the central plain of County Donegal. These two tributaries join at the towns of Lifford/Strabane to form the River Foyle, which then flows northwards through Londonderry into Lough Foyle. The River Foyle itself is tidal throughout its length. The rivers in the Foyle Catchment are shown in Map 2.

The catchment of the River Mourne is the largest in the Foyle system, being greatly extended by a number of tributary streams one of which, the Derg, flows eastward from its source in Lough Derg, in County Donegal. Other major tributaries of the River Mourne are the Strule, Drumragh, Owenkillew, Glenelly, Fairywater and Camowen.

The River Finn rises in the western highlands of County Donegal and flows through Lough Finn and the towns of Ballybofey/Stranorlar to join the Mourne at Lifford.

Lough Foyle is a large, shallow, almost enclosed sea-lough with an area of 187km² and a mean depth of about 5m. Apart from the River Foyle, a number of other rivers and streams drain directly into the Lough. The largest of these, the Faughan and the Roe, are on the Northern Ireland side, and are important both as sources of drinking water and as designated salmonid rivers.

B1.2 OVERVIEW OF MANAGEMENT ISSUES

The importance of the Foyle fishery has been recognised over hundreds of years. The Foyle Fisheries Commission was established as a joint cross border fishery conservation and development body in 1952. The Foyle system has some 830km of river suitable for the passage and rearing of Atlantic salmon (Salmo salar) and has the reputation of being one of, if not the most, productive salmon fisheries in Europe.

In addition to the Faughan and the Roe all of the major tributaries of the Foyle system, including the Strule, Mourne, Finn and Derg, have been designated as salmonid under Directive 78/659/EEC.

Oyster and mussel fisheries in Lough Foyle are still at the development stage.

The major factors affecting water quality in the catchment are agricultural effluents, industrial development and sewage discharges. The city of Londonderry is the largest conurbation in the catchment with a population of about 80,000 persons. Two industries discharge directly to the Lough: DuPont which manufactures plastics and rubber (including neoprene©, lycra©, kelvar© and hypalon©) and Coolkeeragh Power Station. The remaining large industrial effluents are discharged to the city sewerage system which provides primary treatment before disposal at the mouth of the River Foyle at Culmore.

The Port of Londonderry has recently been relocated, as part of a major development plan. Navigation through the estuary and the lough has implications for water quality management, arising from maintenance dredging operations.

Apart from Londonderry, the economy of the catchment depends mainly on agriculture, tourism and some agriculture-based industry. There are no major industrial developments in the ROI portion of the catchment, other than a small flax spinning factory, one meat processing plant, some dairy processing and a mineral waters manufacturer. On the Northern Ireland side the major industries are dairy processing, meat processing, and sand and gravel works. Agricultural activity is based mainly on dairy cattle, beef and sheep rearing.

On both sides of the border there is interest in mining exploration, particularly for gold.

Throughout the Foyle catchment water quality is good with the rivers generally complying with the requirements of relevant E.C. Directives. However, intermittent and diffuse agricultural pollution, as well as STW discharges pose on-going problems of control. Drainage maintenance and forestry development contribute to the impacts on river morphology and catchment runoff.

B2. GEOMORPHOLOGY

B2.1 INTRODUCTION

The extent of the River Foyle catchment area is largely controlled by the underlying solid geology. The catchment area occupies a north-east trending syncline in the Dalradian metamorphic rocks between the basaltic plateau of Ulster to the east and the hills of Donegal to the west. The southern boundary is controlled by a series of fault-controlled, low-lying hills. The topography of the catchment is shown in Map 4.

The geomorphology of the area is described with reference to the Solid Geology, Structural Geology and Quaternary Geology with particular attention to the surface drainage network and the characteristics of the underlying hydrogeology.

B2.2 SOLID GEOLOGY

The solid geology of the River Foyle catchment area is shown on Map 5.

B2.2.1 Foyle, Mourne, Faughan and Roe Valleys

A large portion of the central, northern and eastern part of the catchment area, including the Sperrin Mountains, comprises Dalradian metamorphic rocks (Unit 4). These include schists, grits, quartzites, slates, pelites, psammites and limestones. (The nomenclature of this sequence has been the subject of much research. Details of the sequence can be found on the Geological Survey of Northern Ireland 1:250,000 scale solid geological map and in the Geological Survey of Northern Ireland Publication "British Regional Geology Northern Ireland" (H.E. Wilson, HMSO, 1972).)

The low-lying area representing much of the River Foyle catchment area is due to the presence of a syncline in the underlying Dalradian rocks. From Strabane northwards the River Foyle itself follows the axis of this syncline which forms the Irish continuation of the Loch Awe Syncline of Scotland. The syncline resulted from large-scale complex folding affecting the whole region. This folding, which occurred during the Caledonian orogeny, has resulted in a marked north-east to south-west orientation of geological structures in this area.

B2.2.2 Mournebeg, Finn and Deele Valleys

The western boundary of the catchment area is composed of Donegal granite (Unit 1), which is considered to be of Old Red Sandstone Age, and Dalradian metamorphic rocks.

The major axes of folding and faulting in the mountains of Donegal also exhibit the predominantly north-east to south-west Caledonian trend. However, the majority of the western tributaries of the Foyle drain eastward across the prevailing geological trend. These east-flowing rivers are considered to be an example of a super-imposed drainage pattern. It has been suggested that these rivers established their flow pattern through cover rocks in pre-Tertiary times. The Dalradian rocks of Donegal subsequently became exposed as a result of weathering and erosion postdating Tertiary uplift in the area.

B2.2.3 Owenkillew and Glenelly Valleys

The eastern boundary of the catchment area is marked by the occurrence of the Tertiary basalts (Unit 3) which form the basaltic plateau of Ulster. The north-eastern flank of the catchment is comprised to a large degree of mudstones and sandstones (Unit 7), mudstones and limestones (Unit 8) and chalk (Unit 9). Extensive outcrops of Carboniferous Basal clastics (Unit 6) also occur.

The faulted southern boundary of the Sperrin Mountains is considered to be an extension of the Highland Boundary Fault of Scotland. This complex, faulted zone brings Ordovician, Devonian and Carboniferous rocks in south County Tyrone up against the older Dalradian rocks of the Sperrin Mountains to the north.

B2.2.4 Derg, Fairywater and Drumragh Valleys

The southern extent of the catchment area is controlled by the presence of a series of low-lying fault-controlled hills stretching across southern County Tyrone. These hills comprise of a variety of rocks including: Old Red Sandstone conglomerates (Cranlome Hill and Slievemore), Carboniferous basal clastics (Lendrum's Br and Balaghe Mountain) and Upper Dalradian rocks (Tappaghan Mountain).

The south-west and south-east corners of the catchment area contain several igneous intrusions of granites (Unit 1). The south-east corner of the area also contains an extensive area of basic igneous rocks (Unit 2).

B2.3 GLACIAL INFLUENCES

The Quaternary System began about two million years ago and two glacial periods, the Munsterian and Midlandian, have been identified during which the whole of Northern Ireland was covered by great thicknesses of ice.

A summary of the Quaternary deposits is shown on Map 7.

B2.3.1 Tills or Boulder Clay

Boulder clay, or material formed beneath an ice sheet and varying in size from clay to boulders, covers much of the area (Unit 1).

The Foyle glacier is thought to have persisted after the northern slopes of the Sperrin Mountains had become ice-free. This resulted in some of the eastern tributaries of the present Foyle being unable to join the line of the modern valley and being forced to turn northwards along the eastern margin of the valley glacier. An example of this glacial diversion can be seen at Drumahoe village where the River Faughan turns sharply northwards to run parallel with the River Foyle before joining it some five miles downstream.

B2.3.2 Sands and Gravels

Abundant fluvioglacial sands and gravels are widely distributed in the catchment area. These sediments tend to be found on the lower flanks of high ground and along river valleys. They were laid down by meltwaters close to, or beneath, an ice sheet and include eskers and moraines. Substantial levels of sand and gravel erosion occur in the watercourses in high ground such as the Strule Tributaries.

The coastal terraces around Lough Foyle were formed at this time during the retreat of the Foyle glacier. These terraces occur at various elevations and represent different shorelines formed during isostatic recovery of the land in post-glacial times.

A general rise in sea level of 20m or more occurred about 10,000 years bp. This resulted in the rise of the sea-level overtaking the rate at which the land was being raised and the waves cutting cliffs in the faces of the late-glacial terraces and leaving shingle beaches at the foot of the cliffs. These deposits are termed Raised Beach Deposits and include coastal gravels and sands. The marine transgression was short-lived and eventually the rate of isostatic recovery of the land proved greater than the rise in sea-level. This resulted in a marine regression and clay deposits were laid down along the eastern shore of Lough Foyle. These deposits are very soft clays and extend to about 50m below Ordnance Datum.

Alluvium comprising various types of river and estuarine deposits has formed along river valleys up to the present time. This contributes to significant siltation in the watercourses and considerable maintenance dredging is required in channels which have been improved for flood defence, land drainage and navigation.

B2.4 HYDROGEOLOGY

Little detail is known of the hydrogeology of the area. A report was produced in 1982 by the Commission of European Community entitled "The Groundwater Resources in the Republic of Ireland". Few conclusions are drawn about the hydrogeology of the area due to the lack of data. The maps associated with the report indicate that aquifers of only local importance occur to the west of the River Foyle and that the area to the east of the River Foyle has a surplus supply of groundwater.

B2.4.1 Aquifers

Much of the area is underlain by Dalradian metamorphic rocks, as described above, which comprise a poor aquifer. There are, however, a number of private water boreholes in these metamorphic rocks for domestic and farm supplies. Yields from these boreholes rarely exceed 50m³/day. One industrial source in Londonderry City is capable of yielding 500m³/day but it is assumed that this borehole intersects a fracture zone. It is considered that these metamorphic

rocks must contribute very little to base flow. The water is weakly mineralised with an alkalinity of approximately 50mg/l.

The report outlines four main aquifers:

- Sand/Gravel aquifers which are principally located along the river valleys;
- Chalk aquifer which is located on the north eastern flank of the catchment area;
- Devonian aquifers, which are located in the south east of the area;
- Carboniferous aquifers which are predominantly located in the south of the area;

These are shown in Map 6.

B2.4.1.3 Devonian

The Devonian aquifer in the area has few boreholes which yield more than 100m³/day. There are no public borehole sources in this aquifer and no record of any significant springs emerging from it. Again, it is considered that these rocks must contribute little to base flow. The water is moderately mineralised and may be depleted in oxygen levels.

B2.4.1.4 Carboniferous

The Carboniferous strata, comprising basal sandstones overlain by shales and limestone, do provide reasonable borehole yields especially in the Omagh area. There is a limited area of karstic conditions in the limestone west of Drumquin. The six springs shown in this area (Map 8) are all from the limestone and must contribute significantly to base flow. There are no public supply boreholes in the Carboniferous strata. The water quality is variable, sometimes reducing with iron and manganese in solution. The alkalinity is greater than 120mg/l.

B2.4.1.2 Chalk

There is no reported water extraction from the Chalk aquifer. The water is reported as being strongly mineralised and hard.

B2.4.1.1 Sand/Gravel

Sand and gravel aquifers comprise both fluvioglacial and recent river alluvium deposits. The fluvioglacial deposits have recorded saturated levels of up to 10m in thickness. Recent river alluvium consists mainly of silt but can also include clean sand/gravel layers and contain boreholes with a recorded yield of up to 200m³/day. In the Faughan Valley, below Drumahoe the combined thickness of fluvioglacial and alluvium sands and gravels exceed 30m. All marked springs, with the exception of those west of Dumquin, emanate from sands and gravels.

The public supply boreholes near Mountfield, at Newtownstewart, and Drumahoe are in sand and gravel aquifers. These sands and gravels will contribute to base flow. The alkalinity of the groundwater varies from 130 to 170 mg/l and occasionally much higher. These aquifers are very vulnerable to surface pollution, with NO_3 - N usually up to 10mg/l.

B2.4.2 Acidity

A report was published on the variation in the acidity of groundwater and surface waters in Northern Ireland (Jordan and Enlander 1990). The report indicated that the upland area of the western Sperrins was vulnerable to acidification. Concentrations of total and labile aluminium were high and exceeded the EU Directive on total aluminium in drinking water.

A hydrogeological survey of Northern Ireland to acquire baseline data on the hydrogeology and hydrogeochemistry of the groundwater resources has been carried out by the British Geological Survey.

B3 HYDROLOGY

B3.1 River Flows

The hydrological characteristics of each of the major sub-catchments were assessed in terms of average, high and critical low flows.

Daily flow data from the 12 automatic recording gauging stations within the catchment were used as the base dataset. The location of the gauging stations are presented in Map 9 and in Figure B3.1. The complete hydrological database on which the analysis was based is presented in the accompanying Appendix B3. The results of the hydrological analysis are summarized in Table B3.1 to B3.13. The source of the hydrological data was the DoE (NI) Environment Service and the DoE (ROI) Environmental Research Unit.

The allocation of effective rainfall between surface run-off and groundwater is largely dependent on the nature of the surface.

Within the catchment, there are extensive areas of fluvioglacial sands and gravels together with recent alluvium deposits which comprise mainly silt but also contain a significant proportion of sands and gravels. These areas allow a proportion of effective rainfall to be stored as groundwater which later contributes to the baseflow of the major water courses. Rivers with a high baseflow index are therefore most suitable for the abstraction of surface water within the catchment, reducing the need for storage reservoirs.

In the Faughan Valley, upstream of Drumahoe, the combined thickness of the sand/gravel and alluvium deposits exceeds 30 m which greatly contributes to the high baseflow characteristics of the River Faughan. The River Faughan is utilized for public water supply but there is also scope for additional groundwater abstraction in this sub-catchment.

Water is also abstracted within the River Derg catchment. The river baseflow relies on the water storage capacity of Lough Derg. There are no significant sand and gravel deposits within this sub-catchment. Water abstraction from the River Derg must therefore be carefully controlled to maintain water levels within Lough Derg during periods of low flow.

In contrast many areas of the catchment, particularly in the western region, are underlain by boulder clays of low permeability. In these areas a high proportion of the incident rainfall is conveyed as surface runoff. Consequently, rivers such as the Finn and Deele respond rapidly to both rainfall and drought periods and are referred to as 'flashy' in character.

FOYLE MAJOR CONTRIBUTING CATCHMENTS

FIGURE B3.1

River Fairywater at Dudgeon Bridge		Table B3.1
Station 201002 (National Grid Reference 2406 3758) Contributing Area 161.2 km² Period Processed 1980 - 1989		
Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	0.346	0.380
90 percentile (Q90)	0.488	0.578
75 percentile (Q75)	0.891	1.272
50 percentile (Q50)	2.691	3.798
25 percentile (Q25)	6.599	8.610
10 percentile (Q10)	14.763	13.834
5 percentile (Q5)	21.486	17.203
Baseflow Index (BFI) 0.287		

River Camowen at Camowen Terrace		Table B3.2
Station 201005 (National Grid Reference 2460 3730) Contributing Area 274.6 km² Period Processed 1980 - 1989		
Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	0.959	1.025
90 percentile (Q90)	1.170	1.279
75 percentile (Q75)	1.975	2.303
50 percentile (Q50)	4.272	5.375
25 percentile (Q25)	9.286	10.586
10 percentile (Q10)	15.897	15.015
5 percentile (Q5)	21.968	18.223
Baseflow Index (BFI) 0.444		

River Drumragh at Campsie Bridge		Table B3.3
Station 201006 (National Grid Reference 2458 3722) Contributing Area 324.6 km² Period Processed 1980 - 1991		
Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	0.612	0.677
90 percentile (Q90)	0.833	0.996
75 percentile (Q75)	1.614	1.967
50 percentile (Q50)	4.181	5.570
25 percentile (Q25)	10.817	13.042
10 percentile (Q10)	21.990	20.099
5 percentile (Q5)	31.040	24.553
Baseflow Index (BFI) 0.355		

River Burn Dennet at Burn Dennet Bridge — **Table B3.4**

Station 201007 (National Grid Reference 2372 4047)
Contributing Area 145.3 km²
Period Processed 1980 - 1989

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	0.936	0.971
90 percentile (Q90)	1.186	1.310
75 percentile (Q75)	1.779	1.994
50 percentile (Q50)	3.010	3.491
25 percentile (Q25)	5.246	5.710
10 percentile (Q10)	8.417	7.794
5 percentile (Q5)	10.896	9.232

Baseflow Index (BFI) 0.565

River Derg at Castlederg — **Table B3.5**

Station 201008 (National Grid Reference 2265 3842)
Contributing Area 337.3 km²
Period Processed 1980 - 1991

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	0.557	0.770
90 percentile (Q90)	1.129	1.558
75 percentile (Q75)	2.857	4.158
50 percentile (Q50)	7.636	10.855
25 percentile (Q25)	18.770	20.853
10 percentile (Q10)	34.587	31.503
5 percentile (Q5)	48.257	37.569

Baseflow Index (BFI) 0.322

River Owenkillew at Crosh — **Table B3.6**

Station 201009 (National Grid Reference 2411 3865)
Contributing Area 442.4 km²
Period Processed 1980 - 1989

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	2.192	2.359
90 percentile (Q90)	2.828	3.145
75 percentile (Q75)	4.543	5.526
50 percentile (Q50)	9.023	11.731
25 percentile (Q25)	19.491	23.522
10 percentile (Q10)	36.678	34.495
5 percentile (Q5)	51.690	42.162

Baseflow Index (BFI) 0.391

River Mourne at Drumnabuoy House — **Table B3.7**

Station 201010 (National Grid Reference 2347 3958)
Contributing Area 1844.5 km²
Period Processed 1982 - 1989

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	5.517	6.173
90 percentile (Q90)	7.756	8.466
75 percentile (Q75)	14.639	17.626
50 percentile (Q50)	32.009	40.137
25 percentile (Q25)	71.502	80.220
10 percentile (Q10)	130.658	126.515
5 percentile (Q5)	175.668	150.429

Baseflow Index (BFI) 0.410

River Roe at Ardnargle — **Table B3.8**

Station 202001 (National Grid Reference 2674 4245)
Contributing Area 365.6 km²
Period Processed 1981 - 1989

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	1.148	1.246
90 percentile (Q90)	1.445	1.701
75 percentile (Q75)	2.652	3.223
50 percentile (Q50)	5.056	6.930
25 percentile (Q25)	11.111	14.369
10 percentile (Q10)	23.597	21.911
5 percentile (Q5)	34.520	26.824

Baseflow Index (BFI) 0.374

River Faughan at Drumahoe — **Table B3.9**

Station 202002 (National Grid Reference 2464 4150)
Contributing Area 272.3 km²
Period Processed 1982 - 1991

Flow Characteristics	1 day duration (cumecs)	10 day duration (cumecs)
95 percentile (Q95)	1.039	1.109
90 percentile (Q90)	1.274	1.383
75 percentile (Q75)	2.510	2.814
50 percentile (Q50)	4.545	5.385
25 percentile (Q25)	8.453	10.126
10 percentile (Q10)	16.102	16.021
5 percentile (Q5)	23.084	19.924

Baseflow Index (BFI) 0.471

River Deele at Sandy Mills	Table B3.10
Station 141 (National Grid Reference 2273 3990) Contributing Area 113.0 km² Period Processed 1973 - 1984	
Flow Characteristics	1 day duration (cumecs)
95 percentile (Q95)	0.19
90 percentile (Q90)	0.28
75 percentile (Q75)	0.73
50 percentile (Q50)	1.98
25 percentile (Q25)	4.46
10 percentile (Q10)	8.28
5 percentile (Q5)	11.10

River Finn at Dreenan	Table B3.11
Station 142 (National Grid Reference 2152 3945) Contributing Area 353.0 km² Period Processed 1972 - 1984	
Flow Characteristics	1 day duration (cumecs)
95 percentile (Q95)	0.94
90 percentile (Q90)	1.41
75 percentile (Q75)	3.29
50 percentile (Q50)	8.64
25 percentile (Q25)	23.1
10 percentile (Q10)	42.8
5 percentile (Q5)	59.1

River Finn at Ballybofey	Table B3.12
Station 143 (National Grid Reference 2134 3946) Contributing Area 319.0 km² Period Processed 1972 - 1981	
Flow Characteristics	1 day duration (cumecs)
95 percentile (Q95)	0.73
90 percentile (Q90)	1.21
75 percentile (Q75)	3.05
50 percentile (Q50)	8.00
25 percentile (Q25)	21.6
10 percentile (Q10)	38.0
5 percentile (Q5)	48.9

Table B3.13 Comparison of River Flows within the Foyle Catchment

Station	River	Mean Flow		Low Flow (Q95)	
		(m^3/s)	(m^3/s per 100km^2)	(m^3/s)	(m^3/s per 100km^2)
201002	Fairywater	5.68	3.52	0.346	0.215
201005	Camowen	7.00	2.55	0.959	0.349
201006	Drumragh	8.49	2.62	0.612	0.189
201007	Burn Dennet	4.12	2.84	0.936	0.644
201008	Derg	13.9	4.12	0.557	0.165
201009	Owenkillew	16.0	3.62	2.192	0.495
201010	Mourne	54.6	2.96	5.517	0.299
202001	Roe	9.98	2.73	1.148	0.314
202002	Faughan	7.31	2.68	1.039	0.382
141	Deele	3.39	3.00	0.19	0.168
142	Finn	17.3	4.91	0.94	0.266
143	Finn	14.8	4.63	0.73	0.229

B3.2 Rainfall

The rainfall characteristics recorded at Altnagelvin and Baron's Court for the period 1980-1993 are illustrated graphically in Figure B3.2. This information was sourced from the Meteorological Office.

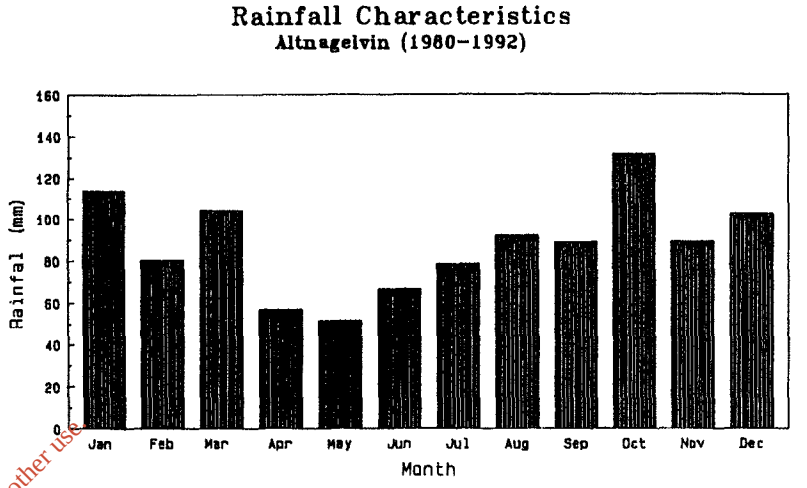
The average annual rainfall varies spatially throughout the catchment as depicted by the Standard Average Annual Rainfall (SAAR) map, NERC Flood Studies Report (1975), see Map 10. The highest rainfall is expected in the upland regions of the River Finn and Lough Derg with a mean annual rainfall of over 2000 mm. Similarly in the Sperrin mountains, the source of the Roe, Faughan, Burn Dennet and Owenkillew sub-catchments, the mean annual rainfall is expected to be in the range 1600-1800 mm. In comparison, the mean annual rainfall recorded at Baron's Court for the period 1980-1992 was 1220 mm and at Altnagelvin the rainfall recorded was 1060 mm over the same period.

At Altnagelvin, the mean annual rainfall recorded for the period 1980-1992 was around 10% higher than the long term annual average rainfall recorded between 1941-1970.

B3.3 The Foyle River Estuary

The Foyle River Estuary extends from the confluence of the Mourne and Finn Rivers at Lifford to Cumore Point at the entrance to Lough Foyle. There are also significant freshwater inputs to this tidal section of the Foyle estuary from the River Burn Dennet and River Faughan.

The flow regime within the Foyle River Estuary is extremely complex. Back eddies are known to occur within both Culmore Bay and Rosses Bay. Temporal variations within the water column also occur, from partially mixed estuarine conditions exhibited during neap tides to fully mixed estuarine conditions at spring tides. During large flood events, freshwater is known to extend as far downstream as Culmore Point over all states of the tide, leading to stratification within the water column.



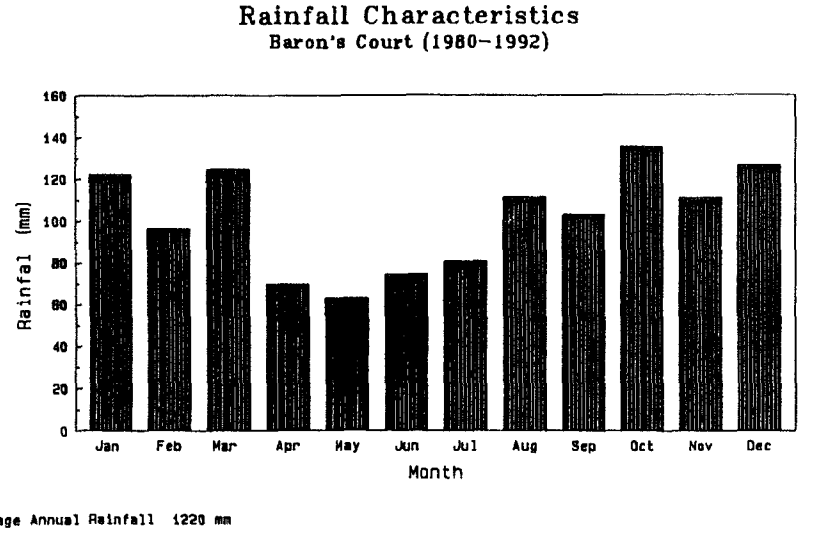


FIGURE B3.2

B4. LAND USE

B4.1 INTRODUCTION

This section provides an overview of existing and potential catchment land use. The predominant activities are agriculture and forestry, which require careful management to protect the water environment. Further detailed consideration of each use of the catchment and its impact on water quality is presented later in Section C.

The existing land use was determined from the most recent satellite imagery of the region. Potential land use was assessed from the catchment topography and soil distribution.

B4.2 EXISTING LAND USE

From LANDSAT satellite imagery of the catchment taken in May 1989, the land uses within the catchment were identified as shown in Map 11. The procedures used are the subject of a separate report.

The following land use classifications were identified within the catchment:

- Water
- Trees
- Good Pasture
- Poor Pasture
- Blanket Bog - Grass
- Blanket Bog - Heather
- Lowland Bog - Grass
- Lowland Bog - Heather
- Tillage
- Urban
- Mud Flats
- Sand/Rock
- Scrub
- Unclassified

These classifications are the same as those applied in the recent CORINE project, which identified land use throughout the European Union.

Within the Foyle Catchment, several major land use zones are apparent from the satellite image. These comprise tillage, good pasture, poor pasture, upland bog, forests and urban areas. The uses are related to soil distribution, height, slope and aspect.

B4.3 LAND USE AND SOIL DISTRIBUTION

The primary parameter in the assessment of potential land use is the soil distribution and the ground slope. The analysis below is based on a complete soil survey on the ROI side of the catchment and on a preliminary survey in NI. The slopes were determined from Ordnance Survey maps and from the records of the soil surveys.

Soil survey provides data for the nature and distribution of soil series which are the basic, spatial units of soil mapping. In Northern Ireland, Soil Survey in the 1993 - 1995 period is concentrating on completion of field mapping and the publication of soil maps on a 1:50,000 scale.

In the Republic of Ireland, Soil Survey County Bulletins of An Foras Taluntais provide interpretations of county soil maps which include soil suitability classifications, consideration of quantitative grazing capacity and any special problem of soil chemical discrepancy.

The hydrology of soil series is important in the management of river catchments. In RoI, soil moisture storage capacity and hydraulic conductivity have been measured on a wide range of soil sites and the parameters used to prepare the runoff risk categories maps, published by Teagasc in 1992.

In NI the hydrology of soil series is being undertaken as a special research project, funded by DANI, that is part of the wider HOST (Hydrology of Soil Types) project of the UK.

The major soils in the catchment are presented on Map 12. The map is based on five major physiographic divisions: Mountain and Hill; Hill; Rolling Lowland; Drumlins; and Flat to Undulating Lowland. The percentage of the principal soil present is referred to in brackets [%].

Soil types vary considerably throughout the catchment.

The slope and aspect of the area are shown in Maps 13 and 14 respectively.

B4.3.1 Mountain and Hill

In the south of the catchment lies an area of Mountain and Hill physiography with Peaty Podzols [75%] comprising the principal soil and Lithosols [15%] and Blanket Peats [10%] making up the associated soils. The use range of these soils is very limited due to high elevation, inaccessibility, the peaty surfaces and low lime and nutrient status. Their use is mainly confined to mountain sheep grazing, amenity and forestry.

The area east of Limavady/Dungivan is a Mountain and Hill area consisting mainly of Blanket Peats [75%] in flatter areas and shallow Brown Earths [25%] on the slopes. Suitable landuse for these soils is limited to forestry.

Large tracts of High Level Blanket Peats occur in the west and southwest of the catchment. Some of this peat type has been cut-over mainly for fuel. These

soils have a very limited use range. They are best suited to extensive grazing due to their organic nature, elevation and wetness.

Also in the northwest of the catchment surrounding Cloghan is an area of Mountain and Hill topography which is as described above. South of Cloghan and Ballybofey lie areas of Low Level (Atlantic Type) Blanket Peats where rainfall is greater than 1,250mm and black bog rush is a major component in its vegetation. It has a greater average depth (approximately 3m) than high level type peats and a small proportion of it is cut-over for fuel. These soils have a very limited use range except for grazing.

B4.3.2 Hill

South of Ballybofey and north of Stranorlar lies a Hill area where the principal soil consists of a surface-water Gley whose origin is due mainly to the impermeable nature of the parent material. Brown Earths occupy the remaining area [10%] . The soils have a limited use range and are unsuitable for tillage due to drainage problems.

B4.3.3 Rolling Lowland

In the north-east and east there is a large area of Rolling Lowland with the principal soil being a well drained Brown Podzolic [60%] of clay loam to loam texture and of low base status. These soils have a moderately wide use range. They are well suited to tillage and pasture but the less favourable climatic conditions in the region limits the range of crops which can be grown. The associated Gley soils [20%] have a limited use range due to poor drainage.

Within this area of Rolling Lowland lie significant tracts of Mountain and Hill topography composed mainly of Peaty Gleys [70%], Climatic Peats [20%] and Peaty Podzols [10%] all of which have a very limited use range. Peaty topsoils, high elevations, sharp slopes and poor drainage restrict their potential to extensive grazing or forestry for which they have a good potential especially at the lower elevations.

B4.3.4 Drumlins

Drumlins occur in the Limavady/Dungiven area where the predominant soil consists of a moderately well drained Grey Brown Podzolic of loam texture and medium base status which gives way to Gleys on flat drumlin summits and to Peaty Gleys and Peats on interdrumlin flats. The soil has a limited use range. It can be used for tillage but is best suited to grassland. Slopes impose limitations to machinery use. The main associated soils (40% Gleys, Peaty Gleys and Peats) have a limited use range because of poor drainage and are mainly suited to pasture production.

Drumlins also occur near Omagh, in the south of the catchment. West of Omagh the predominant soil is extremely heavy in texture and is a poorly drained surface water Gley and the associated soils comprise of interdrumlin Peats and Peaty Gleys [15%]. These soils have a limited use range because of poor drainage, adverse soil physical conditions and frequent steep slopes. However, forestry has proved highly productive on these soils.

South of Omagh, the predominant soil [50%] is a poorly drained surface water Gley (loam to clay loam texture) and of medium base status. The use range of this soil is limited - it is more suited to pasture than to arable cropping. The main associated soil [40%] consists of a moderately well-drained Acid Brown Earth (loam to clay loam texture) and low base status which can be used for arable crops and pasture. The remaining associated interdrumlin Peats and Peaty Gleys [10%] have serious drainage problems and their main use is for summer grazing.

B4.3.5 Flat to Undulating Lowland

A small area of Flat to Undulating Lowland located in the extreme northeast of the catchment, is formed from alluvial deposits. The predominant soil is a poorly drained Gley of silty clay loam texture and of medium to high base status. The topography is flat and elevation is close to or below sea level and for this reason some reclamation has been carried out to control the water table. In this area the surface is a very friable loamy sand overlaying a grey coarse sandy material which somewhat restricts the potential landuse. These soils are more suited to tillage and the production of vegetable crops especially carrots.

SECTION C

USES

INSERT C

C1. PUBLIC WATER SUPPLY

This use relates to the provision of public water supplies from both surface and groundwaters. The Water Executive in Northern Ireland and Donegal County Council in the Republic of Ireland have responsibility for the water supply system. The Executive is run as semi-autonomous Divisions which in turn are divided into subdivisions. In Northern Ireland the Foyle catchment is covered by Western Division of DoE (NI) Water Executive (with Londonderry and Omagh subdivisions).

Information on public supply has been obtained from various reports commissioned by the Water Executive and through discussion with staff of the Water Executive.

There are four types of sources for public supply in the catchment: groundwater including springs and borewells; impoundments; rivers and loughs. The major sources in the catchment are river abstractions, with loughs also being significant. Groundwater contributes only a small proportion of the overall supply. ~~The sources in the catchment, the volume of water supplied in 1992 and the area supplied are presented in Table C1.~~ Only a small proportion of abstracted water is exported from the catchment (2Ml/d from Lough Braden to Enniskillen).

C1.1 RIVERS

Rivers are the largest source of abstraction for public water supply in the Catchment. The major river abstractions are from the Faughan, Derg and Glenedra. The Camowen River is also used during prolonged periods of drought.

On the Faughan the reliable yield is 34.8 Ml/d at Cloghole abstraction. There is a compensation requirement ("residual flow") for fisheries purposes and flows below the intake should not drop below 14.8 Ml/d. This requirement is a constraint on the amount of water that is available for supply as the treatment works can treat 45 Ml/d. In addition, DuPont has obtained an agreement to abstract up to 27.3 Ml/d immediately above the Water Executive's intake. By agreement the water is actually abstracted from the water treatment works as treated water. There is therefore, potential conflict between DuPont and the Water Executive.

In addition to capacity constraints, occasional pollution incidents have forced the water treatment works intake at Cloghole to be closed on approximately six occasions over the past 30 years. The sources of pollution have been generally agriculturally based, although there have been others such as diesel spillage from service industries. On most occasions the closure has been for periods of around one day.

TABLE C.1. WATER SUPPLIES IN THE FOYLE CATCHMENT

Water supply source	Type	Volume supplied in 1992 (Ml/d)	Area supplied
Altnaheglish and Glenedra River	Impounding Reservoir and River Abstraction	20	Londonderry/Limavady
Killea	Impounding Reservoir	1.1	Londonderry
Loughs Fingreen and Macrory	Lough	12.3	Omagh
Lough Braden	Lough	7	Enniskillen 2 Ml/d Omagh 5 Ml/d
Lough Mourne	Lough	7	Finn Valley
Evish/Knockavoe	Impoundment	0	Omagh
Glencordial	River	2.1	Omagh
Cloghole (River Faughan)	River	27.5	Derry City
Bolea	Groundwater	0.5	Limavady
Gortgarn	Groundwater	0	Limavady
Brishey	Groundwater	1	Limavady
Wellglass/Gortcorbies	Groundwater	2.5	Limavady
Culmore	Groundwater	0.03	Derry City
Lenamore	Groundwater	0.3	Gortin/Owenkillew catchment
Camowen River	River	0	Omagh
River Derg	River	12	Strabane
Newtownstewart	Groundwater	1.0	Omagh

Source: Water Statistics for NI (DoE Water Executive)

The River Derg supplies approximately 13.5 Ml/d. The Derg abstraction is two miles above the confluence of the Derg and Mourne rivers and currently no compensation requirement is applied. The Water Treatment Works is capable of treating the entire low-flow and during low-flow conditions very little water is left in the Derg, although water "appears" out of the bed of the river 100 metres or so downstream of the abstraction point.

The Glenedra River is used in conjunction with Altnaheglish, in that both feed into the same Water Treatment Works, Caugh Hill. There are no residual flow requirements (compensation flows). During low flow conditions the entire flow can be taken (approximately 7 Ml/d).

The Camowen River is used in extreme droughts, on average only once every three years. The Camowen River is also used to augment Glenhordial Reservoir which is located upstream of Omagh.

C1.2 IMPOUNDMENTS

There are four impounding reservoirs in the Foyle Catchment. The Altnaheglish Reservoir, by far the largest reservoir, has a reliable yield of 18 Ml/d. The remainder are small, both in terms of water they supply and in relation to their catchment size. Glencordial, which is located on the Killyclogher Burn has a yield of 2.2 Ml/d. Killea, which lies across the border, produces 1.8 Ml/d. Evish and Knockavoe in the Foyle catchment have a reliable yield of 2 Ml/d, although sources are currently not in use.

The major impoundments are either augmented by pumped river abstractions or run in conjunction with them. For example, Altnaheglish is augmented from the River Glenedra and the Glencordial Reservoir is augmented using the River Camowen.

C1.3 LOUGHS

Four loughs in the catchment are used as a source of water supply. These are all located in the Foyle River catchment and tributaries (ie. not in the Faughan or Roe catchments). The largest yields are obtained from Loughs Braden (8.4 Ml/d) and Fingren-Macrory (9 Ml/d). Water from these two sources feeds into the one treatment works, therefore these sources are considered together. The Fingreen-Macrory source is supplemented by water drawn from the Glensawisk Burn.

Donegal County Council abstracts 7 Ml/d from Lough Mourne. There is no compensation release requirement at present. There is a possibility that the abstraction from Lough Mourne is reducing flows in the Derg and in particular flows at the Derg abstraction site. The extent of flow reduction is not known as there has not been a detailed investigation into flows on the Derg system.

C1.4 GROUNDWATER

The groundwater resource in the catchment is small as a consequence of the generally impermeable nature of the bed-rock underlying the catchment. There are a number of springs and borewells used for public supply, but yield from these is small, generally less than 2 Ml/d.

Two main rock formations underlying the catchment contain useable amounts of groundwater. These formations comprise Old Red Sandstones underlying the Omagh, Dromore and Cloghfin area, and Carboniferous sandstones underlying the area west of Omagh, west of Gortin and an area on the edge of Lough Foyle adjacent to Londonderry. Across most of these formations yields tend to be small, however, reasonable yields can be obtained from the Carboniferous strata in the Omagh area.

Public supplies do not draw water from the sandstones but from the gravels adjacent to river channels. These gravel aquifers tend to be very shallow and produce small quantities of water. It is likely that the aquifers are in direct hydraulic connection with the adjacent rivers and abstractions from these sources may have an impact on river flows. This is particularly the case on the lower Faughan, where groundwater is used to augment river flows during extreme low flow events.

C1.5 FUTURE DEVELOPMENTS

Reports commissioned by the Water Executive suggest that the reliable yield of the sources in the Northern Ireland portion of the catchment is less than the level of demand. In the future demand is expected to increase and water shortages are anticipated. The Executive is planning to shut down small "uneconomic" sources, mainly springs and borewells. In the Finn catchment water supplies are also running near to capacity and Donegal County Council has plans to further develop their existing source on Lough Mourne.

There are four main water resource development schemes planned in the Foyle catchment. These are as follows:-

- **River Faughan**: A number of schemes have been proposed to augment flows in the Faughan using an impounding reservoir in the Glenedra or Roe Catchments. Depending on the site of the impounding reservoir the impacts on river flows will vary.

- **River Derg:** Proposals have been made to construct an impounding reservoir on the Glendergan, which is a tributary of the Derg or a regulating structure on the outlet from Lough Derg and use water from these to augment low-flows at the abstraction point. Currently it seems unlikely that these schemes will go ahead.

- **Lough Braden:** The Water Executive plans to increase the yield from Lough Braden by diverting water from Loughs Lack and Lee and diverting small streams in the area into Lough Braden. In addition, water levels in Lough Lack will be raised by 2 metres. This scheme will, in total increase the yield from Lough Braden by 4 Ml/d to approximately 13 Ml/d. The scheme should only have a small and localised impact although the reach from Lough Braden to the Fairywater will be affected. Currently there is no compensation release requirements in this reach.

- **Lough Mourne:** There are plans to double the yield from Lough Mourne to 14 Ml/d through raising the level of the Lough. Part of this scheme would involve establishing a compensation flow of 1.1 Ml/d on the Mourne Beg River, immediately downstream of the Lough. The abstraction may have an impact on low-flows at the abstraction point on the Derg.

In addition to the above schemes there are also plans to upgrade the Curly Hill Water Treatment Works (WTW) at the Evish and Knockavo reservoir Strabane. This WTW could provide 1.7 Ml/d and therefore will have little impact on the Foyle system. This scheme is being subject to further discussions by the Water Executive.

C2. WATER SUPPLY FOR INDUSTRY, AGRICULTURE AND AQUACULTURE

Water supply for industry and agriculture includes cooling water, process water energy supply, stock watering and fish farms. It is difficult to obtain information on abstractions (except for public supply) because there is no licensing system and information on abstractions has not been compiled. Water Executive are unable to supply data for reasons of commercial confidentiality. Another potential use of the water resources within the catchment is for the generation of hydro-electric power. In the 1993 NI/NFFO obligation, two large schemes were proposed: one on the River Roe and the other at Sion Mills on the River Mourne. The latter proposal has recently received NIE approval. If it proceeds (and even if the Company comply with the requirements of the Fisheries Act) the scheme could potentially have a serious affect on the Salmonid stocks in the Mourne system because of the amount of the water abstracted to operate it. Suitable Ecologically Acceptable Flows will need to be developed to minimise the impact on fish migration upstream through the system. The NRA are currently undertaking research into the definition of Ecologically Acceptable Flows.

Environment Service is considering the introduction of abstraction licensing as part of the current review of the Water Act (NI) 1972. If such a policy is introduced information on industrial abstraction will be more readily available in the future.

There are a number of borewells located throughout the catchment supplying both farms and industry. The significant ones are located on Map 7. Many of the domestic farm supplies draw water from the sandstones underlying the catchment. In general the yield from these sources is small, mostly less than 50m^3/day. Around Omagh industrial sources use as much as 1500 m^3/d (1.5 Ml/d) (DOC K1464/73/092). In Derry City one particular borehole is capable of providing up to 500m^3/d (0.5 Ml/d). Throughout much of the catchment, there is little use of groundwater for private, agricultural or industrial supply.

There is very little abstraction from rivers for agricultural use. Irrigation occasionally takes place in the catchment especially in dry summers. Other agricultural uses, such as water supply to dairy sheds, are generally supplied from the mains. The upper reaches of the Foyle are very important for stock watering. In most instances stock are watered by allowing direct access to the river. In these cases, a ramp is built down to the river and an area on the river is fenced off to stop stock wandering. This system can only be used in the tributaries because in the lower reaches storm flows would obliterate the watering structure.

Aquaculture is a significant use of the surface water resource. There are seven fish farms in the catchment and these are shown on the Map 16. Fish farms abstract water from the river and return it a short distance downstream. Therefore there is little or no overall impact on flows in the river (maybe pulses when abstractions commence or are halted). However, over the reach between the drawoff and discharge points, flows can be significantly reduced. The

fishfarms in the catchment are listed in Table C2, together with the abstraction quantity and the Q_{95} in the river.

There is one major abstraction from Lough Foyle. Coolkeragh Power Station abstracts water from the Lough for cooling. Some of this water is then fed to the DuPont industrial complex as part of a combined heat and power scheme. Water is also utilised for a multitude of different uses across the site.

TABLE C2 ABSTRACTIONS BY FISH FARMING OPERATIONS

Fishfarm Name	River	Abstraction (Ml/d)	Q95 (Ml/d)	Ratio:abstraction to Q_{95}
West Ulster Farmers	Upper Derg	< 50% of stream flow	0.7	<1:2
H J Johnston Corgary Trout Farm,	Mournebeg	< 50% of stream flow	15	<1:2
W J Baird Rocks Lodge	Mourne	45	380	0.1:1
P McDermott	Glensawisk Burn (Owenreagh)	0.15	3	0.05:1
Faughan Anglers	Unnamed Tributary of Faughan	< 50% of stream flow	0.7	<1:2
Boveveagh Fisheries	Unnamed Tributary of Roe	4.5	?	?
J Mairs, Ballyarton Fish Farm	Faughan	< 50% of stream flow	?	?

Source: DoE(NI) Environment Service Discharge Consent Details
Foyle Fisheries Commission

C3. FISHERIES - SALMONID AND CYPRINID

C3.1 GAME FISHERIES

C3.1.1 Introduction

The Foyle is regarded as one of the most productive Atlantic salmon rivers in Europe. It supports important commercial and game fisheries for salmon and for migratory trout. The total contribution to the economy is approximately £4m annually.

Management relates specifically to the maintenance of breeding populations of game fish and to the conditions necessary for their successful migration between fresh and saltwater - in both directions. Other issues of concern relate to the operation and maintenance of fish farms and the occurrence of fish kills.

There have been a number of fish kills in the Foyle system since 1988, caused by a variety of spillages. Brown trout, juvenile and adult salmon have been affected. Appendix C3.5 presents details of each recorded fish kill in terms of river, location, species affected and responsible pollutant.

There has been some concern in relation to the possible tainting of the flesh of salmon taken in the Foyle system in recent years. Appendix C3.4 presents a review of the problem of salmon flesh tainting.

The fish discussed in this section are referred to as salmonids and include Atlantic salmon (*Salmo salar L.*) and brown/migratory trout (*Salmo trutta L.*). These species are protected under the EC Freshwater Fisheries Directive (78/695/EEC). This directive sets water quality criteria to protect fish life in designated freshwater reaches. Salmonids require water which is well oxygenated, uncontaminated and soft rather than acid. Watercourses must be deep enough for the adult fish to lie in safety, swift enough to prevent siltation, and varied with a mixture of both open and shaded areas.

The entire system is designated as a salmonid fishery under the Directive. The replacement value of the system has been estimated at in excess of £18m. The Foyle Fisheries Commission was established by both governments in 1952 (succeeding the Moville and Londonderry Boards of Conservators). Most Foyle tidal waters are owned jointly by both governments and managed by the Foyle Fisheries Commission. Freshwater fisheries are in private ownership but the Foyle Fisheries Commission has statutory power to enforce conservation and protection measures.

The Foyle Fisheries Commission are considering the designation of reaches as sensitive in respect of forestry development in County Donegal. Particular requirements may be set for those areas which are important fisheries with low buffer capacity (low level of calcium).

C3.1.2 Salmon Breeding and Migratory Reaches

Map 15 shows the main salmon spawning and nursery areas in the Foyle system together with the locations of adult salmon census (resistivity counter) stations. Foyle Fisheries Commission personnel produce a census of spawning salmon in the Foyle system each year upon which Map 15 is based. An area where salmon spawn and which provides suitable nursery habitat for juvenile salmon can also be suitable for trout fishing - but not perhaps for salmon fishing as adult salmon may only ascend to this location after the closure of the angling season. Appendix C3.3 describes the nature and validity of redd census work on the Foyle.

Map 15 shows the locations of natural barriers to ascending salmon (1 - on the Burntollet River, a tributary of the Faughan River, there is a waterfall about 12 metres high; 2 - on the Deele River, a tributary to the Foyle River downstream of Lifford, there is a gorge with a slide about 30 metres long with a vertical fall of 3 metres immediately upstream) and the locations of several other weirs constructed mainly for water abstraction. Some of these weirs are now derelict and many present site specific difficulties for ascending fish under certain discharge conditions.

C3.1.3 Commercial Fisheries

The commercial salmon fisheries are shown in Map 16 and comprise the following:

Drift-Nets:

92 licences to fish in Lough Foyle and the open sea within the 12 mile limit;
20 licences to fish seaward of Magilligan Point and Greencastle Fort within the 12 mile limit.

Draft-Nets:

1 fixed draft-net at Magilligan Point (not presently commercially fished);
1 bag net at Magilligan strand (not regularly fished);

Traditional right for one fixed draft-net on Magilligan beach (not commercially fished in last 20 years);

River Foyle - some 60-70 draft-nets operated under licence from FFC by private individuals;

River Roe - currently one draft-net operating - historically there were four draft nets, one of which has been purchased and one leased by the Roe Angling Association. The Foyle Fisheries Commission retains the right to operate a draft net seaward of the railway bridge.

Foyle Fisheries Commission retains the traditional right to operate five salmon stake nets in the area of the River Foyle eel fishery (where the River Foyle flows through the county of Londonderry).

Salmon netting rights in freshwater on the River Finn were purchased by the Foyle Fisheries Commission during the late 1950's.

The annual Foyle area catch of salmon and grilse by various classes of commercial fishing for the years 1978-1990 varied between 18483 in 1987 and 86528 in 1989. The average for these 13 years was 47115.

C3.1.4 Aquaculture Units

A total of eights units which are currently operating are located in the catchment (Map 16). Six of these are involved in the production of rainbow trout (*Oncorhyncus mykiss* (Richardson)), one with the production of Atlantic salmon smolt while the remaining one is a fisheries enhancement hatchery situated on the River Faughan. Appendix C3.1 describes these units in terms of production, location and ownership. There are also three units which are consented but are not yet in operation.

The operation and maintenance of fish farms may impact on the water environment and careful management is essential. Chemicals used in aquaculture such as chemotheraputants and orthophosphate may be released and the fish themselves will produce ammonia and suspended solids through their excreta. Escaped fish can also interfere with natural stocks through competition and possible interbreeding leading to loss of genetic integrity.

A recent survey of eleven fish farms in ROI, outside of the Foyle area, shows that overall impacts are not necessarily high; two had no impact on water quality, eight caused a reduction of 0.5 in the Q index and one caused a reduction of 1.0. The Q index is defined later in Section D.

C3.1.5 Game Angling

As one of the most productive Atlantic salmon rivers in Europe, the Foyle is particularly noted for its early running multi-sea-winter salmon (spring salmon). Map 17 shows the locations of the main salmon, migratory trout and brown trout angling areas.

The descriptions of defined channel lengths of the Foyle system as spring salmon, grilse, sea trout or brown trout fisheries indicates the main quarry in that particular channel length. Defined channel lengths may offer spring salmon and grilse fishing - at different times of the year.

The average number of rod licences issued for the years 1988 - 1992 was 5746, the majority of which were local season permits. For these years an average of five percent of licence holders made valid returns and the catch of salmon and grilse made by these respondents for these years was 773 fish. This five per cent of anglers would catch more than the remaining 95%, so it is assumed that

their catch represents 10% of that total annual catch. Then the average annual salmon and grilse recreational fisheries catch for these years was 7730 fish. Migratory trout are also an important recreational quarry. Based on valid returns of the above years the average annual catch per permit holder was 6.96 fish. The estimated annual average catch of migratory trout for all permit holders for the above years was 20,000 fish.

The annual reports of the Foyle Fisheries Commission give no information on the numbers of sea trout taken by commercial salmon fishermen.

Appendix C3.2 describes the ownership/control of and access to the main recreational fisheries of the Foyle system. Due to the nature of fisheries ownership, angling club membership and relationships between angling clubs the information presented in Appendix C3.2 is subject to continuous change and is accurate for 1990.

C3.2 COARSE FISHERIES

C3.2.1 Commercial Fisheries

The Foyle system is largely oligotrophic and does not support a commercial eel (*Anguilla anguilla* (L.)) fishery in freshwater. However, a section of the tidal reaches of the River Foyle (Map 16) constitutes a yellow eel fishery. The commercial eel fishery of the River Foyle is owned by both governments and managed by FFC. The yellow eel catch is usually less than one tonne. The fishery is not regularly leased.

C3.2.2 Coarse Angling

Coarse fishing in the Foyle system (Map 15) occurs at a low level mainly in the Omagh area. During the early 20th century roach (*Rutilus rutilus* (L.)) were introduced by the Abercorn Estate into the lower reaches of the Fairywater. The Abercorn Estate also promotes pike (*Esox lucius L.*) angling on three lakes within the estate on a tributary of the River Derg called the Milltown Burn. There is also coarse fishing at Lough Enagh Eastern.

C4. MARINE FISHERIES AND SHELLFISHERIES

C4.1 INTRODUCTION

In principle, the fisheries in the Foyle Catchment fall into four categories: freshwater finfish, marine finfish, freshwater shellfish and marine shellfish. In practice, the marine finfishery is practically confined to the salmonid fishery; no other species are commercially taken from the Lough although trawlers land the catch they take from the area outside the Lough in Greencastle. The salmon fishery in the Lough and the freshwater coarse and game finfisheries are considered in section C3.

The freshwater shellfishery is now extinct: the only species harvested in the past was the Freshwater Pearl Mussel (*Margaritifera margaritifera*) which was once present in vast numbers and fished for its pearls rather than for food. Since there is no longer a freshwater pearl fishery and since *Margaritifera* are threatened with extinction, this species is treated in the section on Nature Conservation (C6).

This section therefore principally deals with marine shellfisheries, though marine finfisheries are treated as a peripheral subject. A list of marine finfish taken from the intake at Coolkeeragh power station is given in Table C4.1. It should be noted that the list is not a comprehensive species list for Lough Foyle. Other species are present including for example Mullet, Roach and Sunfish.

In Northern Ireland disposal of waste to the sea is regulated by the Food and Environment Protection Act (NI) 1985 and in the Republic, by the Dumping at Sea Act 1981. Shellfish water quality is governed by the Council Directive on the quality required of Shellfish Waters (79/923/EC) which sets mandatory and guideline limits on water quality parameters. Other relevant legislation includes the Fisheries (NI) Act 1966, the Fisheries Act (NI) (Amendment) 1968 and the Fisheries (Amendment) (NI) Order 1991 for Northern Ireland and the Fisheries (Consolidation) Act 1959, the Fisheries (Amendment) Act 1962 and the Fisheries Act 1980 in the Irish Republic. The management of harbours in the Irish Republic is governed by the Fisheries Harbour Centres Acts 1968 & 1980.

C4.2 LOCAL PERSPECTIVE

Marine fisheries have been subdivided into marine finfisheries and marine shellfisheries for the purpose of this report:

C4.2.1 Marine finfisheries

There are no records of a regular finfishery in Lough Foyle other than that for Salmon (*Salmo salar*) which is discussed in section C3. There are local fishing boats working out of Greencastle and Moville, but the amount of commercial fishing inside the lough is thought to be minimal. Such boats as work inside the Lough are involved in the oyster or mussel fishery or in potting or dredging for other invertebrate species. Greencastle is an important fishing port for vessels working outside the Lough, both in near shore and deep water trawling and trawlers occasionally come as far south as Londonderry, though this may be for fuel or servicing rather than to land their catch.

TABLE C4.1

List of fish species taken at Coolkeeragh Power Station between September 1989 and August 1990 (from Moorehead & Service, 1992)

Common Name	Latin Name	Number taken
Common Eel	*Anguilla anguilla*	4
Sprat	*Spratus sprattus*	44
Herring	*Clupea harengus*	31
Brown Trout, Sea Trout	*Salmo trutta*	2
Smelt	*Osmerus eperlanus*	19
Cod	*Gadus morhua*	2
Bib, Pouting	*Trisopterus luscus*	5
Poor Cod	*Trisopterus minutus*	1
Whiting	*Merlangius merlangus*	3
Pollack	*Pollachius pollachius*	4
Three-bearded Rockling	*Gaidropsarus vulgaris*	4
Five-bearded Rockling	*Ciliata mustela*	1
Sand Smelt	*Atherina presbyter*	275
Three-spined Stickleback	*Gasterosteus aculeatus*	3
Fifteen-spined Stickleback	*Spinachia spinachia*	10
Greater Pipefish	*Syngnathus acus*	1
Greater Sea Scorpion	*Myoxocephalus scorpius*	2
Pogge	*Agonus cataphractus*	24
Butterfish	*Pholis gunnellus*	4
Sand Goby	*Pomatoschistus minutus*	15
Common Goby	*Pomatoschistus microps*	17
Plaice	*Pleuronectes platessa*	10
Dab	*Limanda limanda*	7
Flounder	*Platichthys flesus*	46
Long Rough Dab	*Hippoglossoides platessoides*	4
Witch	*Glyptocephalus cynoglossus*	1
Dover Sole	*Solea*	25

NB. Note the above list is not a comprehensive species list for Lough Foyle.

C4.2.2 Marine Shellfisheries

The shellfisheries of Lough Foyle are shown in Map 18.

Although Lough Foyle supports a fishery for both oysters and mussels, there are no EC designated shellfish waters in the catchment. The only species which are regularly fished are the Common Mussel (*Mytilus edulis*) and the Oyster (*Ostrea edulis*). Mussels are widespread and common in the Lough and were the subject of four reports in the late 70s and early 80s, these are summarised in Appendix C4.1. The Oyster fishery is conducted on a sporadic basis, peaking about once every ten years.

There have been recent moves towards and a report on the possibility of commercially developing an aquaculture industry in the Lough, but no applications for permission to do so have been received. The whole of the Lough is included in the Port of Londonderry harbour limits and it is possible that any such applications would have to be on the basis of several orders through the Londonderry Port and Harbour Commission.

There is also an increasing interest in other species of invertebrates including swimming crabs, winkles and whelks, particularly to target markets on the mainland of Europe (see 'Other Species', Summary Information, Appendix C4.1).

A study of anthroprogenically derived chemicals in Lough Foyle, with reference to their impact on shellfish in the estuary, is being carried out by the Queens University of Belfast (see Appendix C4.2). The objectives of this study are to determine the impact of industrial development on water quality and to assist in the development of the shellfish industry. The work is due to be completed in 1995.

C5. RECREATION AND AMENITY

C5.1 INTRODUCTION

This section largely relates to activities which attract people to the river corridor and the Lough waters and to the consequences of the activities. Examples of the uses include water contact sports such as swimming, sailing, water skiing, jet skiing, rowing, canoeing etc as well as non-contact activities such as walking, visits to country parks, heritage sites and so on. Angling is not covered in detail in this section, but can be found in the fisheries section (C3). The consequences of these uses are reviewed under aesthetic considerations, that is, litter (including that derived from sources other than recreation and amenity use) and damage to the river (minor pollution incidents, destruction of bankside vegetation and banks during access).

C5.2 LOCAL PERSPECTIVE

The local planning issues are detailed in Map 19.

C5.2.1 Recreation

Broadly speaking, for the purpose of catchment management, recreation in the catchment may be divided into two main categories: water contact sports and non-contact activities. The former includes swimming, sailing, rowing, canoeing, surfing and jet-skiing, the latter includes river walks, cruises, camping and caravanning.

C5.2.1.1 Water Contact Activities

These are largely carried out on the tidal river downstream of Strabane and in Lough Foyle. The main exceptions are canoeing and rowing, which are also practised in other parts of the navigable river; and such activities as take place on the freshwater loughs. Most of the activities are not regulated or officially organised in either jurisdiction, but in NI there are several DANI-run sites and at least one council-operated facility (in Londonderry).

In the Lough there are three main access points for water-borne activities: Redcastle, Moville and Greencastle, although Quigley's Point is also used by local people.

Moville has traditionally been a resort, although somewhat in decline in recent years. The principal watersports are based on local use for sailing and as access for some diving and angling boats. There is a jet-ski hire business at the harbour and a certain amount of windsurfing and water skiing also takes place. Access at Redcastle is mainly via the Redcastle Hotel site and used by visitors, although there are plans for a marina at this location.

The Harbour at Greencastle is a working fishing port with no proper visitor facilities. Some launching of boats for pleasure does take place, but the most important recreational use is for deep-sea angling offshore of Lough Foyle from charter boats.

The principal outdoor water sports centre on the Foyle River is Prehen Boat House (OS Grid reference: C425 153). This is run by Derry City Council and provides facilities for sailing, rowing, canoeing and water skiing. There is also a small sailing club at Culmore Point (OS Grid Reference: C477 224).

Derry City Council currently has plans to set up a marina on the Foyle between the Foyle and Craigavon Bridges. At present, this is merely a concept but, if realised, would be able to accommodate ocean going yachts.

In the river system upstream of the tidal limits on the Foyle and Finn near Strabane, the main water contact sport is canoeing. Access facilities are provided at six sites in NI (Table C5.2.1.2) although none have been defined in the ROI. The Loughs in the catchment are mainly in the ROI and are used extensively on a casual basis for windsurfing, sailing and canoeing.

Swimming is not a significant pastime in the Foyle system and, although people do probably swim on a regular basis, there are no defined sites or facilities.

C5.2.1.2 Non-contact Activities

In contrast to the relatively low usage of the catchment for water contact sports, there are a number of non-contact activities. Most of the Department of Agriculture amenity sites have walks (Table C5.2.1.2) and there are walks in the country and forest parks at Gortin Glen, Roe Valley, Ness Wood, Ervey Wood, St Columba's, Greysteel Glen and Ballykelly.

Derry City Council maintains two river walks in Londonderry, one either side of the river upstream of Craigavon Bridge. There are plans to have a single circular walk over the Craigavon and Foyle Bridges and along the river shore. There is also a small lake at Gransha, just south of the Foyle bridge on the east bank of the Foyle, which is often used by bird watchers although it is not a nature reserve nor an official RSPB site.

In the Republic of Ireland, the Forest and Wildlife Service maintains walks in Drumboe Wood and the 1991 Ballybofey/Stranorlar Tourism Strategy has proposed a variety of improvements and extensions to these.

There are a number of camping and caravanning sites in the catchment, most notably in Gortin Glen Forest Park and Roe Valley Country Park. Some of these locations are situated close to water bodies and are therefore of indirect importance to catchment management. They include Gortin Glen, Roe Valley, Learmount Wood and Loughermore Bridge.

Table C5.2.1.2 DANI Amenity Sites in the Foyle Catchment

Location	OS Reference	Facilities
Moorlough	H447985	Picnic Sites Walks Car parks Toilets Artificial Beach
Prehen Jetty	H416145	Slipway Jetty
Sion Mills	H346932	Riverside Walk Picnic Site
Milltown Bridge	H365876	Picnic Site
Derg River Walk	H263843	Riverside Walk
Newtownstewart	H404857	Canoe Launching
Half-way house	H419812	Walk Canoe Launching
Strule River Walk	H453727	Riverside Walk Canoe Launching
Drumragh Bridge	H457699	Canoe Launching
Bloody Bridge	H483697	Car Park Canoe Launching
Sperrin	H637943	Picnic Site Riverside Walk
Oak Lough	H499841	Walk Shelter Canoe Launching
Sloughan Glen	H277743	Picnic Site Car Park Extensive Walks and Views

C5.2.1.3 Cruises/Ferries

At present, a small ferry service is operated in the summer months between Magilligan Point and Greencastle (approximately Easter to September). This is a passenger service only but Limavady District Council and Donegal County Council are currently looking into the possibility of upgrading it to a car ferry service, possibly jointly with a private operator. Such a development could present navigation complications in the strong currents around Magilligan Point.

In 1992, Derry City Council operated a cruise vessel on Lough Foyle. This was a pilot scheme only and it was intended that the service should be sold thereafter. In fact, it appears that the scheme aroused considerable interest. The water quality implications of this are not considered significant.

In 1992, the Lifford Development Association proposed the opening of a boat cruise operation linking Lifford, Strabane, Londonderry, St. Johnstown and Carrigans. Funding is currently being sought from the International Fund for Ireland (IFI)

although it appears that the operation is not feasible due to shallow water downstream of Lifford.

C5.2.2 Amenity

The amenity value of the Foyle Catchment, or the public enjoyment derived from recreational use of its water, is largely controlled by the aesthetic quality of the water bodies and their banks. Factors having a detrimental impact on amenity value may be broadly categorised as landscape considerations and litter/waste.

C5.2.2.1 Landscape Considerations

Large sections of the catchment are already protected under designation as Areas of Outstanding Natural Beauty, Country Parks, Forest Parks, Outstanding Landscapes, Peatlands, ASIs and ASSIs etc. (see section C6). The DOE (NI) Planning Strategy for rural NI and the Donegal County Development Plan designated much of the catchment as being of high amenity value and stated that development control policy will be greatly concerned with the impact of any proposed development on the visual amenity of the area.

However, there are areas of the catchment associated with the rivers which do not enjoy definitive protection and may be damaged as a result. Examples might include the trees lining the bank which adversely affect land drainage operations, planning applications for domestic or industrial premises and, in particular, farm buildings adjacent to rivers. Planning approval outside defined areas may not consider the wider visual aspects as a matter of course and some industrial or agricultural development does not require planning at all. Land drainage which removes bank cover not only affects the ecology but also has serious effects on the landscape.

C5.2.2.2 Litter and Waste

Impacts on amenity value due to litter and waste may be a result of activities encompassing everything from casual littering to licensed or illegal waste disposal. Whether litter is derived from casual disposal of cans, wrappers etc, deliberate dumping of household waste, or disposal of industrial and agricultural waste, common visual and odour problems can result. Licensed dumping at sites remote from the water body may also result in wind blown debris having a detrimental impact on amenity value. Such an impact is evident in areas adjacent to tip sites located on both banks of the River Foyle upstream of Strabane/Lifford and at Culmore.

Both jurisdictions have legislation on litter, which is mainly centred on the act of littering as necessary proof. New legislation is imminent in NI which will put the onus on the district councils to ensure that the environment remains litter-free and levels of cleanliness which should be achieved are defined for different areas dependant on their use.

C6. NATURE CONSERVATION

C6.1 INTRODUCTION

The nature conservation sites are shown in Map 20.

Nature conservation is an essential element in the protection of the natural environment. In particular the aim is to conserve remaining natural habitats, native plant and animal species and communities and to maintain biodiversity. In general the most significant pressures come from industry, agriculture, forestry, extractive industries, urbanisation and recreation. The impacts of these changes on nature conservation are difficult to quantify but there are a number of vulnerable habitats and species which act as indicators of change. For instance within the catchment area the traditional wetlands, particularly peat bogs and naturally poorly drained land are particularly under threat. Some are used as tip sites for rubbish, others are exploited for fuel or drained to provide productive farmland.

Both jurisdictions have designations to protect areas of interest; these are Areas of Scientific Interest (ASIs), Peatlands, Outstanding Landscapes etc. in the ROI (see Appendix C6.1) and Areas of Special Scientific Interest (ASSIs), Forestry Nature Reserves, Areas of Outstanding Natural Beauty (AONBs) etc. in NI (see Appendix C6.2). These designations have statutory protection in NI. Details regarding previous and current ecologically relevant surveys for NI are contained in Appendix C6.3.

In ROI, a process is underway to give statutory protection to sites under a new title, National Heritage Area. All ROI sites listed in Appendix C6.1 are under consideration as NHAs.

The legislation to protect the natural environment is either site-specific (ASSIs, ASIs etc.) or species-specific (Wildlife (Northern Ireland), Order 1985, Wildlife Act ROI). The main categories for consideration in this plan are:-

- Statutory Reserves and Parks
- Voluntary Reserves and Parks
- Species-specific measures

With respect to the river corridors in the catchment, nature conservation varies in degree from the preservation of existing undisturbed habitats to the protection and enhancement of other reaches for the purpose of conservation. While the general aim is to protect all aquatic flora and fauna, the focus of conservation in terms of river catchment management is on those species and habitats which are particularly associated with the river corridor as well as enjoying special protection under government legislation.

In June 1994 the Department of Agriculture NI designated part of the Sperrins as an Environmentally Sensitive Area (ESA). Most of the 87,000 hectares involved lies within the Foyle catchment. The designation will enable payments to be made to

farmers who undertake to farm in an environmentally friendly way. The scheme will protect and enhance wildlife habitats as well as landscape and historic features. Among other things it will encourage extensive farming and the avoidance of point and diffuse farm source pollution.

In ROI a scheme known as the Rural Environment Protection Scheme (Refer Section A2.4.3) has recently been established, to encourage farmers to adopt farming practices which reflect concern for the environment including conservation. Under the scheme aid may be paid to farmers on adoption of certain practices and measures which protect the environment. In ROI, the EPA Act also provides for the making of regulations for the control management and regulation of any process or action involving genetically modified organisms.

C6.2 LOCAL PERSPECTIVE

C6.2.1 Reserves and Parks

In NI the designated areas are administered by several different bodies. The Countryside and Wildlife Branch of Environment Service influence the management of ASSIs, AONBs and Marine Nature Reserves. These are all statutory undertakings designated by the department with the exception of the Marine Nature Reserves which are designated by the Secretary of State. Reserves administered by the Department of Agriculture (Forest Nature Reserves), the National Trust and the Ulster Wildlife Trust are not statutory. There is a RSPB reserve at Tullyvery.

In the ROI, Nature conservation is also in the domain of central Government, in the Office of Public Works. The Environmental Protection Agency also has an important role in environmental protection.

In general international measures to protect the environment are administered by the respective government agencies. These include those covered by EC Directives and international conventions (such as the Ramsar convention for the protection of wetlands).

Nature Conservation Areas in ROI are listed in Appendix C6.1 and Designated Areas and other sites in NI managed in the interests of conservation are listed in Appendix C6.2. The most important sites are Lough Foyle, the Foyle River and the Pettigo Plateau including Lough Derg, which are of international rating. Other sites of local, regional or international importance, are spread throughout the catchment. Many are peatlands which are unique to Ireland and are particularly vulnerable.

C6.2.2 Species-Specific Measures

In ROI, species-specific measures are covered by the Wildlife Act (1976), but it is more common to find that such protection is applied in designated areas. Amended legislation is planned for the strengthening of species protection measures. In NI, the Wildlife (Northern Ireland) Order provides for the preservation of individual species at various levels of protection and for both jurisdictions the relevant

international conventions on birds (the Ramsar convention) and wildlife and habitats (the Berne Convention) etc. apply. Biological and ecological surveys conducted in Northern Ireland which are relevant to the Foyle catchment are summarised in Appendix C6.3.

The Wildlife (NI) Order 1985 contains a variety of schedules which confer different levels of protection to the animal and plant species listed in them. Species in the Foyle catchment which are afforded special protection and would be at risk from a deterioration in water quality include the Otter (*Lutra lutra*), the Kingfisher (*Alcedo atthis*) the Common Newt (*Triturus vulgaris*). All these species are included in those schedules imposing protection at all times (Schedule I for birds, Schedule V for other animals).

The Freshwater Pearl Mussel *(Margaritifera Margaritifera)* is currently included in Schedule VII which means that it is only illegal to sell them or parts of them. It is proposed that the Wildlife (NI) Order of 1985 should be amended in the near future so that *M. margaritifera* is included in Schedule V. This would afford the species greater protection as its removal would only be permitted under licence for the purpose of research.

When the legislation is changed to protect *M. margaritifera* at all times it may then be possible, on the occurrence of a pollution incident which causes the death of mussels to secure a prosecution of the polluter by tracing the cause of death utilising (say) tissue analysis.

C7. CULTURAL HERITAGE

C7.1 INTRODUCTION

The cultural heritage of the Foyle Catchment is rich. Throughout the catchment area there are sites and structures of archaeological, historical, architectural and industrial interest, representing some 8,000 years of human activity within the area. There are a range of sites and features which occur in, or beside, or across watercourses, and whose conservation is critical to the management of the catchment and to the development of tourism and educational interests. The range of sites and structures reflect the need for and the use of the water resource. Dredging, channel-widening and other activities associated with watercourse management can have a significant impact on such features, and can also lead to the discovery of new objects, sites or features and thus increase our knowledge of the past, and enhance the man-made heritage.

The integration of these activities in a catchment plan can contribute to both the environment and the economy of the area.

C7.1.1 Northern Ireland

Environment Service: Historic Monuments and Buildings (ES: HMB) is responsible for the identification, recording and protection of the man-made heritage, that is archaeological sites and monuments, buildings and other features of architectural and historical interest, industrial heritage features and maritime archaeology. Individual sites, features or complexes of remains may be scheduled for protection, or taken into the Department's care under the Historic Monuments Act (NI) 1971 or listed for protection under the Planning Order (NI) 1991, or designated under the Protection of Wrecks Act 1973.

Manmade Heritage

A scheduled monument is protected from any form of damage, including destruction as a result of development. A listed monument does not enjoy this level of protection but must be taken into account when a planning decision is reached under the Planning (NI) Order 1972. The Planning (General Development) Order (NI) 1993 provides a definition for a Site of Archaeological Interest (SAI) and suspends a range of activities if an SAI is present in the area concerned.

The Foyle catchment includes in excess of 10,000 listed features belonging to the above three categories, though the number of scheduled monuments is far lower than this figure. In Northern Ireland most of the information is recorded on maps and is also available on databases. The Scheduled and State Care Monuments and Listed Buildings and other features of architectural and historic interest are listed in a ES:HMB publication. Bridges, weirs and mills are identified in the Industrial Heritage Record and archaeological sites and monuments in the NI Sites and Monuments Record.

With respect to marine archaeology there has recently been considerable interest in the wreck of the "Stypie" (an old schooner) which is located in the main channel of Lough Foyle near Redcastle.

Following discussions with the client and Historic Monuments and Buildings (HMB) it was not considered appropriate that site specific information for NI be provided in this document. This is because some of the data is confidential where sites have not been investigated and there is a danger of disturbance by, for instance, treasure hunters. It is noted that the two main bodies who would have need to consult the data are the Planning Service of the DOE (NI) and the Watercourse Management Division (WMD) of DANI, both of whom have agreed procedures for doing so.

The agreement between HMB and WMD includes both those monuments which are identified and any site or artifact that may be uncovered during land drainage operations. HMB are interested in all discoveries from prehistoric sites which may be represented by a layer of shells and stones to such structures as horizontal water wheels, which may have been fairly common but of which no examples are known to be in existence.

There are no plans to review these arrangements and they will not be reviewed in the management options of this plan.

C7.1.2 Republic of Ireland

Legal protection for sites, monuments and artifacts, whether already identified and listed or newly discovered, is provided in the National Monuments Acts 1930 to 1987. National Monuments are in State ownership or guardianship and no activity likely to cause disturbance or damage is permitted. Control is exercised by the National Monuments Branch of the Office of Public Works and by Donegal County Council.

The Sites and Monuments Records (SMRs) contain an index and map of all known and suspected archaeological sites, monuments and features likely to be of significance. All sites of archaeological interest date from the Mesolithic era to the end of the 17th century A.D. More recent heritage sites are mapped by the Ordnance Survey.

C7.1.2.1 Site Locations

The following provides a general description of antiquities on or near the waterways of the catchment which are of importance with respect to cultural heritage. It is based on existing information from previous surveys. While some buildings and other features of architectural and historic interest are considered, there may be others in the catchment, particularly more recent sites, which have not been surveyed.

Information regarding site locations was obtained from the Archaeological Survey of County Donegal (published 1983) and the sites and Monuments Records of the Archaeological Section of the Office of Public Works, together with the associated 1:10,560 archaeological maps.

Eighty three sites were selected for consideration on the basis of their proximity to the waterways of the catchment. These are listed in Appendix C7. In many instances although there are records of antiquities at certain sites they have been destroyed or there are no surface remains visible. These sites are included however as the Office of Public Works regard these as antiquity sites which could yield remains on archaeological excavation.

C7.1.2.2 Waterway Sites

There are no weirs, lockgates, watermills or millraces listed as being of archaeological importance by the OPW. In the past there were two weirs - one on the Deele and one on the Swillyburn. Both were removed during drainage works in the early 1960's. There is one crannóg (artificially constructed lake habitation site) within the catchment at Roosky - this artificial island is now submerged in Port Lough and it seems probable that the site was a crannóg on which a later medieval building was erected.

Within Lough Derg there are 42 islands but only two are considered to be of archaeological interest. The first is Saint's Island on which is located half of a single banked earthen enclosure surrounded by a fosse on the outside. The second island (Station Island) contains some miscellaneous ecclesiastical remains.

C7.1.2.3 Other Sites

Other archaeological sites located close to the rivers are also listed on Appendix C7. Only one possible megalithic tomb site (unclassified) has been identified, in the area at Dooish. (Sheet 77, No. 6).

Six castle sites are listed in the catchment. The most important of these is the remains of Greencastle which was the principal Norman castle in NW Ulster and was built in 1305. The site is situated on the west shore of Lough Foyle and encompasses a massive platform of cropping rock. The upper ward of the castle with its massive NE polygonal tower was accommodated on this outcrop.

In the main, the other SMR listed sites are earthen ringforts (remains of protected enclosures around farmsteads from the Early Christian period (500-1100 A.D.)), destroyed enclosures (probably of Ringfort or Cashel type) and standing stones.

C8 NAVIGATION

Navigation is an important use with many direct and indirect impacts on water quality. The direct operational aspects relate to port management systems, disposal of ships waste, spillages and capital and maintenance dredging. Indirect impacts arise from associated commercial activity and infrastructural requirements.

C8.1 INLAND WATERWAYS

There are no designated navigable inland waterways in the Foyle Catchment. It is of course possible to travel upriver from Derry during high tides in light craft.

A proposal has been made by Strabane District Council to reopen the Strabane Canal. This stillwater canal extends for approximately three kilometres from Strabane along the eastern bank of the River Foyle towards Londonderry, joining with the Foyle river at a point where high tide provides adequate navigation depth.

The navigation authority for inland waterways in Northern Ireland is the Department of Agriculture, while the Office of Public Works has responsibility in the Republic of Ireland. Londonderry Port and Harbour Commissioners have local responsibility for navigation on the River Foyle upstream of Craigavon Bridge. A special canal authority has been suggested in the proposal for the Strabane Canal.

In general, it is considered appropriate that any developments on the River Foyle should not interfere with the possibility of future inland navigation requirements.

C8.2 LONDONDERRY PORT

Londonderry is traditionally the regional centre and marine port of north west Ireland. Port trade reached 1.4 million tonnes per year by the 1970s but dropped markedly in the 1980's. Londonderry is primarily an import destination, the main trades being bulk cargoes of coal, animal feeds, timber, steel, chemicals, fuels, oils and petroleum products. The port now handles about 800,000 tonnes annually (a small port by international standards) with approximately 500 annual arrivals, generally short sea voyages in ships ranging from 1200 to 3000 dead weight tonnage (dwt). Decline of port trade was partly due to poor facilities and high costs.

The port at Londonderry was relocated in 1993 from its traditional site at Meadowbank, along the River Foyle in the city centre, to a purpose designed deepwater terminal at Lisahally, 5 km downstream. Reasons for the move included the constraints on ship tonnage due to the relatively shallow river channel near the city, with its persistent need for maintenance dredging, and the limiting headroom at the Foyle Bridge. Further, the residual port area had become too small to meet harbour needs.

The new port at Lisahally has a site area of 10 hectares and provides a 365 metre long deep water quay with 10m depth at lowest tide. The new port provides tidal

access to fully laden vessels of 15,000 dwt. Annual port trade is now expected to increase to 1 million tonnes by 1995 rising to 1.25 million tonnes by the year 2000.

An oil company imports petroleum products into a private jetty near the city centre and the company maintains a local navigation channel. Standby supplies of heavy fuel oil are delivered directly to Coolkeeragh Power Station jetty, downstream of Lisahally Port. Chemicals including chlorine and caustic soda are imported to a nearby chemical complex.

Londonderry Port and Harbour Authority has prepared emergency plans for port activities. Management of spillages within the Lough is the responsibility of the Department of Environment NI and Donegal County Council.

C8.3 DREDGING OF NAVIGATION CHANNEL

The navigation channel through Lough Foyle was dredged in 1992/3, increasing the depth available at low water from 6.9m to 8m. The minimum width of the channel is 50m. There is a turning circle of diameter 350m at Culmore Bay. Studies carried out on possible impact of dredging on shell fisheries in the estuary prior to work being carried out did not foresee significant impacts arising. During the works no dredging was carried out during the periods of salmon runs. A backhoe dredger was used in Culmore Bay and a suction system was used elsewhere in the Lough.

Returns given to the Department of the Environment (NI) show that maintenance dredging material quantities were of the order of 50,000 - 60,000 tonnes per year in the past. Typical nett sedimentation in the navigation channels is 0.2m per year.

The Department of Environment (NI) previously granted a licence under the Food and Environment Protection Act (1985) for the disposal of dredged material at a site within the Lough, in the vicinity of the North Middle Bank. The licence, which expired in 1990, has not been renewed. As part of the project to construct the new port at Lisahally, modelling studies were carried out to identify a suitable alternative site for the disposal of both capital and maintenance dredging material within the Lough. However in the event the capital dredging material had to be disposed of outside the Lough.

For maintenance dredging the Harbour Authority has considered the option of "flow-lane disposal" when during periods of swift currents and high freshwater runoff, the bed of the navigation channel would be agitated to allow the high sediment erosion characteristics of the channel to remove silt downstream. This procedure would however have required further analysis of sediment control in the Lough to assess environmental impact.

In January 1995 the Department of the Environment issued a licence, valid for one year, for the disposal of 10,000 m^3 of dredge spoil in an area of the Lough off Redcastle where the chart depths are 10.7 metres .

C9. FLOOD DEFENCE AND DRAINAGE

C9.1 HISTORICAL PERSPECTIVE

River flooding and unsatisfactory land drainage conditions are problems of special significance in Ireland.

Probably the chief cause of drainage difficulties derives from the configuration of the country. The high maritime rim and flat interior cause many of the rivers to have poor gradients frequently intercepted by lakes. This results in the familiar sluggish flow, poor channel conditions and in many instances frequent and prolonged flooding over wide areas.

About the beginning of the last century, interest in the problem developed to a realisation of the size of operations required and the need for large scale Government intervention. This led to the 1842 Drainage Act. Drainage was the subject of a total of six parliamentary enactments as well as a large number of amendments modifying their proposals.

The greatest intensity of drainage work stemmed from the 1863 Act and continued to the turn of the century. A special maintenance Act of 1866 provided for protection of existing works.

Work was carried out on the Foyle Catchment during this period, most notably the flood protection embankments in the lower reaches of the catchment which survive today.

C9.2 PRESENT POSITION

The present drainage channels are shown in Map 21.

C9.2.1 Northern Ireland

There are some 700km of the River Foyle system which have been designated under the 1973 Northern Ireland Drainage Order, and as such are maintained by the Watercourse Management Division (WMD) of the Department of Agriculture.

Channels are designated by the Drainage Council on the basis of recommendations from the Department of Agriculture.

All new rural drainage schemes were completed some years ago, but minor improvements to the flood defences of Omagh and Strabane, and to some of the urban tributaries of the Foyle in the city of Londonderry are ongoing. ~~The Drainage Order provides for schemes to be undertaken to solve problems on a local or larger scale.~~

Specific urban flood protection measures are being developed, particularly following the severe floods in Omagh and Strabane in 1987. Attenuation is provided by oversized culverts and basic systems of flood warning are being implemented using Meteorological Office rainfall predictions and telemetry from river gauging stations. Inspectors monitor the efficiency of the flood protection systems on a continuous basis in Omagh.

Responsibility for the maintenance of the system is split between the Omagh and Coleraine offices, with the former managing the designated watercourses upstream of the Burndennet confluence and including that tributary, and the latter the main arterial river downstream to Craigavon bridge in Londonderry, and including the urban watercourses in the city.

Riparian owners on each side of the channel of a watercourse which has not been designated are responsible for maintenance. This procedure is enforced by Department of Agriculture under Schedule 5 of the Drainage Order.

C9.2.2 Republic of Ireland

The 1945 Arterial Drainage Act provided for the following:

(a) Responsibility for initiating and carrying out drainage schemes rests with the Commissioners of Public Works.

(b) The total catchment area is the basis for investigating and preparing schemes.

(c) Maintenance is also the responsibility of the Commissioners of Public Works, once a scheme has been completed.

The Deele and Swillyburn Drainage Scheme was completed in the period 1958-62. This scheme involved three tributaries of the Foyle, the third being the minor Carrigans tributary. The works involved construction of embankments in the lower tidal reaches, channel excavation upstream and development of storage channels and flap valves at the embankments. Two weirs were removed during the works, one at Ballindrait and the other at Sandymills.

The effects of arterial drainage schemes on flood flows have been documented by the Commissioners of Public Works. In catchments which exhibit poor initial conditions with, say, 10% of lands damaged (i.e. subject to frequent flooding) comprehensive catchment drainage schemes give an average increase of 40% to 60% in peak flows, with a shorter time to peak. Low flows may be increased or decreased, depending on the geomorphology and channel network. Hence dilution of effluents following drainage improvements is greater during storm conditions and it may be reduced in dry periods.

The main tributary in Donegal is the River Finn. Although embankments were constructed here in the 19th century, these have not been maintained. The Finn is listed by the Commissioners of Public Works in their proposed drainage schemes, but this is unlikely to be undertaken in the near future. A particular flood problem

occurs on the Finn downstream of the towns of Ballybofey/Stranorlar, while the towns themselves are protected by high embankments.

Monitoring and control of rural and urban flood defence on the Finn falls outside the responsibilities of all Government agencies. However, Donegal County Council has certain powers to undertake channel clearance works on a limited one-off basis if particularly hazardous conditions occur.

C9.3 POTENTIAL EFFECTS OF MAINTENANCE WORKS

Whilst all new works and maintenance are subject to the environmental assessment procedures contained in the regulations, maintenance works such as dredging and bank stabilisation affect water quality and aquatic habitats. In general, decisions on whether a special study of these potential effects is needed are made by the engineers controlling the works. Conservation advisors are available within the Department of Agriculture and the Commissioners of Public Works to assess the situation.

Both ROI and NI are committed to carrying out environmentally sensitive drainage works. In particular river corridor surveys are a feature of maintenance works in NI. Furthermore DANI as part of its Countryside Management Strategy has produced a booklet to explain the measures being undertaken and proposed to integrate environmental protection and rehabilitation measures into drainage works.

De-silting operations are carried out by dragline or hydraulic excavators. In general, work is carried out from one bank only and the silt is spread on the bank or used to top up the adjoining embankment.

Potential effects of maintenance works on vegetation in the Foyle system is restricted mainly to the channel banks. Wetland and fen communities have acclimatised to the post-scheme water regime and there is little or no continuing works in these areas. The river system generally flows through developed agricultural lands where the flora and fauna have been modified by farm management. The predominant land use is pasture, which varies from rough grazing to fertilized reseeded grass. In grazed areas, little marginal or emergent vegetation grows, other than annual species. Areas of meadow adjoining the rivers have a narrow border of marginal vegetation. This marginal vegetation provides habitat for insects, fish, otters and birds.

Areas of scrub and developing woodland are not extensive in the catchment. These are preserved where possible during drainage works.

Where significant volumes of silt are deposited by the river, rehabilitation of excavated spoil is carried out by removing topsoil, spreading spoil, replacing topsoil and reseeding. Natural regeneration of vegetation is preferred on the channel bank and on adjoining undeveloped lands.

Particular care is necessary during excavation in areas of botanical interest and in fish spawning stretches, so that there is minimum disturbance to either bank. Shallow side slopes and berms can reduce the impact of excavation, facilitate recovery and in the long-term preserve habitats. Reinstatement of spawning beds may be necessary during maintenance works.

A joint research project on mitigation of fisheries impacts has been undertaken by the Office of Public Works and Central Fisheries Board in Republic of Ireland. This culminated in the following guidelines which are now operated in all sensitive areas.

- The adoption of a less rigorous maintenance regime which allows for an undulating bed, a complex flow regime and maintenance of a summer base width suited to fish is proving to be very successful and can still meet the drainage requirements.
- Working in a downstream rather than upstream direction may benefit both fisheries enhancement and lengthen the maintenance cycle.
- The creation of in-river banks near the toe of the main bank can restore the pre-drainage base width, improve nursery areas and serve as walkways for anglers. The banks have remained reasonably stable in floods.

C9.4 CONTROL OF FLOW AND WATER LEVEL

The River Foyle is tidal from Lough Foyle to Strabane. An extensive embanked system is provided both on the eastern shore of Lough Foyle and on the tidal reaches of the River Foyle and its tributaries. Maintenance of these embankments is an important element in the present management of the catchment. Repair of breaches and other damage caused by overtopping is expensive and hence substantial freeboard is provided for settlement and wave action.

Run-off is collected in pondage basins along the landward side of the marine embankments from which it is discharged to the sea by a series of pumping stations which are operated by the landowners. This is supplemented by gravity systems consisting of culverts through the embankments fitted with flap sluices at their outlets which open at low tide. The pumping stations provide adequate drainage of the agricultural land within each of the four intakes which are below sea level.

Available storage in channels must be capable of containing the runoff during the period of closure. Where available storage volume is considerably less than required, then it is a question of reducing the area enclosed - by using additional intercepting channels, discharging directly into the outfall, or abandoning some of the lands proposed for protection.

Inland floodbanks have been constructed on many tributaries, most notably on the Faughan, the Roe and the Finn. The system of drainage from embanked areas is by gravity through culverts fitted with flapped sluices.

There are no reservoirs or main sluices on the river system. Control of water level is by fixed weirs. These weirs were constructed for the most part over a hundred years ago, some associated with millpower developments. However many weirs are broken down or breached and only a few have efficient fish passes. The largest is on the Mourne at Sion Mills. The fish pass at the Campsie Barrage located at the upstream end of the tidal portion of the River Faughan works effectively when sufficient flow is available.

A small number of velocity-control structures exist. These take up excess fall by a series of steps or drop weirs along the upland channels.

The completed drainage schemes and the works on associated bridges and structures are designed to provide an appropriate standard of flood protection and channel freeboard for improved land drainage. The general standards applied throughout the Foyle system are:

Agricultural Land	3/5 year flood (15 year Summer flood)
Urban Areas	50/100 years
Embankment Design	10/20 years

This system of management has been accepted as a more than acceptable standard of flood protection and the completed works have performed to this standard.

As a result of these flow control improvements, there is a sparsity of wetland areas in the catchment. However, some reedswamp and wetland areas do occur in the Finn sub-catchment, which has not been the subject of drainage works.

C10. EFFLUENT DISPOSAL

Effluent disposal relates directly to the disposal of domestic, industrial and agricultural effluent to the river system. The conditions to be met by a discharge are detailed in a specific discharge consent or agreement that is set by the Environment Service of the DoE(NI) and licences issued by the Donegal County Council. As well as the obvious impacts on the receiving waters quality, effluent disposal can impact on river flows and serve to augment low flows. In this section the quantity of effluent discharged is considered. In later sections the quality of the effluent is considered in terms of impacts on receiving waters.

Effluent disposal is considered in this section under three headings:

- Pollutant loads.
- Dilution ratios.
- Industrial and domestic loads to sewage treatment works.

C10.1 POLLUTANT LOADINGS

Loadings to each of the main sub-catchments from industrial sources, sewage treatment works and fish farms are presented in Table C10.1. Where possible we have used average effluent quantity and quality values obtained from sampling programmes. However, for many discharges quantity and quality data are not available and in these cases we have used the following assumptions:

C10.1.1 Effluent flow rates from Sewage Treatment Works

The location of sewage treatment works is shown in Map 22.

Effluent flow data for STW's in the catchment are not available. In order to calculate loadings from STW's we used the population equivalent served by the STW and a flow value of 170 l/person/day. This flow figure was chosen after considering domestic water consumption in Northern Ireland, which is 126 l/person/day (Water Resource Strategy for Northern Ireland, 1992) and allowing approximately 50 l/person/day for the infiltration of water into sewers. Effluent volumes and average concentrations at the monitored STW's are presented in Table C10.1.1.

C10.1.2 Effluent quality data for small Sewage Treatment Works

The effluent quality from smaller STW's and septic tanks is analysed only once per year. Therefore for these works we assumed concentrations of BOD, ammonia and phosphate which varied with the type of treatment process. The assumed concentrations are presented in Table C10.1.2.

C10.1.3 Septic tanks

The location of septic tanks is shown in Map 22.

Septic tanks can contribute to nutrient loads in rivers. The number of septic tanks in the catchment is unknown and information on the ability of the soil to assimilate nutrients is not available.

Following discussions with the Environmental Health River Officers and the Water Executive we have assumed that 50% of the population throughout the catchment is served by septic tanks. In addition, we have assumed that nutrients from septic tanks are not removed by soil processes. Thus, in each sub-catchment the loading from septic tanks is assumed to be 50% of the loading from sewage treatment works.

C10.1.4 Industrial Discharges

Industrial discharge locations are shown in Map 23.

There are considerable gaps in the water quality data for industrial discharges. Where data was not available we used the limits specified in the discharge consent. However, the discharge consent for some industries did not specify limits for ammonia, nitrates or phosphates.

We have calculated loadings from the creameries in the catchment using average pollutant load data for the Killygordon creamery in the Finn catchment. We have assumed that this data can be directly applied to all creameries in the Foyle catchment. The load data from this creamery is presented in Table C10.1.4.

We were unable to estimate loadings from the following industries because of a lack of information:

(i) Limavady Stockyards
(ii) Deele Industrial Estate

In situations where cooling water discharges have not been monitored we have assumed that the cooling water does not contribute to pollutant loadings. This may not be the case for Coolkeeragh Power Station because the cooling water is dosed with chemicals, mainly chlorine, to prevent the build up of marine organisms on the cooling system. Monitoring data for the discharge at Coolkeeragh are not available.

Data on heavy metal loadings from industry or persistent pollutants are not generally available, except for from the DuPont and Hoescht fibre industrial sites.

C10.1.5 Fish farms

There are a number of fish-farms in the catchment. Fish farms discharge large volumes of water and in smaller streams effluent from fish farms may contribute up to 50% of the low flow. The 95 percentile flow (Q95) is a useful way of expressing low flows. The Q95 is the flow exceeded for 95% of the time (or for more than 18 days each year on average). For many of the fish farms effluent flow and concentration data are not available. Where data have been available we have used the following assumptions, which are based on the discharge consent issued by the Environment Service.

- BOD concentrations in fish farm effluent are elevated by 2 mg/l compared with the abstracted water.
- Ammonia concentrations increase by 0.25 mg/l.
- Fish farms are licensed to abstract up to 50% of river flows. We have assumed that 50% of river flows means 50% of the Q_{95} and that this is the normal flow used by the fish farm.

Effluent from fishfarms may contain nitrates, phosphates, antibiotics, Malachite Green and other substances. Data on the concentrations of a range of substances which may occur in effluent from fishfarms are not available. We have been unable to make assumptions concerning nutrient loads from fishfarms as a consequence of a lack of information.

C10.2 DILUTION RATIOS

We have assessed the level of effluent disposal use in each of the sub-catchments by comparing the effluent discharge flow with the Q_{95} river flow in the receiving waters. The assessment was made using the following three categories:

Heavy Use:	Dilution at Q_{95} river flow of less than 1:2
Medium Use:	Dilution at Q_{95} river flow of between 1:2 and 1:8
Light Use:	Dilution at Q_{95} river flow of greater than 1:8.

The effluent flows, Q_{95} river flows and the ratio between them are presented in Table C10.2 for the major reaches. Q_{95} is estimated for the downstream point of the reach. The Foyle is lightly used for effluent disposal by industry and from STWs, with the exception of the lower Fairywater and the Glenmornan Rivers.

C10.3 LOADING TO SEWAGE TREATMENT WORKS

Industrial discharges can form a significant proportion of the sewage load that a STW receives. The loadings from industrial sources to the main STW's are shown in Table C10.3. The treatment of industrial effluent can require a substantial investment in an STW if high effluent quality is to be achieved. The Water Executive introduced an effluent charging policy in 1992 in line with the "Polluter Pays Principle". Starting from 1992 companies are required to pay an increasing proportion of the costs of effluent treatment. By 1996 companies will be paying the full cost. As a consequence of increases in disposal charges, industry is considering cheaper disposal options, such as directly discharging to the river.

TABLE C10.1: MAJOR POINT DISCHARGES INTO THE FOYLE

Reach and discharges	Average flow (Ml/d)	Average daily loadings (kg/day)			
		BOD	Ammonia	Nitrates	Soluble Phosphorous
Burndennet					
Donemana STW	0.025	7.6	3.8	2.5	1.3
Minor STW's	0.09	4.9	3.9	0.7	0.4
Finn					
Ballybofey/Stranolar	0.46	68.9	68.9	0.28	2.3
Castlefin	0.18	123	6.5	0.83	1.61
Lifford	0.26	36.2	10.9	0.13	1.31
Minor STW's	0.29	6.38	3.1	1.08	0.57
Killygordan Creamery	0.08	2.4	0.75	2.07	0.56
Carrigans Meats	0.25	16.7	6.24	2.04	1.54
Herdmans	0.06	31.5	0.38	0	0.72
Derg					
Castlederg STW	0.31	3.1	0.71	2.75	1.03
Minor STW's	0.73	12.6	6.89	3.77	1.92
Johnstons Fishfarm	2.9	12.6	2.6	0.13	1.17
Maybrook Fishfarm	0.45[2]	90[2]	11.3[2]		
West Ulster Farmers' Fishfarm	0.35[3]	0.7[2]	0.09[2]		
West Ulster Farmers Creamery	No consent				
Lower Mourne (below Derg confluence)					
Sion Mills STW	0.54	16.32	8.16	5.44	2.72
Minor STW's	0.09	2.48	1.25	0.83	0.41
Herdmans (A)	0.7	42			
Herdmans (B)	0.95	303			

Reach and discharges	Average flow (Ml/d)	Average daily loadings (kg/day)			
		BOD	Ammonia	Nitrates	Soluble Phosphorous
Upper Mourne (above Derg confluence)					
STW's	0.37	11.2	5.61	3.74	1.87
Johnson Fishfarm	45				
Strule					
Omagh STW	4	287.8	51.9	28.2	20
Minor STW's	0.94	1.58	0.79	0.53	0.28
Strathroy Dairy	0.15[1]	4.6[4]	1.35[4]	3.9[4]	1.5[4]
Fairywater					
STW's	0.18	6.14	3.58	1.7	0.89
Nestle[1] (effluent)	0.2	2.4	1.8[4]	5.2[4]	2.0[4]
Nestle[4] (cooling)	8	24			
Camowen					
Carrickmore STW	0.17	5.2	2.6	1.73	0.87
Minor STW's	0.38	11.4	5.7	3.81	1.93
NIES	0.045[1]	1.13			
Glen Yeast	0.25[1]	2.5[1]			
Drumragh					
Dromore STW	0.33	9.9	5	3.3	1.7
Fintona STW	0.43	13.1	6.5	4.4	2.2
Minor STW's		3.4	1.6	1.0	0.5
Masters Meats	0.4	11.9	20[1]		

Reach and discharges	Average flow (Ml/d)	Average daily loadings (kg/day)			
		BOD	Ammonia	Nitrates	Soluble Phosphorous
Owenkillew					
McDermott Fishfarm (Glensawisk Burn)	1.6[3]	3.2	0.4		
McDermott Fishfarm (Crocknaboy)	Unknown				
STW's	0.23	16.7	14.4	1.6	1.2
Foyle River					
Artigarvan STW	0.19	5.8	2.9	1.9	1.0
New Buildings Sewerage Outfall	1.53	382.5	382.5	0.92	7.65
Strabane STW	3.97	459.3	59.4	3.6	15.4
Minor STW's	0.28	21.3	18.8	1.78	1.35
Artigarvan Creamery (effluent)	0.18	19.8	2.0[4]	5.0[4]	1.8[4]
Artigarvan Creamery (cooling water)	0.35	40.6			
Faughan					
Claudy STW	0.204	6.1	3.1	2.0	1.0
Drumahoe STW	1.36	35.5	3.9	26.9	9.1
Minor STW's	0.406	14.2	8.4	3.88	2.06
Faughan Anglers Fishfarm	0.33	0.62	0.075		
Ballyarton Fish Farm	Unknown				
Roe					
Aghanloo STW	0.55	16.4	8.2	5.5	2.7
Dungiven STW	0.43	12.75	6.4	4.2	2.1
Limavady STW	2.27	60.4	21.3	33.0	16.7
Minor STW's	0.4	15.2	9.25	4.0	2.1
Hoescht Fibres	1.4				
Whiteside Fishfarm	4.51	91	1.11		

Reach and discharges	Average flow (Ml/d)	Average daily loadings (kg/day)			
		BOD	Ammonia	Nitrates	Soluble Phosphorous
Limavady Stockyards	?	?	?	?	?
Semple and Sons	0.01	1.79			
Deele					
Convoy STW	0.18	26	1.8	0.3	0.49
Deele Industrial Estate	?	?	?	?	?
Swillyburn					
Raphoe STW	0.18	6.0	1.1	1.2	0.5
Lough Foyle					
Culmore STW	20.6	1984.2	282.4	20.0	68.3
Ballykelly STW	0.64	14.5	8.3	0.65	2.2
Donnybrewer STW	0.51	5.6	5.1	0.36	1.5
Greysteel STW	0.21	6.3	3.1	2.1	1.0
Minor STWS'	0.43	12.2	7.4	3.1	1.66
Moville STW	0.85	161.5	9.78	1.6	2.72
Greencastle Seafoods	0.01	5.25	0.064	0	0.119
DuPont	70	550	270		

Source of data:
DoE(NI) monitoring data for 1992 and data collected by the Donegal County Council

NOTES:
[1] These data were obtained from the industrial discharge consent.
[2] These data were obtained from the fish farm consent.
[3] These data are based on the fish farm consent and are 50% of the Q_{95}.
[4] These data are based on effluent concentrations for the Killygordon Creamery and the Express Dairy

Subcatchment and Discharge	Average Flow	Average Concentration (mg/l)			
		BOD	NH_4-N	NO_3-N	SRP-P
Finn					
Castlefinn	2.0	693	36.4	4.7	9.1
Lifford	3.0	138	41.5	0.5	5.0
Carrigans	0.6	166	183.2	0.6	5.5
Killgordon	0.4	59.3	15.5	1.1	1.2
Derg					
Castlederg	3.6	24.1	6.4	9.6	6.1
Mourne/Strule					
Sion Mills	6.3	15.9	7.2	4.9	5.5
Newtownstewart	4.3	35.3	12.6	0.8	6.0
Omagh	56.1	59.4	10.7	5.8	4.1
Drumragh					
Fintona	5.0	26.3	10.4	2.6	4.1
River Foyle					
New Buildings	17.7	180.1	13.3	1.6	5.7
Strabane	45.9	115.8	15.0	0.9	3.9
Faughan					
Drumahoe	15.7	26.1	2.9	19.8	6.7
Roe					
Dungiven	4.9	24.4	5	17.3	8.0
Limavady	26.2	26.7	9.4	14.6	7.4
Deele/Swillburn					
Convoy	2.1	146	10.3	1.7	2.7
Raphoe	2.1	33.5	6.4	7	3.0
Lough Foyle					
Moville	9.8	190	11.5	1.9	3.2
Ballykelly	7.4	22.6	13.1	1.0	3.4
Donnybraver	5.9	11	9.9	0.7	2.9
Culmore	238.1	96.5	13.7	1.0	3.3

Source: Monitoring data from the DoE (NI) Environment Service and the DCC

TABLE C10.1.2: ASSUMED CONCENTRATIONS IN EFFLUENT FROM STW'S.

Treatment Process	BOD (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	Soluble Phosphate (mg/l)
Outfall	300	25	0.6	10
Septic Tank	180	20	0.6	5
Primary Treatment	150	20	0.6	5
Secondary Treatment	20	10	10	5

TABLE C10.1.4: NUTRIENT LOADINGS FROM CREAMERIES

Creamery	Total Ammonia (mg/l)	Nitrates (mg/l)	Phosphates (soluble) (mg/l)
Killygordon	5	24	7

Source : Data from the Killygordon Creamery, provided by DCC

TABLE C10.2: RATIOS OF EFFLUENT DISCHARGE TO RIVER FLOWS

River	Reach	Industrial discharges (Ml/d)	STW effluent (Ml/d)	Total effluent	Fish farms	Q_{95} (Ml/d)	Ratio: effluent to Q_{95}	Effluent Use
Strule	Omagh to Fairywater confluence	8.35 (includes Nestle discharge to the lower Fairywater)	4.9	13.3	0	134	> 1:8	Light
Strule	Fairywater confluence to Newtownstewart	0	0.041	0.041	1	170	> 1:8	Light
Fairywater	Above gauging station	0	0.18	0	0	30	> 1:8	Light
Fairywater	Gauging station to confluence with Strule	8.2	0	8.2	0	30	1:3 > 1:8	Medium
Camowen	Entire River	0.3	0.72	1.02	0	54	> 1:8	Light
Drumragh	Entire River	0	0.87	0.87	0	~50	> 1:8	Light
Quiggery	Entire River	0	0.51	0.51	0	~50	> 1:8	Light
Burndennet	Entire River	0	0.34	0.34	0	80	> 1:8	Light
Derg	Source to upstream of Castlederg	0	0.21	0.21	2	48	> 1:8	Light
Derg	Castlederg to Strule	0	0.83	0.83	2	48	> 1:8	Light
Finn	Entire River	0.39	1.19	1.58	1	114	> 1:8	Light
Mourne	Newtownstewart to Derg confluence	0	0.37	0.37	0	-	> 1:8	Light
Mourne	Derg confluence to Strabane	1.7	0.63	2.3	0	514	> 1:8	Light
Owenkillew	Entire River	0	0.23	0.23	3	2.2	> 1:8	Light
Mourne	Tidal	0	6.0	6.0	0	-		Light

River	Reach	Industrial discharges (Ml/d)	STW effluent (Ml/d)	Total effluent	Fish farms	Q_{95} (Ml/d)	Ratio: effluent to Q_{95}	Effluent Use
Faughan	Entire reach	0	1.97	1.97	0	80	> 1:8	Light
Roe	Upstream of Dogs Leap	0	1.4	1.4	1	79	> 1:8	Light
Roe	Downstream of Dogs Leap	1.4	2.3	3.7	0	99	> 1:8	Light
Ballykelly	Entire Stream	0	1.37	1.37	0	-	-	-
Muff	Entire Stream	0	0.055	0.055	0	-	?	-
Burnfoot	Entire Stream	0	0.036	-	0	-	?	-
Glenmornan	Entire Length	1.2	0.324	1.5	0	10.7	1:8-1:3	Medium

Source of data: Q_{95}'s are from Table B3.1 to B3.12. Effluent flows are from Table C10.1.

TABLE C10.3: MAJOR INDUSTRIAL DISCHARGES TO SEWAGE TREATMENT WORKS

Sewage Treatment Works	Industrial Load (Population Equivalent)	Domestic Load (Population Equivalent)	Ratio: Industrial/Total Load
Sion Mills	1403	1797	43%
Omagh	9314	19186	33%
Newtownstewart	503	1697	30%
Fintona	899	1664	35%
NewBuildings	3255	5080	64%
Strabane	10487	12513	46%
Drumahoe	2839	5161	35%
Aghanloo	2887	333	90%
Dungiven	0	2933	0%
Limavady	3381	9969	25%
Ballykelly	1205	2555	32%
Donnybrewer	107	2204	5%
Culmore	46897	74103	39%

Note: No information is available for the Republic of Ireland

Source: Data collected by the Water Executive for the Asset Management Plan

C11. SOLID WASTE

Solid waste relates to the disposal of domestic, industrial and agricultural waste (solid) throughout the catchment. Waste disposal has the potential to significantly impact upon the water quality of the catchment through the contamination of ground-water or surface water. Management of landfill sites is essential to ensure that other uses of the river are not impacted upon.

During the last two decades there has been increasing concern about the impacts of landfills on water quality, arising from pollution incidents which occured in a number of areas around the world. In the past there was little in the way of legislative control on landfills. Sites were either designed without taking leachate management into consideration or on the principle that leachate should be diluted by surface/ground waters and dispersed into the environment. There are now well established methodologies on how landfills should be managed and the design philisophy is that leachate should be contained.

Currently, the District Councils in Northern Ireland and the Donegal County Council have the responsibility for licensing landfill sites and ensuring that licence conditions are met. Under the Pollution Control and Local Government (Northern Ireland) Order 1978, a District Council cannot issue a disposal site licence for a use of land for which planning permission or a consent under the Water Act (NI) 1972 is required unless permission is in force or such consent. Consents under the Water Act are issued by Environment Service and are one aspect of the role Environment Service has in landfill management in Northern Ireland.

At sites that have a Water Act Consent water quality impacts are measured. Comprehensive monitoring is essential to ensure that contamination does not result in harm to the public health or damage to the environment. The obvious areas of concern for water quality with respect to contamination from landfill sites revolve around those sites disposing of difficult and/or special ("hazardous") wastes in areas that overly aquifers or in areas from which leachate may enter waterways.

Many landfill sites were constructed prior to the introduction of the licensing regime and the location of these and/or the type of material stored is generally unknown. Given that hazardous waste, frequently a product of industrial processes, would have been deposited at various locations in the Foyle catchment, it is highly likely that there are hazardous waste sites in the Foyle catchment. For example, there are a number of "tarry waste" sites in the catchment.

Since the late 1970's hazardous waste has been exported from Northern Ireland. At present landfills should only be receiving household waste and non-hazardous industrial and commercial waste. However, the leachate from "non-hazardous" materials may still contain significant quantities of pollutants, such as high levels of BOD, and landfills therefore require careful management to avoid water pollution.

Some hazardous waste is exported from NI for disposal but there is one site within the catchment licenced to accept "special waste" as defined in the Pollution Control (Special Waste) Regulations (NI) 1981. This is Derry City Council's Culmore Road site. The special wastes disposed of at Culmore are mainly asbestos, vanadium grit from Coolkeeragh power station and low level radioactive hospital waste.

In the following sections the location of landfills is discussed, followed by a consideration of tarry waste sites and animal carcasses.

C11.1 LANDFILLS

C11.1.1 City of Londonderry Area

Detailed information on landfills in the Derry City Council District has been collected by the Derry City Council. However, this level of detail is not available throughout the remainder of the catchment. The Derry City Council District covers the Faughan, Foyle and Muff catchments.

In 1992 the Derry City Council identified 144 landfill sites in the Derry City Council District. Of these sites 11 were located in the Muff catchment, 86 in the Faughan and 47 in the Foyle River area.

The results of the information collected by the Derry City Council indicate that some 21 landfill sites are located within 5 km upstream of public water supply intakes. These landfills and the materials stored are presented in Table C11.1.1(a). Twelve landfills in the Derry City Council may pose a threat to water quality but, at present, this does do not appear to be the case. These sites are listed in Table C11.1.1(b). There are 17 sites in the Derry City Council District where leachate from landfills can be observed entering adjacent waterways. These sites are listed in Table C11.1(c). Six landfill sites are located on sands and gravels and therefore have significant potential to cause pollution of ground-water. These sites are listed in Table C11.1.1(d).

C11.1.2 Areas of the catchment outside City of Londonderry Area

The landfills in the area of the catchment outside of the Derry City Council district are listed in Table C11.1.2. Is it suggested that this list of landfills is not complete and there are likely to be many more landfills, both currently operating and closed and a complete inventory of sites should be compiled as a matter of priority.

C11.2 TARRY WASTE SITES

Tarry waste sites have caused concern in the Northern Ireland portion of the catchment. The pollution potential of these sites is currently under investigation. It is suggested that this plan is updated in the near future to take into account the results of the tarry waste study.

C11.3 ANIMAL CARCASSES

Areas of the catchment are also used for solid agricultural waste disposal. This use mainly concerns the disposal of dead animals. Prior to concern about "Mad Cow Disease" (BSE) dead animals were collected from farms and used by the animal feed industry. This disposal route is no longer available to farmers. Carcass removal facilities are provided by the private sector on a "user pays" basis. At present farmers usually bury dead animals in pits on their land. However, there have been occasional reports of dead animals being dumped into water courses but this is not a regular occurrence. In addition, some carcass pits have caused concern to the Statutory Authorities. In 1993 the situation regarding poor disposal methods of carcasses has improved and the issue is not of great concern to the Authorities. However, during a survey of the River Foyle undertaken by the Foyle Catchment Consultants several animal carcasses were observed on river banks. The dead animals comprised sheep, goats, pigs and cattle.

TABLE C11.1.1(a): LANDFILLS IN THE DERRY CITY DISTRICT WHICH ARE LOCATED NEAR TO PUBLIC WATER SUPPLIES

Site Name	IGR	Size Code	Type of Waste
River Faughan Catchment			
Ardlough Road	469169	3	C
Fincairn Road	475160	1	B
Fincairn Road	475160	2	C
Gortree Road	475168	3	C
Carmoney Road	479193	3	C
Gortree Road	482168	3	C
Rossdowney Road	473168	3	C
Mobouy Road	479191	2	C
Mobouy Road	478178	3	C
Mobouy Road	479180	2	A
Millbrook Park	460150	2	B
Creggan Service Reservoirs			
Sheriffs Road	403179	2	A
Groarty Road	405184	1	A
Glassagh Road	413166	2	C
Glassagh Road	413166	2	C
Collon Lane		2	C
Sherrifs Road	402174	2	A
Springhill Road	410170	2	C
Heather Road	405164	2	A
Heather Road	405160	2	C
Heather Road		Scrap Yard	

NOTES: The sizes of sites are divided into three classes as follows:
1 Sites containing small quantities of material, between 1 and 5 standard skip loads.
2 Sites containing between 5 and 20 standard skip loads of material.
3 Sites contained more than 20 skip loads of material.

The type of waste has been divided into three classes as follows:
A Inert material, such as topsoil, brickwork and concrete.
B Relatively inert material, such as plastic and metal.
C Reactive material, such as household and commercial waste, dead animals etc.

Source of Information: Data collected by the Derry City Council

TABLE C11.1.1(b): SITES THAT POSE A POTENTIAL THREAT TO WATER QUALITY

Site Name	IGR	Size Code	Type of Waste
Gortnessy Road	499171	2	C
Edenreagh Road	522276	2	C
Electra Road	477218	1	C
Craigtoke Road	566126	2	C
Gortree Road	457168	3	C
Ardground Road	502100	2	C
Clooney Road	493207	2	C
Church Road	447133	3	C
Baranailt Road	544078	2	C
Longland Road	556049	2	C
Ardmore Road	473132	3	C
Lisdillon Road	469109	2	C

NOTES: The sizes of sites are divided into three classes as follows:
1 Sites containing small quantities of material, between 1 and 5 standard skip loads.
2 Sites containing between 5 and 20 standard skip loads of material.
3 Sites contained more than 20 skip loads of material.

The type of waste has been divided into three classes as follows:
A Inert material, such as topsoil, brickwork and concrete.
B Relatively inert material, such as plastic and metal.
C Reactive material, such as household and commercial waste, dead animals etc.

Source of Information: Data collected by the Derry City Council

TABLE C11.1.1(e): LANDFILLS THAT ARE SUSPECTED TO BE RELEASING LEACHATE

Site Name	IGR	Size Code	Type of Waste	Comments
Ward Road	513179	3	C	Tarry waste site - surface runoff
Alder Road	452221	2	C	Runoff from agricultural waste
Judges Road				Surface run-off of oil
Duncastle Road				Visible leachate
Ardlough Road	469169	3	C	Visible leachate
Rossdowney Road	473168	3	C	Tarry Waste site - surface runoff
Bonds Glen Road	499070	3	C	Visible leachate
Gortilea Road	569093	2	C	Visible leachate
Ballyrory Road	565044	3	C	Runoff from agricultural waste
Chambers Brickworks, Drumahoe				Surface runoff from concrete products
Correys Scrapyard, Campsie				Surface runoff of oil
Tullyalley Scrap yard				Surface runoff of topsoil
McLaughlins Scrap Yard				Runoff of concrete products and diesel

NOTES: The sizes of sites are divided into three classes as follows:
1 Sites containing small quantities of material, between 1 and 5 standard skip loads.
2 Sites containing between 5 and 20 standard skip loads of material.
3 Sites contained more than 20 skip loads of material.

The type of waste has been divided into three classes as follows:
A Inert material, such as topsoil, brickwork and concrete.
B Relatively inert material, such as plastic and metal.
C Reactive material, such as household and commercial waste, dead animals etc.

Source of Information: Data collected by the Derry City Council

TABLE C11.1.1 (d): LANDFILLS WHICH POSE A POTENTIAL THREAT TO GROUNDWATER

Site Name	IGR	Size Code	Type of Waste
Ardlough Road	469169	3	C
Glenshane Road	482130	3	C
Carmoney Road	479193	3	C
Mobouy Road	478178	3	C
Kildoag Road	497103	2	C
DuPont Landfill	-	-	-

NOTES: The sizes of sites are divided into three classes as follows:
1 Sites containing small quantities of material, between 1 and 5 standard skip loads.
2 Sites containing between 5 and 20 standard skip loads of material.
3 Sites contained more than 20 skip loads of material.

The type of waste has been divided into three classes as follows:
A Inert material, such as topsoil, brickwork and concrete.
B Relatively inert material, such as plastic and metal.
C Reactive material, such as household and commercial waste, dead animals etc.
No information has been made available for DuPont Landfill

Source of Information: Data collected by the Derry City Council

TABLE C11.1.2: LANDFILLS IN THE FOYLE CATCHMENT OUTSIDE OF THE DERRY CITY COUNCIL DISTRICT

Site Name	IGR	Type of Waste	Comment
Mullaghmore	466742	Domestic and Commercial	Council site, closed in April 1993
St Julians Road	457737	Domestic and Commercial	Council site, closed in 1973
Tamlaght Road	428179	Inert material only	Private site
Mullaghmore	463742	Inert material only	Private site
Mullaghmore	464741	Inert material only	Private site
Carricklee	-	-	-
Churchtown	-	-	-

Note: This list of landfills is not complete and thorough inventory of sites is recommended as a matter of priority. No information has been made available for Carricklee and Churchtown
Source of data: Western Group Environmental Health Committee.

C12. SLUDGE DISPOSAL

This use concerns the application of sewage sludge to agricultural land. Sewage sludge and slurry (which is considered separately in Section C14.3.1) are high in nitrates, phosphates and organic matter and can be an excellent fertilizer resource.

The Water Executive disposes of sludge through landfills and by supplying farmers. Farmers who accept sludge generally combine the sludge with slurry and apply both simultaneously to the land.

Of particular interest to water managers is the amount of sewage sludge disposed of to land. During one year (1992) a total of 8,400 tonnes of dry sludge was applied to land in Counties Londonderry, Tyrone and Fermanagh.

In ROI the practice of landspreading of sludge is not widespread. This is confirmed by the County Donegal Farm Surveys which showed that no farm in the ROI area of the catchment accepted imports of sludge.

The application of sludge to land is covered by an EC Directive (86/278/EEC of 12 June 1986) which seeks to minimise the risk associated with sewage sludge application. Sludge may contain significant quantities of pathogenic organisms (to both humans and animals) and dangerous substances, such as heavy metals. In order to minimise health risk from pathogenic organisms, the EC Directive requires that animals must not graze land for a minimum period of 3 weeks. The Directive sets limits for concentrations of heavy metals in soils and sludges. Regulations implementing this directive have been made in both NI and ROI. There are other time restrictions on agricultural practices (after application) which depend on whether the sludge has been treated or is untreated.

C13. MINING, QUARRYING AND PEAT EXTRACTION

C13.1 INTRODUCTION

Mining activities, quarrying, sand-washing and peat extraction can all have an impact on water quality and require management. In this section these activities are discussed and the locations where these activities take place are defined. In Section E the impact of these sites on water quality is assessed in terms of spillages and pollution risk.

The water quality issues that are of concern with respect to mining are: run-off from the site, which may contain high suspended sediment loads; spillages of hazardous material, such as petroleum products; discharges of heavy metals. In ROI since May 1994 it is now obligatory for mineral industries to obtain Integrated Pollution Control Licences from the EPA.

All of the existing mining operations in the catchment extract bulk rock quantities such as marble, limestone, slate, metadolerite, basalt and schist. One locality on the Deele Tributary extracts bulk rock and copper.

The description of mineral resources in the Foyle catchment is based on the 1985 'Mineral Localities in the Dalradian and Associated Igneous Rocks of County Donegal, Republic of Ireland and of Northern Ireland' compiled by the Geological Surveys of Northern Ireland and the Republic of Ireland. Specific sites are shown on the attached in Map 24.

Section C13.2 refers to those bulk rock localities in the catchment where working quarries are located. Section C13.3 details those localities where the existence of minerals has been recorded. Quarrying and sand-washing sites are discussed in section C13.4 and peat extraction sites in C13.5.

C13.2 BULK ROCK SITES

Table C13.1 lists some of the bulk rock sites within the catchment. The list is not complete particularly in the Roe and Faughan catchments due to unavailability of information.

C13.2.1 Marble and Limestone

Limestone and marble lithologies are common in many formations of the Dalradian Supergroup. Quarrying of these lithologies has taken place in several widely separated areas. Currently active quarries are primarily producing crushed stone and one is manufacturing ground limestone.

C13.2.2 Slate

Three known slate sites occur in the catchment, all in County Donegal. None of these sites are worked.

C13.2.3 Metadolerite and Basalt

Donegal County Council extracted metadolerite at Sheldon's Quarry (Magherasollus, Co. Donegal) for use as road metal. This site is now closed. Dolerite is produced at Hadden's Quarry (Carrickmore) and basalt is produced at Mountfield No. 1 Quarry, both in Co. Tyrone.

C13.2.4 Schist

Grit from quartz schists is produced at Dunhugh quarry, Co. Derry. In County Tyrone three quarries are listed as being in production -Aughafad (Schist); Cashty (quartz grit) and Letterbratt (grey quartz schist).

C13.3 MINERAL SITES

There are commercially viable mineral deposits in the Foyle catchment. Appendices C13.1 and C13.2 list respectively the metallic mineral locations and industrial mineral localities within the catchment. At present there are no mines operating in the catchment in Northern Ireland. In the past exploratory mining operations have occurred and two such operations, one in the Owenkillew, the other near Omagh, closed down in the early 1990's. Currently a mining company has received a licence to establish a gold mine near Omagh. This application is, at the time of writing this plan, the subject of a Public Enquiry with regard to planning and this plan does not wish to preempt the findings of the Enquiry. A Water Act appeal is being heard concurrently with the water issues. The proposed mine is not discussed further in these proposals for water quality management.

There is continued interest in mining exploration.

In ROI mining developers require planning permission from the Local Planning Authority, an Integrated Pollution Control licence from the EPA, a State Mining Facility from the Minister for Transport, Energy and Communications and possibly permission from such organisations as the National Authority for Occupational Safety and Health and the Department of Justice. At present there are no mines operating in the ROI area of the catchment. In ROI the Report of the National Mineral Policy Review Group was issued in April 1995. The objective of the review was to ensure that the contribution of the minerals industry to the national economy and in particular its job creation potential is maximised, whilst ensuring mining operates in an environmentally acceptable fashion leading to sustainable development. The Review Group made 52 recommendations in the areas of promotion of minerals development, fiscal arrangements, legislation, administration and the environment.

C13.3.1 Lead Zinc Sites

The main centres of mineralization in Donegal occur along the SE margin of the Main Donegal Granite near Gartan Lough and Lough Finn, and in the Inishowen Peninsula. In the Sperrin Mountains mineralization is largely confined in the north of the range the Dungiven Limestone and in the south of the range in green beds and black schists.

C13.3.2 Lead Copper Sites

The lead-copper association occurs as small veining of galena in quartzite and metadolerite in County Donegal. In the Sperrin Mountains chalcopyrite with galena and pyrite occur associated with the Dungiven Limestone and in chlorite schists of the Tyrone volcanic group. Some of these sites were exploited for lead in the past.

C13.3.3 Copper Sites

Copper occurs widely in Donegal but generally in such small amounts that there is no record of it ever having been mined.

In the Sperrin Mountains, chalcopyrite occurs particularly in the tuffs and lavas of the Tyrone Volcanic Group.

C13.3.4 Iron Sites

Generally only minor tracts of pyrite are reported from the Dalradian and intrusive rocks of Donegal. To the south of the Sperrin Mountains, haematite occurs widely as a siliceous ironstone, often associated with pyrite, within the Tyrone Volcanic Group.

C13.3.5 Uranium Sites

During the period 1976-81 a number of uranium exploration programmes were undertaken, some as part of an EC effort to increase self-sufficiency in energy raw materials. To this end the EC contributed substantial financial aid to cover the exploration costs of a number of companies in Co. Donegal. However, economic recession gave rise to a depressed demand for uranium and, by 1982, exploration had ceased.

In Donegal, the most significant primary uranium mineralisation occurs in the Main Donegal Granite. The Main Radiometric Zone (MRZ) is a north east trending zone of anomalous radioactivity which can be traced in sparse outcrop over a length of 9km.

It is situated 3.5km NNW of Fintown in mountainous terrain underlain by the Main Donegal Grainte extending from Lough Agarvy to at least Clogherachullion. The uranium-bearing zone, averaging 0.3kg/tonne U_3O_8 over a width of 8.7m, was traced along strike for 520m. However higher grade values were erratically distributed.

C13.3.6 Gold Sites

The presence of alluvial gold has attracted attention in the Sperrin Mountains intermittently over the years. Appendix C13.1 lists a substantial number of gold localities within the catchment (see also Appendix C13.2).

C13.3.7 Industrial Mineral Sites

Deposits of barite occur in the Dalradian rocks while talc was formerly mined from the sediments in County Donegal.

C13.4 QUARRYING AND SAND-WASHING

Sand for building supplies and other purposes is extracted from a number of sites throughout the catchment. As part of the quarrying process the sand is washed and the wash water contains high levels of suspended sediments. The wash-water has a significant pollution potential and can have a detrimental impact on the in-stream ecology by covering the river bed in fine silts. Quarries and sand washes can also have an impact on water quality in terms of spillage, such as diesel oil.

In the Northern Ireland section of the catchment the sand washing sites require a discharge consent under the Water Act (NI) 1972. The location of consented wash sites are presented on Map C13 and are listed in Table C13.2.

C13.5 PEAT EXTRACTION

Peat is extracted mainly from the Camowen, the Faughan and the Roe Catchments. Peat extraction has also long been practised in the upper Derg catchment. Much of the peat is extracted by commercial operators. Planning permission is required for commercial peat extraction. The locations of consented peat extraction sites in NI are shown on Map C13 and are listed in Table C13.3. In the Donegal area of the catchment peat extraction is mainly carried out by individuals on a very small scale and is not subject to licensing. In the future however, extraction of peat in the course of business which involves an area exceeding 50 hectares will require an IPC licence from the EPA.

The mechanical extraction of peat for domestic purposes is also becoming increasingly widespread.

Run-off from peat extraction sites can contain high levels of suspended solids. The discharge consents set limits on suspended solid levels. In addition, spillages of oil at abstraction sites can have an impact on receiving waters; discharge consents also state that there must be no visible oils in run-off from the extraction site. Peat extraction sites are usually located in catchment headwaters and any spillage or a release of water containing high suspended sediment loads can affect the entire length of a river.

In NI there is a policy to minimise peat extraction - the UK's 1993 Statement of Policy on Conservation of Peat is relevant in this regard. The policy should benefit water quality objectives.

TABLE C13.1: BULK ROCK SITES

	Site	Grid Reference	County
Marble & Limestone	Bellanmore	B957031	Donegal
	Drumkeen*	C150028	Donegal
	Meentymorgal*	B925013	Donegal
	Lisbunny*	C522040	Derry
Slate	Glentown	C311097	Donegal
	Moneydarragh	C554397	Donegal
	Port	C017350	Donegal
Metadoleite & Basalt	Magherasollus (Sheldon's Quarry)	C260039	Donegal
	Carrickmore* (Hadden's Quarry)	H609721	Tyrone
	Mountfield*	H544789	Tyrone
Schist	Dunhugh*	C420135	Derry
	Aughafad*	C465007	Tyrone
	Cashty*	H371814	Tyrone
	Letterbratt*	H471923	Tyrone

Source:- - Mineral localities in the Dalradian and Asscoiated Igneous Rocks of County Donegal, ROI and NI - Geological Surveys of NI and ROI, 1985

- Pers. comm. with DCC and ES

*indicates working location

TABLE C13.2: QUARRYING AND SAND-WASHING SITES

Site	IGR	Key features of discharge consent
Dunhugh Quarries, New Buildings	C420135	Limit on suspended solids. No oil and grease.
Milltown Gravel, Strabane	H391996	Limit on suspended solids. No oil or grease.
Milltown Gravel, Newtownstewart	H372874	Limit on suspended solids. No oil or grease.
Birnaghs, Newtownstewart	H380871	Limit on suspended solids. No oil or grease.
Castle Bridge, Greencastle, Omagh	H581821	Limit on suspended solids. No oil or grease.
Brackaghmore, Mountfield	H573802	Limit on suspended solids. No oil or grease.
Murrinnaguigan, Mountfield	H555790	Limit on suspended solids. No oil or grease.
Killyclogher, Omagh	H469741	Limit on suspended solids. No oil or grease.
Mullaghslin, Omagh	H565738	Limit on suspended solids.
Sluggan, Carrickmore	H645711	Limit on suspended solids. No oil or grease.
Sixmilecross	H608633	Limit on suspended solids.
Fallaghearn, Beragh	H609629	Limit on suspended solids. No oil or grease.
Garvaghy, Ballygawley	H574600	Limit on suspended solids. No oil or grease.
Acheson and Glover Ltd, Eskragh	H515595	Limit on suspended solids. No oil or grease.
Gorticrum, Scotch	H405996	Limit on suspended solids
Ballyheather, Strabane	C383044	Limit on suspended solids. No oil or grease.
Aughafad, Dunnamanagh	H481991	Limit on suspended solids. No oil or grease.
Ballymallaght, Dunnamanagh	H491988	Limit on suspended solids. No oil or grease.

Source: Discharge consent details obtained from the Environment Service

TABLE C13.3: PEAT EXTRACTION SITES

Site	IGR	Consent details
Arvalee	H481681	Limit on suspended solids. No oil or grease.
Tattykeel	H481681	Limit on suspended solids.
Drumlester, Carrickmore	H601706, H607700	Limit on suspended solids. No oil or grease.
Tonnegan, Carrickmore	H602710	Limit on suspended solids. No oil or grease.
Sperrin Peat Ltd	C605136, 606136, 607138, 608139, 608140, 608141	Limit on suspended solids. No oil or grease.

Source: Discharge consent details obtained from the Environment Service

C14. AGRICULTURE

C14.1 INTRODUCTION

This section of the report reviews the available data regarding agricultural practices in the catchment. Further information on farming methods and impacts on water quality is presented in Section B4 Land Use and in Section E, State of the Catchment.

Agriculture makes a significant contribution to economic life in Ireland both north and south of the border. Agricultural productivity has been greatly increased by mechanisation, the availability of artificial fertilisers, pesticides and the intensive rearing of livestock. Associated with these changes has been the expanded use of silage for fodder and the off-farm purchase of feed. These developments have changed the nature of farming and modified the natural environment.

Agriculture activity can be a source of pollution and destruction for watercourses, habitats and wildlife. Large farming enterprises by their very size have greater potential to cause environmental damage. For example, there is the need to dispose of, as waste, livestock excreta and vegetable residues which, in the much smaller amounts accumulating under traditional farming systems, were formerly recycled as fertiliser for fodder and other crops. The accumulation of large quantities of high-strength organic wastes, (usually in slurry form) and agricultural chemicals, is a particular risk for surface waters and groundwaters. The minimisation of such risks is therefore important in forming environmental policy.

C14.2 AGRICULTURAL PRACTICES

The source of data utilised for the Northern Ireland side of the catchment was the results of the 1992 DANI Farm Census, based on rural districts. Sample Farm Surveys have been undertaken by DANI in the Foyle Catchment. Unfortunately, these surveys were undertaken on a confidential basis and are not available for analysis.

In ROI, the most recent agricultural land use statistics for rural districts (1991 census) have not been published. Data for the 1991 census is currently available only on a county basis. The latest published data in the rural district format is the 1980 census and this is presented below in the overview of agricultural practices. However, more recent detailed information was obtained from Teagasc for the purpose of the nutrient loadings derived later in Section E2.2.

In Donegal, a comprehensive farm survey was undertaken in 1993 for the purpose of this catchment strategy by Donegal County Council, in conjunction with the Farm Development Service, Department of Agriculture, Foyle Fisheries Commission and Teagasc. The survey covered all farms in the catchment located in the Republic of Ireland. Issues of land use practice, animal husbandry and waste disposal were addressed. The questionnaire did not deal with tillage.

C14.2.1 Northern Ireland

The majority of agricultural land on both sides of the catchment is devoted to pasture and rough grazing, as is the case throughout Ireland (See Tables C14.2.1 (a) and C14.2.1 (b). There are significant areas of tillage in the Derry and Limavady districts which are both above the average for Northern Ireland. These areas of tillage are clearly defined on the satellite image of the area. The quantity of tillage in the Castlederg and Omagh districts is considerably below the provincial average. The concentration of cattle numbers per hectare of agricultural land in all districts is below the provincial average. The concentration of sheep is significantly above average, except for the rural district of Omagh.

There is no information available in NI on individual livestock units.

Pollution risk is highest in the more intensively farmed area shown.

SUMMARY OF DANI FARM CENSUS RESULTS 1992 AND ROI CSO AGRICULTURAL STATISTICS 1980.
TABLE C14.2.1(a)

Rural District	Total Area Grass (Ha)	Total Area Crops (Ha)	% Agri Area Tilled	Total Agri Area (Ha)	Total Cattle	Cattle Density (per ha)	Total Pigs	Pig Density (per ha)
Limavady (NI)	25685	4336	9.36	46327	39344	0.85	5310	0.11
Derry (NI)	17685	3205	12.17	26331	27127	1.03	2619	0.10
Castlederg (NI)	15593	383	1.42	27010	28098	1.04	19219	0.71
Omagh (NI)	60540	1123	1.28	87545	116497	1.33	37488	0.43
Strabane (NI)	27021	2175	4.63	47019	49115	1.04	15195	0.32
All of NI	768939	65912	6.28	1049671	1559829	1.49	587106	0.56
Inishowen*	21521	15606	17.60	88685	47156	0.53	N/A	N/A
Stranorlar	22481	14244	20.18	70589	44277	0.63	N/A	N/A

* A large proportion of this district lies outside the catchment

TABLE C14.2.1.(b)

Rural District	Total Sheep	Sheep Density per ha	Total Poultry	Poultry Density per ha
Limavady (NI)	191,440	4.1	2,165	0.05
Derry (NI)	121,058	4.6	11,213	0.43
Castlederg (NI)	117,146	4.3	1,126	0.04
Omagh (NI)	187,111	2.2	505,041	5.77
Strabane (NI)	173,474	3.7	74,066	1.58
All of NI	2,631,01999	2.5	12,278,857	11.70
Inishowen* (ROI)	77,351	0.9	**	
Stranorlar	42,085	0.6		

**Total for County Donegal, 190,498

Note: Totals are not available for all of the Republic of Ireland

C14.2.2 Republic of Ireland

Since the results of the 1991 Census of Agriculture are not yet available on a rural district basis in Co. Donegal, the results of the 1980 survey are included in Table C14.2.1(a) and C14.2.1(b) above for comparison purposes. Both Inishowen and Stranorlar have significant areas of tillage although it must be noted that the quantity of land under tillage in the Republic has fallen by 30% between 1980 and 1991. If this national decline level were applied to the Inishowen and Stranorlar figures, the percentages of land being tilled in each district would be 12% and 14% respectively, comparable with Londonderry.

A large proportion of the catchment within Co. Donegal consists of mountainous blanket bog and rough grazing and has little agricultural significance.

The number of cattle and sheep in each district is relatively low. However, on a national basis there have been significant increases in livestock in the period 1980 to 1991. Numbers of sheep increased by 170%, pigs by 26% and poultry by 22%.

On the basis of the response to the Donegal Farm Survey, an inventory of large livestock units and large farms in the catchment was assembled. The results are presented in Tables C14.2.2.(a) - C14.2.2.(c).

TABLE C14.2.2.(a)
INVENTORY OF LARGE PIG UNITS IN CO. DONEGAL
(FOYLE CATCHMENT)

Location	River	Farm Area (Hectares)	Pigs (Number)
Raphoe	Deele	80	750
Raphoe	Deele	48	660
Glentogher	Carby River	24	660
Lifford	Deele	29	192

Source: Donegal Farm Surveys, 1993

TABLE C14.2.2 (b)

INVENTORY OF LARGE CATTLE HERDS IN CO. DONEGAL (FOYLE CATCHMENT)

Location	River	Farm area (Hectares)	Bovines (Number)
Muff	Muff Burn	142	450
Castlefin	Deele	72	400
Moville	Glebe River	141	300
Lifford	Foyle	81	280
Alt Castlefin	Finn	60	220
Convoy	Deele	76	200
Lifford	Foyle	112	200
Kildrum	Carrigans Burn	200	190
Kildrum	Carrigans Burn	23	170
Quigley's Point	Foyle	44	170
Skelpy	Finn	52	170
Greencastle	Foyle	75	170
Greencastle	Foyle	120	160
Newtown	Carrigans Burn	131	160
Cornamoyle	Foyle	48	150

Source: Donegal Farm Surveys, 1993

TABLE C14.2.2 (c)

INVENTORY OF FARMS GREATER THAN 130 HECTARES IN CO. DONEGAL (FOYLE CATCHMENT)

Location	River	Farm area Hectares
Quigley's Point	Augh River	800
	Deele	401
Convoy	Deele	392
Glentougher	Carby Burn	364
Redcastle	Clare River	295
Alt Castlefin	Finn	241
Isakaheen	Ardmore Burn	240
Alt Castlefin	Finn	201
Kildrum	Carrigans Burn	200
Muff	Muff Burn	191
Glentougher	Carby Burn	161
Quigley's Point	Foyle	160
Greencastle	Foyle	160
Quigley's Point	Foyle	154
Muff	Muff Burn	142
Moville	Glebe	141
Convoy	Deele	140
Carrigans	Carrigans Burn	140
Kildrum	Carrigans Burn	140
Newtown	Carrigans Burn	131

Source: Donegal Farm Surveys, 1993

The results of the Donegal Co. Council survey indicate a very low level of movement of animal slurries. No farm imports sludge and the number of farms exporting sludge off the farm site is only three.

The survey indicates that 68% of the land on the farms surveyed is suitable for the application of slurry. The survey also shows that over 95% of all farms are storing slurry indicating that the potential for the disposal of slurry imported from outside the region is limited.

Equivalent information for Northern Ireland is not currently available.

C14.3 FARM WASTES

Agricultural activity can adversely affect water quality in a number of ways. In particular, water quality can be impaired by the direct entry of polluting farmyard wastes to waters and by nutrient inputs. The main concern arising from farm wastes is their direct ingress to waters, due to badly designed or maintained storage facilities or the lack of such facilities. This concern arises particularly in relation to silage effluent. In both ROI and NI state grants have been made available to assist in the provision of necessary facilities. Assistance is made available for the provision of slurry and silage effluent storage tanks, animal housing and fodder storage. The degree of take-up of such assistance within the Foyle catchment is not known.

C14.3.1 Landspreading of Slurry

Slurry is applied by farmers in the spring and summer. The slurry consists of animal waste that has been collected over the winter (when the animals are housed indoors), silage leachate and farmyard runoff. The usual policy is to apply slurry to a field immediately after the grass has been cut and harvested for silage production. However many farmers leave large quantities of slurry in storage for subsequent spreading. The slurry is an effective fertilizer that strongly enhances grass growth.

There is no explicit legislation governing the timing of landspreading animal manure slurries. In ROI, Local Authorities may in accordance with Section 21 of the Water Pollution Act 1990, (by making bye-laws) avail themselves of statutory powers regarding landspreading of slurry over the autumn and winter periods and promote the adoption of waste management plans on an individual basis. Guidelines are being prepared in order to assist local authorities in the preparation of such bye-laws. Intensive animal rearing and processing above certain thresholds will be subject to a new system of integrated pollution control (IPC) licences to be operated by the Environmental Protection Agency. Specifically, licensing will be required for the rearing of poultry where the capacity exceeds 100,000 units and for the rearing of pigs where the capacity exceeds 1000 units on gley soils or 3000 units on other soils.

The application of slurry can have a significant impact on water quality Slurry can enter waterways as runoff following application on poorly drained soils or as a consequence of spillage from storage facilities. The decision to spread is judged on an individual basis as it is a function of soil type, land slope, weather conditions and the quantity of slurry being stored.

Both DANI and farming organisations in ROI have issued Codes of Practice to farmers giving advice as to how to control pollution resulting from land application of slurry.

The EC Directive Concerning the Protection of Waters Against Pollution Caused by Nitrates from Agricultural Sources (91/676/EEC) will influence slurry spreading practices on lands draining to waters affected by or vulnerable to nitrate pollution. Member States are required to have identified such vulnerable zones. Needs in this respect are being assessed at present. Specific Codes of Practice for landspreading of slurries are to be prepared and implemented in these zones.

Present indications are that nitrate pollution is not a significant problem in the catchment and within NI DANI and DoE have indicated that the designation of Nitrate Vulnerable Zones will not be needed.

C14.3.2 Farmyard Runoff

As part of the farm survey carried out by Donegal County Council, an assessment was made of the degree of pollution risk from the farms surveyed based on the information obtained by the survey. The risk assessed related principally to farmyard runoff rather than the overall pollution potential of the farm. Three categories of pollution risk were employed:

(1) High
(2) Medium
(3) Low

The survey also provided details on soil type, slope of land and slurry production, storage and disposal.

The pollution risk results of the survey are contained in Table C14.3.2. Equivalent information for Northern Ireland is not currently available.

TABLE C14.3.2

POLLUTION RISK FROM FARMS SURVEYED IN FOYLE CATCHMENT (CO. DONEGAL)

Pollution Risk Category	% of Farmyards in Category
HIGH	10
MEDIUM	15
LOW	75

Source: Donegal Farm Surveys, 1993

C14.3.3 Agricultural Chemicals

The amount of inorganic chemicals used on agricultural land should be based on crop and animal production requirements. In ROI Teagasc have developed recommendations for the application of inorganic fertilisers based on soil analysis results. Table C14.3.3 presents the correlation between the soil phosphorus level and necessity for application of phosphorus.

TABLE C14.3.3 INDEX SYSTEM AND ACTUAL SOIL TEST RANGE OR P MINERAL SOILS

P Index	P ppm	Correlation with Crop Response
1	0-3	Nutrient Response Definite
2	4-6	Nutrient Response Likely
3	7-10	Nutrient Response Unlikely, except for root crops, but a maintenance dressing should be used
4	>10	Nutrient Levels adequate, maintenance dressings not necessary at present except for potatoes. For silage P should be applied until the soil test exceeds 15 ppm.

Source: Teagasc, ROI

The Teagasc publication "Guidelines for Phosphorus Use on Soils" (1991), recommends that, even in a disposal situation, the maximum soil P level for mineral soils should not exceed 30ppm.

From soil samples taken in the catchment it can be seen that soil phosphorus levels where available, are everywhere below 10ppm. This indicates that additional spreading of phosphorus from time to time is recommended in these areas. However, there are cases of continued use of fertiliser at high application rates even when the soil no longer requires it. Concern has been expressed at the marked increase in nutrient enrichment of watercourses in recent years arising directly from fertiliser application.

Phosphorus loading from animal manures and crop fertilizers are shown in Maps 27 and 28 respectively.

The method of controlling the use and disposal of pesticides differs in both jurisdictions. In Northern Ireland, the Department of Agriculture have produced a number of Codes of practice which cover the safe use and disposal of pesticides and sheep dip on farms and holdings.

There is also an independent UK registration scheme (BASIS) for the pesticide industry which is recognised by the UK Control of Pesticides Regulations 1986 and extends to Northern Ireland. The aim of the scheme is to ensure a high standard of safety in the storage, distribution and application of pesticides with due regard to be had to the protection of the environment. The scheme also requires that people offering advice on these products receive proper training.

In ROI clearance to market pesticides is given on the basis of detailed evaluation of information and studies which must be submitted by the person wishing to market the

product. The information is evaluated by the Pesticide Control Unit, Department of Agriculture and Food. There is at present no specific Code of Practice governing the safe use of pesticides or sheep dips except that users follow all instructions on the packaging with respect to application rates and safe usage. The main problem with respect to sheep dips occurs when the resulting polluting wash down waters are discharged into adjacent streams. There is no control on sheep dips within Co. Donegal. Both ROI and UK are signatories to the Convention of the Marine Environment of the North-East Atlantic which will replace both the Oslo and Paris Conventions (PARCOM). PARCOM Recommendation 94/7 deals with the elaboration of National Action Plans and Best Environmental Practice for the reduction of inputs to the environment of pesticides from agricultural use. ROI and UK expect to ratify this convention during 1995.

C14.4 FERTILISER USAGE IN THE FOYLE CATCHMENT

Tables C14.4 (a) and C14.4 (b) present details of the calculated fertiliser inputs per hectare for Donegal District Electoral Divisions (DEDs) and NI Rural Districts. The fertiliser levels used are based on national values obtained from the paper "Fertiliser Use Survey" by Murphy and O' Keeffe, published in the Proceedings of the Fertiliser Association of Ireland, Winter Meeting, November 1987.

In general, nitrogen loading from crop fertilisers is within the range 55-85kg/ha (shown in Map 26) whilst that from animal slurries ranges between 110-170kg/ha (shown in Map 25). Phosphorus loadings from crop fertilisers range between 15-25kg/ha and the P loading from animals is also within the range 15-25kg/ha. In ROI, the national P application rate is 13.2kg/ha. From data supplied by Teagasc the resulting phosphorus levels in soils for the ROI part of the catchment are within the range 3-10ppm.

The Rural Districts used for collation of the Northern Ireland loadings are considerably larger in size than the DEDs which were used for the Co. Donegal levels. Data is not available to provide information for Northern Ireland in areas smaller than rural district size. Data is presented for a number of Rural Districts in Northern Ireland which are only partially in the catchment.

TABLE C14.4(a)
FERTILISER USAGE, DONEGAL DISTRICT ELECTORAL DIVISIONS (DEDs)
(FOYLE CATCHMENT)

DED Name (shown in Map 29)	Crop Area (Ha)	Crop Fertiliser N Usage Over Total DED area (Kg/Ha)	P Usage Over Total DED area (Kg/Ha)	Animal Manures N Load Over Utilised Area (Kg/Ha)	Animal Manures P Load Over Utilised Area (Kg/Ha)
Laghy	696	63.8	12.2	76.34	12.73
Lough Eask	391	52.1	10.8	58.11	9.69
Pettigo	535	66.2	13.0	90.26	15.05
Tawnawully	408	54.2	11.4	104.42	17.41
Templecarn	287	63.8	12.7	89.51	14.92
Tullynaught	721	59.9	13.9	79.14	13.19
Fintown	135	57.7	11.1	59.11	9.86
Glenleheen	149	49.5	10.3	36.24	6.04
Graffy	172	58.5	15.5	39.63	6.61
Burt	2205	82.6	21.5	101.10	16.86
Castlecary	852	64.2	14.6	109.92	18.34
Castleforward	1734	90.4	32.4	103.70	17.28
Gleneely	1259	63.0	13.1	134.24	22.48
Glentogher	331	60.6	14.2	94.58	16.15
Greencastle	903	56.6	11.8	127.71	21.30
Kilderry	1624	71.1	17.4	129.87	21.67
Killea	3600	74.4	25.3	121.10	20.19
Moville	493	59.9	14.2	109.75	18.30
Redcastle	789	59.8	11.8	158.46	26.68
Three Trees	610	59.4	11.4	91.56	15.26
Turmone	1035	60.3	12.1	93.25	15.59
Whitecastle	1271	61.1	19.9	111.84	18.67
Kincraigy	2271	69.9	19.9	133.86	22.32
Seacor	33	52.4	12.6	49.63	8.27
Altnapaste	1133	55.1	11.0	57.16	9.54
Castlefinn	1733	72.3	18.0	219.62	36.80
Cloghan	792	60.3	14.1	61.96	10.33
Cloghard	1237	68.1	12.9	161.51	26.93
Clonleigh North	2244	73.7	18.0	134.96	22.64
Clonleigh South	1676	68.6	17.8	147.27	24.55
Convoy	1950	64.3	13.0	140.71	23.47
Dooish	331	67.3	13.4	115.09	19.19
Feddyglass	1462	80.2	21.0	134.61	23.06
Figart	1217	60.7	12.7	185.75	31.40
Gleneely	1450	68.2	14.4	120.90	20.16
Goland	146	61.5	13.4	58.38	9.76
Killygordon	1763	71.1	14.0	168.19	28.14
Knock	453	64.6	13.4	84.25	14.04
Lettermore	639	59.7	13.4	84.24	14.06
Meencaragh	134	48.3	9.2	63.50	10.58
Raphoe	1530	65.4	15.4	191.99	32.19
St. Johnstown	2205	83.8	23.2	115.45	19.26
Stranlorlar	1807	55.8	11.3	112.38	18.93
Treantaghmucklagh	2025	76.7	21.3	107.50	17.94
Urney West	975	71.2	16.0	177.00	29.54

Source:- Teagasc

TABLE C14.4(b)
FERTILISER USAGE, NI RURAL DISTRICTS

DED Name	Crop Area (Ha)	Crop Fertiliser N Usage Over Total Rural District area (Kg/Ha)	Crop Fertiliser P Usage Over Total Rural District area (Kg/Ha)	Animal Manures N Load Over Utilised Area (Kg/Ha)	Animal Manures P Load Over Utilised Area (Kg/Ha)
Irvinestown	27055	66.5	18.5	41.41	6.95
Coleraine	30039	78.9	20.9	131.17	22.96
Limavady	30319	81.1	21.5	121.43	20.30
Derry	20568	82.0	22.9	114.79	19.23
Magherafelt	38733	78.1	20.8	147.08	26.69
Castlederg	15835	71.2	18.5	167.93	28.36
Clogher	22768	70.0	18.3	97.11	18.95
Cookstown	24978	72.9	18.7	139.85	25.90
Dungannon	32652	71.3	18.9	130.53	27.27
Omagh	60946	72.6	18.4	103.59	18.26
Strabane	28370	76.7	19.9	143.89	24.39

C15. FORESTRY

C15.1 DESCRIPTION OF RESOURCE

C15.1.1 Northern Ireland

Forestry resources in NI can be divided into public and private sectors.

C15.1.1.1 Public

In Northern Ireland, all public forestry is managed by the Forest Service, DANI

Details of the principal state forests in Foyle Catchment in Northern Ireland are presented in Table C15.1.1.1.

TABLE C15.1.1.1
PRINCIPAL FORESTRY SERVICE FORESTS IN FOYLE CATCHMENT (NI)

Forest Name	County	Area in Forest (Hectares)	Area Planted (Hectares)	Conifer (Hectares)	Broad Leaf (Hectares)
Binevenagh	Londonderry	800	659	587	36
Grange Park	Londonderry	1263	1097	1057	0
Springwell	Londonderry	1165	1069	1038	0
Campsey	Londonderry	35	31	31	0
Cam	Londonderry	1033	968	946	1.8
Gortnamoyagh	Londonderry	936	732	722	0
Glenshane	Londonderry	1021	442	440	0
Banagher	Londonderry	1060	1010	1003	3
Altbrittain	Londonderry	597	395	395	0
Goles	Londonderry	416	393	393	0
Ballykelly	Londonderry	98	89	80	7
Learmount	Londonderry	120	116	69	37
Creggan	Tyrone	680	588	587	0
Altmore	Tyrone	587	550	547	0
Dunmoyle	Tyrone	389	357	351	0
Davagh	Tyrone	1234	1051	1027	0
Seskinore	Tyrone	136	94	45	15
Lough Bradan	Tyrone	2086	1823	1802	1
Lack	Tyrone	658	539	502	7
Glenderg	Tyrone	2755	2312	2276	0
Pigeon Top	Tyrone	336	305	278	0
Slievedoo	Tyrone	1238	993	985	0
Moneygall	Tyrone	325	179	169	1
Aghyryan	Tyrone	423	414	393	1
Ligfordrum	Tyrone	644	605	587	3
Killens	Tyrone	163	76	76	0
Bradkeel	Tyrone	128	98	98	0
Ecclesville	Tyrone	72	45	37	1
Gortin Glen	Tyrone	1498	1234	1131	6

Note: The breakdown of Area Planted is as follows: High Forest Conifer, High Forest Broadleaf, Recreation, Amenity, Conservation, Research and Christmas Trees

C15.1.1.2 Private

There are a number of private forests in the catchment. The extent of these forested areas is listed in Table C15.1.1.2 from information given in 1992 DANI Farm Census. Further information on private woodlands in Northern Ireland is provided by the 'Private Woodland Inventory of Northern Ireland 1975-1979' published by DANI in 1981. The data presented in this publication is given on a county by county basis only. Although the data dates from the mid 1970's, a reasonable indication of the composition of the private woodland can be obtained as the character of woodland does not change quickly. The information is presented in Table 15.1.1.3

TABLE C15.1.1.2
EXTENT OF PRIVATE FORESTS IN NI RURAL DISTRICTS

Rural District	Area Forested Hectares
Limavady	635
Derry	311
Omagh	1274
Strabane	949

TABLE C15.1.1.3
COMPOSITION OF PRIVATE FORESTRY IN NORTHERN IRELAND 1979
(% of Total Area Forested)

County	High Forest			Other Forest	Cleared since 1975	Total Area
	Broadleaf	Conifer	Mixed			
Tyrone	29	42	11	9	9	100
Londonderry	60	10	15	10	5	100
Fermanagh	56	9	13	13	9	100

C15.1.2 Republic of Ireland

Forestry in ROI can be divided into public and private resources.

C15.1.2.1 Public

Coillte is a commercial company which manages public forests in the Republic.

The Foyle River catchment area includes parts of seven Coillte managed forests: Inishowen, Meeniroy, Gweelarra, Finn Valley, Barnestown and Pettigo. The area is dominated by two soil types; acidic brown earths and climatic peats. There are also some occurrences of peaty podzol.

The majority of the forest properties in Inishowen Forest do not drain into the Foyle basin. These areas were planted in the 1960's and 1970's. The dominant species are Sitka spruce (65% approximately) and lodgepole pine (35%).

Meeniroy forests is located on the watershed between the Foyle and Swilly catchment areas south-west of Inishowen. Forest properties consist generally of young spruce plantations planted in the mid 1980's on ploughed or mounded ground.

The western end of the catchment area includes the Upper Finn Valley and brings in some forest properties in Gweelarra forest. The age of these crops is varied, some being planted in 1959, some as late as 1993. The species is approximately 70% Sitka spruce, 25% pine and 5% Japanese larch and other conifer species.

Moving in easterly direction down the Finn Valley, the site type changes from climatic peat to the better acidic brown earths. In this area the percentage of pine decreases and that of broadleaf and other conifers increases. The area includes some of the earlier forest plantings (late 40's and early 50's), some of which are currently being clearfelled and replanted.

On the southern periphery of the catchment, the soil is again climatic peat. The species mix reverts to a pine dominated one, ie pines 60% and spruce 40%. Planting began here in the late 1950's with the bulk being carried out in the mid 1960's.

C15.1.2.2 Private

Reduced support for traditional farming and improved grant aid for planting of trees has created favourable conditions for a rapid expansion of plantation forestry in Ireland. The potential economic benefits of an expanded role for forestry are substantial. Within the next few years ROI will become a net exporter of wood products for the first time this century.

Private forestry in ROI is administered by the Forestry Service, Department of Agriculture and Food. Details of private forestry in the catchment are given in Table C15.1.2.2. Private forestry has taken place principally on blanket peat areas which has limited the choice of species.

TABLE C15.1.2.2

SUMMARY OF PRIVATE FORESTRY IN FOYLE CATCHMENT AREA - CO. DONEGAL

Zone of Catchment	Area Approx (Ha)	Soil Type Planted	Age of Plantation (Years)	Species Mix	Remarks
Lough Derg Area	40	Mostly Upland Blanket Peat	1 to 4	90% Spruce/Pine 10% Larch/ Pine	
Fintown - Reelan	500	Upland Blanket Peat	1 to 6	100% Conifer	Very active area Private Afforestation likely to increase considerably - not much scope for broadleaf
Finn Valley Lower	200	Upland Blanket Peat	1 to 4	90% Spruce/Pine 10% Larch/ Pine	Likely increase in Private Afforestation
Lagan and East Inishowen	40	Islands of poor land within good land	1 to 5	80% Spruce/Pine 20%Larch/Broadleaf	Rate of Afforestation unlikely to change

NOTES: To date afforestation in the Fintown/Reelan and Finn Valley areas has been in large blocks - average size of block in area 2 is about 50 hectares and in area 3, the average block size is approximately 20 hectares

Afforestation in Area 4 has occurred in small blocks, the average size of which is approximately 4 hectares.

C15.2 IMPACT OF FORESTRY DEVELOPMENT ON WATER QUALITY

Afforestation can have a major influence on the physical and chemical characteristics of watercourses within a catchment. Plantation establishment can affect water quality and fisheries and can influence water yields significantly.

The nature and extent of the effects alter through the lifetime of the tree crop. In the earlier stages of afforestation there can be significant changes in stream flow, with increased run-off, sharper storm hydrographs and significant increase in sediment yields due to site preparation, drainage and ploughing. Once the catchment is covered by closed canopy forestry , the effects of enhanced drainage become subordinate to the processes of soil drying and water loss by evapotranspiration. Fish resources may be affected by excessive shading and contamination from fertilisers if forestry development is badly designed.

Forestry in upland regions scavenge anthropogenic pollutants (sulphur dioxide and nitrous oxide) and sea salts from the air onto the leaves and needles and change the composition of ions in rainfall and other forms of precipitation (bulk deposition) reaching the trees. This precipitation when it reaches the soil through stemflow and throughfall through the forest canopy results in an acidic soil and following runoff, acidification of streamflow.

Critical acidity loads for soils in the Republic of Ireland are presented in the publication 'Mapping Critical Loads for Europe', CCE Technical Report No. 1, July 1991. A number of zones within the Foyle catchment are included in the most sensitive areas. While Coillte considers the extent of some of the sensitive areas within Co. Donegal as shown in this figure to be overestimated, the catchment should be considered as relatively sensitive.

The Forestry Service in the Republic of Ireland has issued a set of Guidelines which are designed to reduce the impact of forestry practices on the aquatic environment. The guidelines:

1. Require consultation with the local Regional Fisheries Board if the area for development is over five hectares and includes aquatic habitats.

2. Provide a comprehensive list of instuctions for ground preparation and planting, use of fertilizers and other chemicals, thinning, harvesting, as well as construction of roads, bridges, culverts and fords.

3. Set out a procedure whereby catchments may be designated as 'acid sensitive'

4. Require extra precautions to be taken when planting acid sensitive areas.

The guidelines call for the identification of Designated Sensitive Areas by each Fishery Authority in the Republic of Ireland, in this case the Foyle Fisheries Commission. 'Sensitive Areas' are those which are particularly sensitive because of their important fisheries and low buffering capacity (low level of calcium).

'Sensitive' areas will be designated on the basis of the following c[illegible] :

(1) The aquatic zone is part of a recognised salmonid fishery and is a spawning , nursery or angling area, and;

(2) The geology is base poor, and;

(3) In water samples taken regularly between 1st February and 31st May, either

- pH equal or less than 5.5, or
- water hardness, in milligrams of calcium carbonate per litre, is less than 12
- water alkalinity, in milligrams of calcium carbonate per litre, is equal to, or less than 10.

In the Foyle catchment area, this designation procedure is scheduled to commence in April 1994.

Within a Designated Sensitive Area, the guidelines for forestry development relate to the following issues:

- Forest Establishment
- Ground Preparation
- Planting
- Fertiliser Application
- Chemicals Application
- Thinning and Harvesting
- Roads, Bridges, Culverts and Fords.

Buffer zones located downstream are a useful management tool.

There are also guidelines dealing with afforestation developments greater than 40 hectares in Non-Designated Areas.

C15.3 FERTILISER APPLICATION

Typical fertiliser usage requirements for forestry developments (as practised by Coillte) are set out below.

- At the start up stage of forestry, if phosphate is absent from the soil, in peatlands, for example, rock phosphate is applied at a rate of 350kg/hectare unless the crop goes into check. This is relatively insoluble and comprises 13% elemental Phosphorous.

- In existing plantations, urea is applied at a rate of 250-400 kg/ha and Rock Phosphate at a rate of 350 kg/ha.

- A herbicide is normally only applied at the establishment stage. The product used is Gardoprim, containing Therbutalazene, at a rate of 12 l/ha.

C15.4 FUTUR[illegible] EVELOPMENTS

In Northern Ireland as a whole the annual rate of afforestation and reforestation is running at a rate of 1,000 hectares, levels which are expected to be maintained. Information particular to the catchment regarding likely development is not available.

Future Coillte forestry developments in the Donegal section of the Foyle catchment are likely to be of the following order:

- Afforestation, estimated at between 200 to 400 ha per annum.
- Reforestation, estimated at approximately 200 ha per annum.

An investment programme, with EC assistance, to promote and develop Irish forestry is underway. The development of planting is encouraged through grant schemes, a requirement being that all reasonable steps are taken to avoid adverse effects on the environment. This is done by means of a prior assessment system for proposed forestry developments, combined with monitoring of successful applications. Thus applications for grant aid may only be approved subject to a number of conditions.

Generally, environmental considerations in the forestry programme are given emphasis, as the following objectives and measures outlined by the ROI Forestry Service indicate:

- The diversification of species, in particular the encouragement of broadleaved trees to improve visual amenity, provide additional habitats for flora and fauna, and provide quality hardwood timber.

- As far as possible, open areas such as boglands are avoided for afforestation. Grant aid will not be available for forestry on boglands of scientific interest or those listed for conservation. Afforestation by Coillte Teoranta (the Forest Service) on Bord na Mona (the Peat Development Board) boglands will be confined to cutaway bogs which can no longer produce peat in commercial quantities.

- Environmental impact assessment is required for forestry development projects above 200 hectares (10 hectares for conversion of broadleaved high forest).

Both Coillte and the Forest Service of DANI have a policy to plant future forestry developments in higher nutrient lowland areas. This will result in a much lower level of fertiliser application.

As with agriculture the use, storage, application and disposal of insecticides, fungicides and herbicides have the potential to cause detrimental effects on aquatic life and water supplies. In NI all pesticides used must be approved by DANI. The use of chemicals and pesticides in forestry in ROI is governed by a set of guidelines issued by the Department of Energy, Forest Service.

SECTION D

CLASSIFICATION SYSTEMS

D1. INTRODUCTION

In this section we develop a water quality classification system for the catchment. It is strongly recommended that a single classification system is used for the entire freshwater catchment. A single system will allow water managers in both catchment jurisdictions to assess the state of the rivers using the same set of rules. Investment decisions concerning infrastructure can then be objectively assessed at the catchment level. This point may be important if further EU funding is sought for environmental improvement schemes in the catchment under the INTERREG initiative. In addition, we suggest that a single classification system is used for the estuary.

For convenience the river and its key tributaries have been divided into a number of reaches which can then be classified. The reaches have been chosen such that they are representative of an existing sampling site within that reach, and it is assumed that the site is typical of conditions throughout the reach. It is recognised that this may not be the case in some circumstances but the assumption is considered to be appropriate for the purposes of this management plan. It should be noted that in general we consider the sampling locations to be well chosen and representative of conditions over a reach.

In this section a classification system for running freshwaters is firstly developed followed by a brief description of a system for defining eutrophic lakes. Thirdly a classification system for estuaries is presented together with a system for assessing the trophic status of estuaries. Classification systems for water contact activities and shellfisheries are then considered.

D2. AN INTEGRATED FRAMEWORK FOR RUNNING FRESHWATERS

In this section we develop a system which can be applied to all freshwater reaches containing running water. The system we have developed is based on the currently used and proposed classifications in both NI and the ROI and includes consideration of chemical aspects and macro-invertebrates.

Incorporation of these aspects will present the water resource manager with a more comprehensive understanding of the state of a reach than either a chemical or a biological classification system alone. It should be noted that research is continuing in many areas, including both the use of macro-invertebrates and macrophytes for water quality classification purposes, and the classification system set out in this section should not be considered as definitive and may need updating in the future.

Throughout this section much of the discussion focuses on a classification system for fisheries. Standards for fisheries are generally the most strict of all the water quality standards that apply to different uses and it can generally be assumed that if a river meets the water quality criteria for a salmonid fishery most other uses are unlikely to be constrained by water quality.

Firstly, the existing and proposed water quality management frameworks in both jurisdictions are summarised. Subsequently a chemical management framework is developed, followed by a biological framework. These aspects are then integrated into a single framework.

D2.1 EXISTING WATER QUALITY MANAGEMENT FRAMEWORK

The existing framework for water quality management in the NI and ROI parts of the catchment is given below:

D2.1.1 Northern Ireland

D2.1.1.1 Existing chemical classification system

At present there is a chemical classification system, which shows the overall quality of the catchment and monitors change in this through time. This system has a semi-statutory basis in that the Environment Service has the stated aim that all rivers and estuaries should be above a certain class.

D2.1.1.2 Chemical classification system

A chemical classification system has been developed by the National Rivers Authority for England and Wales. Legislation has been prepared and passed into law and it is likely that it will be used in Northern Ireland. The proposed management framework applies to freshwater reaches only.

D2.1.1.3 Biological classification system

A biological classification system also exists and this monitors the health of the river by reference to its macro-invertebrate populations. This system is non-statutory and is used as a management tool.

D2.1.2 Republic of Ireland

D2.1.2.1 Biological classification system

A biological assessment system which monitors the health of the river ecosystem by reference to its macro-invertebrate populations presently exists. Regard is also given to eutrophication as observed by the level of macrophyte, particularly attached algae, growth. Rivers in the ROI have been classified using this system since the early 1970's (the "Q" system). The system is not statutory.

D2.2 CHEMICAL CLASSIFICATION SYSTEM

This section discusses the details of the chemical classification systems used in Northern Ireland and the Republic of Ireland. Most of the discussion focuses on standards for fisheries which are of most importance in developing a Water Quality Management Strategy for the Foyle System.

D2.2.1 Northern Ireland

The Chemical Classification System that is used in Northern Ireland was devised in the late 1970's by the National Water Council (NWC) and applied to the whole of the United Kingdom with the exception of Scotland. The system categorises rivers into five classes; 1 (A and 1B) (Good); 2 (Fair); 3 (Poor); and 4 (Bad) and estuaries into four classes; A (Good); B (Fair); C (Poor); and D (Bad).

The policy of the Environment Service is to manage river and estuarine systems so that water quality is at least Class 2 under the national classification system, with no downward movement between classes.

A chemical classification system adopted by the NRA for England and Wales sets different standards for different River Ecosystems and other uses of the river. The targets for River Ecosystem (RE) use are set to protect not only the fish themselves but also other animal life which are essential components of the entire ecosystem. There are five River Ecosystem Classes. The classes in the River Ecosystem Classification are expected generally to equate to the suitability of waters to support fish of the types indicated in Table D2.2.1.(a) below. The table also shows the NWC Classes which are broadly similar to the particular RE Class. The key water quality parameters for the RE classification system are presented in Table D2.2.1(b).

The classification system proposed by the NRA builds on the experience gained in operating the current NWC system. The NWC system uses 95% percentiles to assess water quality. Experience has shown that this system results in a higher than desirable chance that a reach is placed in the wrong class. The proposed system uses 90 percentiles to assess compliance, rather than 95 percentiles. Research by the NRA in England and Wales has shown that a particular reach can be placed in a class with a much reduced chance of error using 90 percentiles, whilst this is still representative of the worst conditions in the reach.

It is also proposed, therefore, that if a reach is stated as having failed to achieve its target, there should be 95 percent confidence in that statement. This has to be taken into account when assessing compliance, and the recommended procedure for this is set out in an NRA technical document.

TABLE D2.2.1.(a) : NWC CLASSES AND EQUIVALENT CLASS IN THE PROPOSED NRA CLASSIFICATION SYSTEM

RE Class	Similar NWC Class	Class Description
RE1	1a	Water quality suitable for high class salmonid and cyprinid fisheries
RE2	1b	Water quality suitable for sustainable salmonid and high class cyprinid fisheries
RE3	2	Water quality suitable for sustainable cyprinid fisheries
RE4	3	Some fish species may be present but water quality unsuitable for sustainable fishery
RE5	4	Fish unlikely to be present

TABLE D2.2.1 (b) RIVER ECOSYSTEM CLASSIFICATION: WATER QUALITY CRITERIA

Class	Dissolved Oxygen % Saturation 10% ile	BOD (ATU) mg/l 90% ile	Total Ammonia mg N/l 95% ile	Un-ionised ammonia mg N/l 95% ile	pH lower limit as 5% ile upper limit as 95% ile	Hardness mg/l $CaCO_3$	Dissolved Copper µg/l 95% ile	Total Zinc µg/l 95% ile
RE1	80	2.5	0.25	0.021	6.0-9.0	≤10 >50 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
RE2	70	4.0	0.6	0.021	6.0-9.0	≤10 >50 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
RE3	60	6.0	1.3	0.021	6.0-9.0	≤10 >50 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
RE4	50	8.0	2.5	-	6.0-9.0	≤10 >50 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500
RE5	20	15.0	9.0	-	-	-	-	-

It should be noted that RE1 and RE2 meet the requirements for the EU Salmonid Directive.

D2.2.2 Republic of Ireland

The ROI does not have a distinct chemical classification system and chemical aspects are considered in the ROI in terms of the relevant EU Directives. These Directives apply to both jurisdictions and are considered in Section E.

Water quality classification in the ROI is based mainly on biological assessments. However where chemical data exists, regard is given to it, to confirm biological quality findings. Where conflict arises the biological quality is given greatest credence. Table D.2.2.2 shows the general correlation between chemical quality and biological classification.

TABLE D2.2.2: GENERAL CORRELATION BETWEEN CHEMICAL QUALITY AND BIOLOGICAL CLASSIFICATION

Chemical Parameters	Class A	Class B	Class C	Class D
DO	80%-100%	Fluctuates widely	Fluctuates very widely, potential fish kills	Low during the day, possibly zero at night.
BOD	<3 mg/l	Close to normal	May be high at times	High or very high

D2.2.3 Comparing and Contrasting Chemical Classification Systems

The ROI has not developed a chemical classification system, whilst the NI has used a classification system for a number of years. A new, proposed system has been developed by the NRA in England and this system may offer many benefits over the system currently used in NI.

D2.3 MACRO-INVERTEBRATE CLASSIFICATION SYSTEM - FRESHWATER

The chemical classification system refers largely to the background chemical water quality and is monitored by discrete spot samples taken typically at monthly or fortnightly intervals. Biological communities, however, reflect the overall quality of the environment in which they exist. The natural environment can suffer stress in a number of ways which may not be detected by chemical monitoring alone. Such sources of stress include:

- intermittent pollution due to short lived events such as storm overflows or silage spills
- presence of toxic elements, such as heavy metals or pesticides
- nutrient enrichment, from agricultural run-off and point discharges
- changes to the flow regime, such as a reduction in flows due to over-abstraction
- river management, including excessive aquatic plant control, canalization and draining of adjacent wetlands

The effect of environmental stress is normally to change the balance of biological communities, with an increase in tolerant species and a reduction or disappearance of sensitive species. The use of macro-invertebrates is now a well established technique for assessing the effects of pollution and river management. In this context, the term macro-invertebrates covers all the insect and small animal life living on the river bed, for example worms, snails, caddis flies and beetles. In clean, healthy rivers there will be both a large number of macro-invertebrates and also a wide variety of taxa (groups of species). In rivers suffering stress, either of these factors can be affected, but there is normally a change of balance between families, with an increase in pollution tolerant species such as worms and an absence of pollution sensitive species, for example mayflies and stoneflies.

D2.3.1 Biological Classification in Northern Ireland

In Northern Ireland the analysis system developed by the Biological Monitoring Working Party Group (BMWP) is used by water managers. The BMWP score provides an indication of the biological condition of rivers through the identification of different macro-invertebrate families at a particular site. Each family is given a score between 1 and 10, depending on their sensitivity to pollution. Those that are most sensitive (e.g. mayflies and stoneflies) are given the highest scores, whilst pollution tolerant species (e.g. chironomid larvae and tubificid worms) are allocated low scores. The contributions of the individual families present at the site are totalled to give a BMWP score, with a high score being indicative of good water quality whilst a lower score indicates pollution stress.

A further measure of biological status used in Northern Ireland is the Average Score Per Taxon (ASPT) value, which is obtained by dividing the overall BMWP score by the number of families, or taxa, present. The ASPT value is a measure of the relative contribution of the taxa, with a high ASPT indicating that there is a high proportion of pollution sensitive taxa at the site and it is therefore likely to be in a healthy condition.

Although the BMWP score is a good indicator of pollution stress at a site, it is important to note that invertebrate communities will naturally vary between sites depending on characteristics such as water depth, flow velocity, substrate, bank side vegetation and water hardness. A computer-based model called RIVPACS (River Invertebrate Prediction and Classification System) has been developed by the UK Institute of Freshwater Ecology to predict the status of invertebrate communities in a river relative to certain natural physical and chemical properties. RIVPACS was developed using data from England and Wales, although it is currently being updated to suit conditions in Northern Ireland.

The results of applying RIVPACS are predictions of BMWP and ASPT scores for the site in an "unpolluted" state. The comparison of these predicted scores with those actually observed provide a better indication of the pollution stress at the site than the actual scores themselves. On the basis of these comparisons, the macro-invertebrate biology is categorised into 4 classes; Good (unstressed fauna); Moderate (slightly stressed fauna); Poor (highly stressed fauna) and Bad (extremely stressed fauna).

Under the Biological Monitoring Programme the invertebrates are sampled three times per year: in Spring, Summer and Autumn.

D2.3.2 Biological Classification in the Republic of Ireland

In the Republic of Ireland a similar scoring system to the BMWP system is used. The pollution status of a stream is determined by comparing the relative proportions of the organisms collected from a stream with the expected ratios in similar, but unpolluted habitats. This system takes into account the physical characteristics of the sample site that influence the macro-invertebrate community, such as water depth, bed material and current speed. The results of the biological assessment are then converted into a five point biotic index, Q5-Q1, where the status of each class is as shown in Table D2.3.2:

TABLE D2.3.2 : BIOTIC INDEX FOR EXPRESSING QUALITY OF FRESHWATER SYSTEM

Biotic Index or 'Q' Value	Community Diversity	Water Quality
Q5	High	Good
Q4	Slightly reduced	Fair
Q3	Significantly reduced	Moderate
Q2	Low	Poor
Q1	Very Low	Bad

In the ROI the invertebrates are sampled every few years, with the period between sampling varying between sampling sites. Unpolluted sites are sampled less frequently than polluted sites.

D2.3.3 Comparing and Contrasting the Two Systems

The two biological classification systems are similar. However, the ROI system has an extra class which does not directly correspond to any of the RIVPACS classes. We suggest that Q5 corresponds to "Good Quality" in the RIVPACS system whilst Q4 and Q3 correspond to "Moderate Quality", and Q2 and Q1 correspond to "Poor" and "Bad" quality respectively.

D2.4 EUTROPHICATION AND OTHER BIOLOGICAL CONSIDERATIONS

The use of river macrophytes (plants and weeds, normally growing in the river bed) is starting to become recognised as a valuable tool in the assessment of the overall health of the river environment. Unfortunately, a rigorous framework for assessing water quality using macrophytes does not exist in either jurisdiction. However, it should be noted that research is proceeding in a number of European Countries on a rigorous classification system based on macrophytes. The restricted flora of brisk rivers may have implications in the mobility of any classification system developed.

It is important to include macrophytes as a measure of river water quality as macrophytes are a useful indicator of eutrophication. In this section we develop a classification system for eutrophication in running freshwaters which includes consideration of macrophytes. Eutrophication is defined as:

' *the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned*' (UWWT Directive (91/271/EEC).

However, the assessment of whether a stretch of water actually or potentially is eutrophic is not possible simply by reference to numeric chemical criteria. It is recommended *(Ref DR/8/1(A): Criteria and Procedures for Identifying Sensitive Areas and Less Sensitive Areas (Urban Waste Water Treatment Directive) and 'Polluted Waters' (Nitrates Directive) in England and Wales)* that the following symptoms are considered when identifying waters as eutrophic or potentially eutrophic.

The following symptoms all need to be considered when identifying running freshwaters as eutrophic or potentially eutrophic, but the presence of any of them, either singly or in combination, will not necessarily indicate eutrophication and a final judgement will depend on local conditions and knowledge.

a. Phosphorus Concentration

   An annual average orthophosphate concentration over 50μg/l P.

b. Algal Biomass

   Excessive growth of attached algae, especially Cladophora, which may reach biomass levels of several hundred g/m^2. Planktonic algae producing annual mean concentrations of more than 25 μg/l chlorophyll-a or a maximum of 100μg/l.

c. Water Retention Time

   In rivers affected by planktonic algae, sufficient retention time for algal multiplication (normally over 5 days).

d. Dissolved Oxygen

   A strong diurnal cycle of dissolved oxygen saturation, daytime supersaturation levels (over 150%) and reduced night time saturation levels.

e. Effects on Fauna

   Reductions in diversity and increased abundance of pollution tolerant taxa which can be attributed to the effect of nutrient enrichment.

f. Effects on Macroflora

   Substantial adverse changes in macrophyte abundance and/or diversity.

g. Effects on Microflora

   Exceptional increases in planktonic, floating, or attached algal biomass leading to blooms, scums or discolouration.

An important element of the criteria for running freshwaters is if substantial adverse changes in macrophyte abundance and/or diversity have occurred. Macrophytes, like macro-invertebrates, are sensitive to the environmental conditions in which they exist. They can play a vital role in the water quality of the river itself, increasing dissolved oxygen due to photosynthesis during the day and decreasing it due to respiration at night. In extreme cases, where there is a very large plant biomass, this diurnal variation in dissolved oxygen can be a significant source of stress for invertebrates and also fish life.

A wide variation in the numbers and types of aquatic plants is normally found within rivers. Three distinct macrophyte zones are generally apparent, depending on the physical nature of the river reach under consideration. In the upper reaches, the river is often characterized by fast flowing water over a rocky substrate with mosses and liverworts being the dominant species. The middle reaches are generally still reasonably fast flowing over a gravel substrate, where rooted plants adapted to withstand the flows, such as Water Crowsfoot, tend to dominate. The lower reaches are deeper and slower moving with silty or sandy substrates and macrophytes are typically submerged and emergent species similar to those occurring in a shallow lake or pond. Within each of these zones the distribution and abundance of different macrophytes are often very different, reflecting sources of environmental stress such as organic pollution or nutrient enrichment.

Obvious signs that a river is suffering from organic pollution include the appearance of 'sewage fungus', which is normally only found near to the source of the pollution.

D2.5 PROPOSED INTEGRATED WATER QUALITY CLASSIFICATION SYSTEM

It would be useful for a water quality management framework in the Foyle catchment to incorporate chemical and biological aspects. The framework is presented in Table D2.5. The overall class of a reach is the lowest of any of the two elements. For example, if a reach achieves the chemical class of RE1 but has a biological rating of Q3 (the lower end of Moderate) the overall class is FC (Foyle Classification System, Class C).

It should be noted that chemical classification is only one part of the proposed classification system. Whilst chemical monitoring is useful for determining the extent to which a river is suffering from significant pollution stress from routine sources macro-invertebrates provide a more sensitive means of classification. Thus, we consider the macro-invertebrate part of the classification system to provide a more important means of classification than purely chemical data.

TABLE D2.5: PROPOSED INTEGRATED WATER QUALITY CLASSIFICATION SYSTEM FOR RUNNING FRESHWATERS IN THE FOYLE

Water Quality Consideration	Class FA	Class FB	Class FC	Class FD
Chemical Aspects	RE1	RE2	RE3	RE4/5
Biological Survey	Good, Q5	Fair, Q4	Moderate, Q3	Poor, Q2/1
Biological (Q) (Quality)	Q5 Good	Q4 Moderate	Q3 Moderate	Q2, Q1 Poor, Bad

D3. FRESHWATER LAKES

Neither jurisdiction has developed a water quality classification system for freshwater loughs. It is suggested that the OECD classification system is used and this system is presented in Table D3. The classification system is based on chlorophyll-a concentrations. Limited chlorophyll data are available for certain freshwater loughs in the catchment.

TABLE D3: TROPHIC CLASSIFICATION SYSTEM FOR FRESHWATER LOUGHS

Lake Trophic Category	Chlorophyll-a (mg/m³)		Algal Growth	Probability of pollution	Impairment of multipurpose use of lake
	Annual Maximum	Annual Mean			
Ultra-Oligotrophic/ Oligotrophic	<8	<2.5	Low	Very low	Probably none
Mesotrophic	8-25	2.5-8	Moderate	Low	Very little
Eutrophic	25-75	8-25	High	Strong	Appreciable
Hypertrophic	>75	>25	Very High	Very high	Very high

Source: OECD Report on the trophic status of lakes, slightly modified in line with the report "Water quality in Ireland,1987-90" by the ERU.

D4. ESTUARIES AND COASTAL WATERS

Estuarine conditions are extremely difficult to quantify in any detailed classification system. The interaction of salt and fresh water produces variable salinity environments, both in the short term due to tidal movements and seasonally with river flow fluctuations. The change in chemical composition of the water causes flocculation of sediment particles and adsorption of pollutants such as metals (if present) onto them. The enlarged sediment particles tend to settle out of the water column, typically producing the muddy substrates associated with estuaries.

The organisms inhabiting these difficult conditions are specialised to exploit them and although some have evolved to tolerate small variations, others are capable of surviving in a wide range of salinities. This makes it almost impossible to classify estuaries using a system comparable to that applied to rivers.

The NWG classification system which is proposed should be used for the Foyle Estuary, is therefore not based entirely on rigorous numerical standards, but is partially subjective. In addition we propose a system for defining the trophic status so that the sensitivity of the estuary to eutrophication can be classified.

For the purposes of this section we define the estuary as covering the area from the open sea to the tidal limits of the rivers in the catchment.

D4.1 INTEGRATED CLASSIFICATION SYSTEM

We propose that the classification system developed for NI (currently under review) is used. This system comprises a method of scoring for a range of categories. The parameters and the scores are presented in Table D4.1(a). The class of a particular estuary is determined by summing the points for the different categories and comparing these to a classification system which is presented in Table D4.1(b). It should be noted that a new General Quality Assessment scheme is currently being developed by the National Rivers Authority for use in England and Wales for assessment of estuarine water quality. It is recommended that this scheme is evaluated once it is adopted in England and Wales.

TABLE D4.1(a): SCORING SYSTEM FOR CLASSIFYING ESTUARIES

		Scores
Biological Quality		
(a)	Allows the passage to and from freshwater of all relevant species of migratory fish, when this is not prevented by physical barriers (relevant species include salmonids, eels, flounders and cucumber smelts, etc)	2
(b)	Supports a residential fish population which is broadly consistent with the physical and hydrographical conditions.	2
(c)	Supports a benthic community which is broadly consistent with the physical and hydrographical conditions.	2
(d)	Absence of significant levels (in terms of environment or public health risk) in the biota of persistent, toxic or tainting substances from anthropogenic sources	2
	Maximum number of points	10
Aesthetic Quality (Choose one description only)		
(a)	Estuaries or zones of estuaries that either do not receive a significant contaminant input or which receive inputs that do not cause significant aesthetic pollution	10
(b)	Estuaries or zones of estuaries which receive inputs which cause a certain amount of aesthetic pollution but do not seriously interfere with estuary usage.	6
(c)	Estuaries or zones of estuaries which receive inputs which result in aesthetic pollution sufficiently serious to affect estuary usage.	3
(d)	Estuaries or zones of estuaries which receive inputs which cause widespread public nuisance.	0
Water Quality		
Dissolved oxygen exceeds the following saturation values:		
	60%	10
	40%	6
	30%	5
	20%	4
	10%	3
	below 10%	0

Source: Report on River and Estuary Quality in Northern Ireland published by the Environment Service

TABLE D4.1.(b): CLASSIFICATION SYSTEM FOR ESTUARIES

Classification A	Score (Number of Points)	Description
Class A	30-24	Good Quality
Class B	23-16	Fair Quality
Class C	15-9	Poor Quality
Class D	8-0	Bad Quality

Source: Report on River and Estuary Quality in Northern Ireland published by the Environment Service

D4.2 EUTROPHICATION - TIDAL WATERS

The following are criteria which are useful for determining whether an estuary is eutrophic:

a. Nitrate Concentrations

Winter (February) nitrate-nitrogen concentrations significantly enhanced relative to a background concentration for a defined geographical area based on salinity.

b. Occurrence of Exceptional Algal Blooms

Attention should be given to the occurrence of unusual blooms of phytoplanktonic species or blooms of unusual scale or blooms with unusual toxicity characteristics.

In considering abundance it can be taken that blooms of algae in coastal waters normally reach densities of at least 5 x 10^5 cells per litre and chlorophyll-a concentrations of around 10 mg/m^3.

c. Duration of Algal Blooms

It could be considered exceptional if the normal spring bloom algal densities persisted through the summer until the autumn bloom without the typical nutrient-limited decline in the summer.

This applies to relatively calm waters where thermal stratification occurs during the summer, and therefore nutrients can be consumed from the upper warm waters. In well mixed waters such as is the case in much of the Irish Sea, stratification is not as strong and nutrients are readily available from the whole of the water column and a single summer bloom may occur, rather than two separate blooms in spring and autumn.

d. Oxygen Deficiency

Attention should be given to decreased oxygen concentration at the surface, as well as in deeper water layers, including in areas where sedimentation and/or stratification may occur.

Care must be taken under this heading to ensure that consideration is given to oxygen deficiency which is due to the decay of plant material and not caused by organic discharges to the local areas.

e. Reductions in Fauna

Substantial increases or decreases in benthic biomass, shifts in species composition and mortality of benthos and fish.

f. Changes in Macrophyte Growth

These can be relatively minor, such as the disappearance of red algal species, or a reduction in depth of the photic zone, or more significant, for example dense and widespread growth of *Enteromorpha* spp.

g. Occurrence and Magnitude of Paralytic Shellfish Poisoning (PSP)

The occurrence of PSP-causing species (eg *Alexandrium* sp) is endemic in areas around the UK coast even where there is no nutrient enrichment and blooms of varying significance occur each year. However, their scale may be enhanced by nutrient enrichment, extending the duration and geographic area of effect of the present chronic phenomenon. Such an extension could indicate eutrophication but could also be due to a variety of natural causes.

h. Formation of Algal Scums on Beaches and Offshore

Dense blooms of colonial or chain-forming species (e.g *Phaeocystis*, *Chaetoceros*) can result in drifts of cells on the sea surface or on the strand-line, or slimy deposits on fish nets or drogues. The significance of these phenomena should be placed in a historical perspective as such phenomena have been regularly recorded in some UK coastal waters for over 100 years.

D5. WATER CONTACT ACTIVITIES

The presence of bacteria and viruses in water may pose a health risk to users who may come into contact with the water, such as bathers and canoeists. Harmful microorganisms are normally only present in very small numbers, if at all, and are therefore difficult to use as the basis for setting targets and for regular monitoring. It is therefore normal practice to use common, but not harmful, bacteria for this purpose on the basis that if large numbers of these bacteria are present then there is a risk that some harmful microorganisms will also be present. The most often used indicator species are Total Coliforms, Escherichia coliforms (E. coli) and Faecal Streptococci. E. coli are a commonly used indicator of faecal contamination (although they are also naturally present in soil, for example) and are often referred to as Faecal Coliforms.

However, the problem of using indicator species in the river environment is that the bacteria can be derived from a number of sources other than sewage works discharges, including run-off from urban or agricultural areas. Faecal coliforms and streptococci are more reliable indicators in this situation since they are generally derived from faecal material from mammals, although they are also found in bird faeces. Problems may thus be encountered in livestock farming areas and near bird colonies where the contribution of faecal coliforms from animal faeces may be significant. In these instances numbers of faecal indicators cannot be directly related to STW discharge. There is not a reliable correlation between numbers of faecal indicator organisms and the possible presence of microorganisms which could be harmful to humans.

No standards are proposed for water contact activities in this report, although the results of bacteriological sampling are considered in Section F.

D6. SHELLFISHERIES

Environment Service have classified sites in NI under the EC Shellfish Hygiene Directive (91/492/EEC). Shellfisheries in the Foyle catchment are designated under 79/923/EEC on the quality required of shellfish waters.

SECTION E

TARGETS

E. TARGETS

E1. INTRODUCTION

The targets for water quality in the Foyle are set out in the following sub-sections. Targets are set for each freshwater reach in the catchment in terms of the classification framework developed in Section D. For the catchment as a whole targets are set in terms of other water quality management aspects, such as litter on stream banks. In addition the targets set out in the relevant EU Directives are discussed.

E2. FRESHWATER TARGETS

All areas that are used for salmon spawning in the catchment (mapped in Section C) should have a target of Foyle Classification System, Class A (Class: FA). The remainder of the catchment should be at least FB (Foyle Class B), which equates to sustainable salmonid waters, because salmonids use the entire catchment. It is accepted that this method of setting targets is somewhat arbitrary.

Account must be taken of effluent disposal and other valid uses of waterways such as fish farming. The catchment generally receives small amounts of effluent in relation to river flows (Section C10), so effluent disposal should not cause a downgrading in class. Given the importance of the natural salmon fishery in the Foyle system, we suggest that effluent disposal or fish farming should not in any case be allowed to downgrade the class below FB.

A balanced approach is required for any classification system to be credible, and it would not be productive to set unachievable targets. Effluent disposal practices from several fish farms in the catchment would prevent the achievement of Class FA, and it should be recognised that tightening consents to overly stringent levels may question the viability of such farms. It may therefore be more pragmatic to accept that some reaches may achieve a classification of FB, however every effort should be made to ensure that water quality is maintained at a level as near to that which would fit a classification of FA as possible.

The classification system should take account of special ecological features. Under this criteria we suggest that particular attention is paid to the freshwater mussel *Margaritifera margaritifera*. Targets for *Margaritifera margaritifera* are not known, it is believed that the strictest water quality standards should apply because recent research indicates that the freshwater mussels may be very sensitive to eutrophication and/or pollution. The species is in serious decline in the Foyle catchment. However, it should also be noted that the precise reasons for the decline are unknown. Therefore, it is proposed that reaches where mussels are present are given the target of FA. This approach is, compatible with the concept of "precautionary action". It should be noted that most of the current Margaritifera reaches do not meet the FA standard. Reasons for the decline in Margaritifera are not fully understood, and further research is required.

Based on these assumptions, Map 34 identifies targets for each reach defined in the catchment using the Foyle Classification System which has been developed. The reaches and targets are listed in Table E11 at the end of Section E.

E3. ESTUARINE TARGETS

A target of Class A for the Foyle is suggested. This target reflects the importance of the use of the estuary by migrating fish.

In addition, the current Class A status of the Lough should also be protected as it has significant value in terms of its commercial shellfishery, game angling, recreation and amenity uses.

E4. EC DIRECTIVES

In addition to the classification systems used in the ROI and NI, various European Commission (EC) Directives apply.

The most relevant Directives to this Foyle Water Quality Management Strategy are:-

a. **78/659/EEC on the quality of fresh water needing protection or improvement in order to support fish life.** Under this directive reaches are designated as Salmonid (eg. trout or salmon) or cyprinid (i.e. coarse fish) waters and those so designated are shown on the map. The directive sets both guideline and imperative water quality standards for these reaches, which are detailed in Appendix A2.2. The reaches designated for the Foyle catchment are shown on Map 30, along with the sampling sites which are used to assess compliance.

b. **75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water.** The standard is designed to set guidelines for the minimum amount of treatment for a certain quality of water. It is normal practice to match the level of water treatment to the quality of the abstracted water rather than attempt to improve water quality to meet existing levels of treatment. The water classification is divided into three categories as follows, based on the type of treatment:

A1: Simple physical treatment and disinfection.
A2: Normal physical treatment and disinfection. Examples of treatment processes include pre-chlorination, coagulation, filtration.
A3: Intensive treatment. This includes all the above examples and other treatment processes such as carbon filtration.

The type of treatment used in WTW's in the Foyle catchment and the water quality class that should apply are presented in Table E4(a). Details of the water quality standards that apply are presented in Appendix A2.2.

TABLE E4(a): TREATMENT PROCESS AND WATER STANDARDS FOR ABSTRACTION FOR POTABLE SUPPLY

Water Treatment Works	Source of Water	Treatment Process	Water quality class	Water quality sampling site
Derg	River Derg	DW3	A3	01/05/Q155
Glenhordial	Glenhordial reservoir	DW2	A2	
Lough Macrory	Loughs Fingren and Macrory	DW2	A2	
Caugh Hill	Glenedra River and Altnaheglish reservoir	DW2	A2	02/02/Q007
Carnmoney	River Faughan	DW3	A3	02/01/Q001
Lough Braden	Lough Braden	DW2	A2	
Lough Mourne	Lough Mourne	DW2	A2	

NOTES: DW3 corresponds to intensive treatment
DW2 corresponds to normal physical treatment with pre-chlorination.

c. **79/923/EEC on the quality required of shellfish waters.** Under the "Shellfish Waters Directive", Member states are required to designate coastal and brackish waters which need protection or improvement to support shellfish and comply with a number of water quality parameters. Although several species are fished in Lough Foyle (see Section C4), the area is not designated as a shellfish water. In the absence of any other relevant legislation, the water quality targets for shell fisheries are based on the guidelines quoted in the Shellfish Waters Directive.

d. **91/492/EEC laying down the health conditions for the production and the placing on the market of live bivalve molluscs.** The "Shellfish Hygiene Directive" requires Member States to designate bivalve mollusc production areas and classify them according to the treatment required by the harvested shellfish before they can be sold for human consumption. The requirements for harvesting, transportation and processing of shellfish, as well as the end product standards are laid down in this Directive.

e. **76/160/EEC concerning the quality of bathing water.** No bathing waters have been identified within in the Plan area.

f. **86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture.** The directive sets down requirements for the sludge treatment, monitoring of sludge and soil quality, monitoring of potentially toxic elements in the sludge, planting, grazing and harvesting constraints following the application of sludge, keeping of records and measures for environmental protection, including water pollution.

g. **76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.** This directive identifies a list of families and groups of dangerous substances, selected mainly on the basis of their toxicity, persistence and bioaccumulation (List I), and a separate list (List II) of substances that can also have deleterious effects on the aquatic environment. The directive requires that Member States take steps to eliminate pollution by List I substances and to reduce pollution by List II substances. Directive 86/280/EEC is a 'master' directive for List I substances and is supported by a number of 'daughter' directives for individual substances. The List I and II substances are detailed in Appendix E1 of this Water Quality Management Strategy along with the Environmental Quality Standards to be applied for the receiving waters. Compliance with the dangerous substances directive is assessed by monitoring at the sites listed in Table E4(b). The locations of all these monitoring sites are shown on Map 30.

TABLE E4 (b): SAMPLING SITES FOR DANGEROUS SUBSTANCES

Sampling Location	Site name	Grid Reference
River Mourne	Strabane Bridge (01/01/Q001)	H345975
River Burndennet	Burndennet Bridge (01/02/Q001)	C374048
River Finn	Clady Bridge (01/03/Q001)	H293940
River Faughan	Mobouy Bridge (02/01/Q002)	C477193
River Roe	Roe Bridge (02/02/Q002)	C670296
Lough Foyle	South of Lisahally Warf	C470218
Lough Foyle	Coneyburrow Light	C486234
Lough Foyle	Kilderry Light	C490248

Source : Information provided by the DoE (NI) Environment Service

h. **80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances.** This Directive prohibits the direct or indirect discharge into groundwater of List I substances and limits discharge of List II substances, unless prior investigation can establish that pollution of groundwater will not occur, or unless the groundwater is permanently unsuitable for other uses.

i. **91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.** It requires Member States to identify waters affected by pollution from nitrates if protective action is not taken. For these designated vulnerable zones Member States are required to establish action programmes in order to reduce water pollution from nitrogen-containing fertilisers and in particular to set specific limits for the application of livestock manure. Member States are also required to establish and promote codes of good agricultural practice implemented by farmers on a voluntary basis with the aim of providing for all waters a general level of protection against pollution.

The criteria for designation cover waters which contain or may contain nitrate concentrations in excess of 50 mg/l, particularly where they are intended for the abstraction of drinking water, and any surface waters (freshwater, estuaries and coastal) which are eutrophic or which in the near future may become eutrophic if protective action is not taken. In the case of this directive, eutrophication is restricted to where it is caused by compounds of nitrogen of agricultural origin, and therefore applies primarily to coastal and estuarine waters where eutrophication is normally nitrogen limited. The first round of designations are required to be made by mid-December 1993.

j. **91/271/EEC concerning urban waste water treatment (UWWT).** The UWWT Directive lays down minimum standards for the provision of sewerage systems and sewage treatment. The sewage treatment standards vary according to the nature and sensitivity of the area receiving the sewage discharge and the size of the discharge. The Directive specifies secondary treatment as the norm but provides for higher standards of treatment (involving nutrient removal) for discharges to sensitive areas, and at least primary treatment for discharges to less sensitive areas. The criteria for designation of sensitive waters are similar to those for the Nitrates Directive (91/676/EEC) except that eutrophication is defined as .....'*the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorous,.....*' Members States are required to identify sensitive and less sensitive areas for the purpose of this directive.

E5. HEALTH RELATED TARGETS

There are no identified bathing waters in the catchment. However, some areas of the estuary are used for primary water contact recreation, in particular the River Foyle around Londonderry and offshore of Moville. It is recommended that consideration is given to the application of the terms of the EC Bathing Waters Directive to those areas of the Lough traditionally used for swimming. The guideline and imperative water quality standard are detailed in Appendix A2.2.

AESTHETIC QUALITY

The aesthetic quality of the river corridor relates to its scenic beauty. This may be distracted from by a variety of factors, including the following:-

- Litter on banks and in the water
- Odour
- Noise
- Oils and other chemicals
- Foam on the water
- Discoloured water
- Dead animals
- Unsightly buildings
- Poached banks

In Northern Ireland, pollution of water bodies is extensively covered by the Water Act (Northern Ireland) 1972, which empowers the Department of the Environment (NI) to regulate against pollution of waterways and the discharge to sewers by poisonous, polluting or littering substances.

The contamination of river banks by litter is dealt with by the Pollution Control and Local Government (Northern Ireland) Order 1978 which places the onus of litter control on the local councils. The Order covers any land, public or private, also relating to the intertidal zone. There is a section dealing specifically with noise. The Litter (Northern Ireland) Order 1993 defines grades of litter pollution on a visual basis (i.e. density of litter) and sets time limits for different zones within which these must be restored to a more acceptable grade. The Order provides for beaches, including the intertidal area (Category 5 Zone) and canal towpaths and embankments (Category 11 Zone). River embankments are, however, not included in the Order.

Dead animals are a very real problem, particularly in recent years; on a visit to the River Foyle between Strabane and Londonderry in April 1994, the Northern Ireland bank had in excess of thirty dead sheep and five cattle in one section about 500 metres long. The total number along the catchment banks can only be guessed at, but must be significant. Whilst this problem may be partly seasonal, it presents a problem of public health and aesthetic quality. It is illegal to dispose of fallen animals in this way and, while the majority may be victims of bad weather and drowning, there is no doubt that a percentage will be deliberately dumped as a convenient method of disposal.

No targets can be set for this particular problem and the issue of responsibility for removal of the remains is complicated.

While there is no legislation directly prohibiting unsightly buildings, any potential affront to the aesthetic nature of the catchment's architecture should be dealt with during the Planning process by the relevant planning authority. There remains, however, the potential for unsightly farm or industrial buildings which may not require planning permission.

Other forms of pollution are covered by international directives. Odour, discoloured water, foam, oils and other chemicals are dealt with by EC legislation such as the Bathing Water Directive, the Freshwater Fish Directive and the Shellfish Water Directive.

It is difficult to define exact targets for aesthetic quality, which is itself largely subjective as a category. The need to do so is self-evident and options will largely appear as a matter of course in the section on the state of the catchment.

CONTROL OF INTERMITTENT POLLUTION

The ability of the water environment to support uses, including basic ecology, can be affected significantly by intermittent pollution, i.e. events of relatively short duration (typically of a few hours) but which can have a marked impact on the river and, in extreme cases, result in fish kills.

These events are normally the result of poor management of potentially polluting substances, for example leakage from slurry or chemical stores, although they can also result from accidents, such as oil or petrol pollution following a road traffic accident. The target is to reduce the number, and impact, of intermittent pollution events in the catchment to a level where they do not cause lasting environmental stress. In particular they should not prevent the river from meeting its chemical or biological targets.

Combined sewer overflows (CSOs) are a particular form of intermittent pollution. No data are available on the impact of sewer overflows in the catchment and no targets are set. However, a number of sewer assessment are being undertaken by Water Executive to determine the current situation in a number of areas including Derry. Environment Service will be advising on the water quality aspects relating to intermittent discharges in line with the Urban Pollution Management Strategy. The problem of CSOs is not being considered in general in the ROI at present. In the UK CSOs have been the subject of a great deal of study as part of the UK Urban Pollution Management Research Programme. This programme has produced a number of reports and its recommendations are now included in the Government's proposals for implementation of the Urban Waste Water Treatment Directive in England and Wales. Of particular interest are the recommendations made for the assessment of the impact of CSO discharges. These are summarised in Table E7.

TABLE E7: INDICATIVE IMPACT ASSESSMENT CRITERIA FOR SETTING CONSENTS FOR CSO DISCHARGES TO FRESHWATERS

LOW SIGNIFICANCE Discharge control methods, e.g. Formula A, QUALSOC Dilution > 8:1 (foul DWF @ 5%ile low river flows (Q95)) No interaction with other discharges This approach is likely to be adequate in most cases. However, for very high dilutions less demanding requirements than Formula A may be acceptable
MEDIUM SIGNIFICANCE Simple Impact Assessment Models (e.g. QUALSOC, QUALSIM, CARP, plus sewer hydraulic model WALLRUS) Dilution < 8:1 No interaction or limited interaction with other discharges > 2000 population equivalent Cyprinid fishery This approach is only likely to be required if all of these criteria apply
HIGH SIGNIFICANCE Complex Models (river and sewer hydraulic models, e.g. MOSQITO, river quality models e.g. MIKE11) to be overtaken by UPM procedure when finalised Dilution < 2:1 Interaction with other discharges > 10,000 population equivalent Cyprinid or Salmonid fishery

Source: Guidelines prepared by the Urban Pollution Management Group.

CONTROL OF DIFFUSE POLLUTION

Diffuse pollution can be a major cause for failures to achieve water quality targets. In the context of this report, diffuse pollution mainly concerns increased pollutant load contained in run-off from non-urban areas. The pollutant load could be organic in nature, resulting from the application of slurry or sewage sludge, or it could be increased nutrients, again from sludge and slurry but also from mineral fertilisers. Pesticides may also be associated with rural runoff. Acidification is a further type of diffuse pollution, and this could be a problem in some of the upland areas of the Foyle.

The basic target for the control of diffuse pollution is that it should not lead to the failure of the river to meet any of its other targets. However this is somewhat vague and a more direct target is to ensure that codes of good practice are available and implemented.

A Code of Practice has been issued by the Departments of Agriculture in both jurisdictions. The codes apply whenever agricultural practices involving the spreading of organic or mineral fertilisers occur. It should be noted that the code of practice is a general code and may not necessarily be relevant to a particular reach or sub-catchment. The key provisions relate to:

- Storage and management of farm wastes
- Spreading rates and dates for organic and mineral fertilisers
- Management practices on the farm to reduce nitrate losses having regard to such matters as crop requirements, weather, soil type, soil nutrient status etc.

In relation to the application of sludge the same specific requirements that apply to slurry application are required to be met. These are largely based on the EC Directive concerning sludge application which is discussed in section C12:

- The heavy metal content of the soil is measured before and after sludge application.
- The heavy metal content of the sludge is measured, and if it is too high then appropriate action is taken.
- Levels of pathogens are reduced to below an acceptable level prior to the application of sludge to land.

RIVER FLOWS

There are no specific objective targets for river flows in the Foyle. However we suggest as a general target there should be no significant diminution of natural flow regime and in particular the passage of fish should not be impeded as a result of insufficient flow related to abstractions. This applies to the river as a whole or to any individual reach within it.

E10. RIVER TOPOGRAPHY

This section considers the general requirements for the topography of the river and its corridor as well as the provision and maintenance of permanent facilities and access. The overall River Topography Targets for the catchment are collated from the individual uses and summarised in this Section. The nature of the features that are included under the term River Topography means that the targets involved can vary widely in scale. The intention here is not to identify, for example, points of access to the river wherever they are required, but rather to indicate the major topographical requirements of various reaches in relation to the uses concerned.

It is suggested that the following general and specific requirements are considered to be targets for the catchment:

E10.1 GENERAL REQUIREMENTS FOR USES

- The river should be of a width and depth appropriate to the flow regime.
- Presence of uncultivated bank-side vegetation alongside the river to provide habitats, shade and cover for fish, a buffer against diffuse pollution; and to enhance the quality of the landscape.
- Presence of natural river features such as emergent vegetation, meanders and pool-riffle sequences for conservation of the river corridor and to enhance the quality of the landscape.
- Limited access to the river for livestock to minimise damage caused by trampling.
- New development not to reduce the conservation value of the river corridor.

E10.2 SPECIFIC REQUIREMENTS FOR USES

E10.2.1 Flood Defence and Land Drainage

- The maintenance of flood defence structures to ensure their continued effectiveness.
- No significant increase in flood risk as a result of new development.
- No new development to be in the flood plain unless adequate measures are taken to ensure no increase in flood risk.

E10.2.2 Mineral Extraction

- To ensure the restoration of all mineral extraction sites to an acceptable environmental standard.
- Maintenance of the integrity of the river banks and channel adjacent to mineral extraction sites.

E10.2.3 Fisheries

- Barriers to be passable to migratory fish at low river flows (95 percentile).
- Clean and suitable gravel beds for salmonid spawning.

E10.2.4 Recreation and Amenity

- Maintenance of existing footpaths and access points.
- Promotion of new facilities where they are consistent with other catchment objectives.

E10.2.5 Nature Conservation

- Retention of and augmentation of wetland areas in catchment.

E10.2.6 Cultural Heritage

- Maintenance of valuable features.

E11. RIVER MANAGEMENT

This section considers the regular activities for the management of the river and its bank-side features which are necessary to enhance and maintain the various uses of the river. The overall River Management Targets are collated from the individual uses and summarised in this section (see Table E11).

The intention here is not to provide a maintenance schedule (for example the location, methods and frequency of weed cutting required for land drainage or fisheries management) but rather to indicate the major river management requirements in relation to the uses concerned.

It is suggested that the following general and specific requirements are considered to be targets for the catchment.

E11.1 GENERAL REQUIREMENTS FOR USES

- Co-operation with local authorities and riparian landowners to ensure banks and surrounding areas are free from litter.
- Carry out river corridor surveys to determine the conservation value and management requirements of river reaches.

E11.2 SPECIFIC REQUIREMENTS FOR USES

E11.2.1 Flood Defence and Land Drainage

- Weed control to be carried out in a way that provides adequate flood protection but that ensures the continued survival of healthy aquatic vegetation.
- Carry out tree management to prevent obstructions caused by fallen trees.
- Maintenance and clearance of ditches in a way which encourages rather than diminishes ecological diversity.

E11.2.2 Navigation

Continued monitoring of sediments in Lough Foyle to allow full assessment to be made of flow lane disposal for maintenance dredging.

E11.2.3 Fisheries

- Where necessary, carry out appropriate fish stocking to augment natural stocks, especially where these stocks have been reduced by pollution. Due regard should be given to maintaining the genetic integrity of the natural stocks.
- Identify, maintain and improve spawning gravels.
- Carry out weed control at appropriate intervals to provide open water for angling.
- Designte specific reaches as sensistive in respect of forestry development.

- Carry out further research into salmon tainting compounds.
- Careful management and monitoring of fish farm facilities.

E11.2.3 Conservation

- Maintenance of valuable conservation features.

TABLE E11: FOYLE CLASSIFICATION SYSTEM TARGETS

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Mourne Beg	Lough Mourne (Source) to Meenreagh Bridge	H063888	H142852	-	-	FB
Mourne Beg	Meenreagh Bridge to Confluence with the Derg	H142852	H230838	01/05/Q003	6	FB
Derg	Source to Conf with. Glendergan	H90759	H149791	-	-	FA
Derg	Glendergan to Mourne Beg Conf.	H149791	H230838	01/05/Q002	5	FA
Derg	Confl. Mourne Beg to Castlederg STW	H230838	H272841		-	FA
Derg	Castlederg STW to WTW	H272841	H325862	01/05/Q155	179	FA
Derg	WTW to Conf with Strule	H325862	H367878	01/05/Q001	4	FB
Unamed tributary of Derg	Source to River Derg, includes Loughs Catherine and Fanny	H352800	H363876	-	-	FB
Glendergan R.	Source to Conf. with Derg.	H053839	H149791	01/05/Q855	202	FA
Killen Burn	Source to Conf. with Derg, includes Lough Lee	H222745	H230828	01/05/Q365	203	FB
Fairywater	Source to Clare Bridge	H243785	H293802	-	-	FB
Fairywater	Clare Bridge to Conf. with Drumquin	H293802	H354771	01/09/Q400	180	FB
Fairywater	Conf. with Drumquin to Gauging Station	H354771	H467759	01/09/Q200	182	FB
Fairywater	Gauging Station to conf. with Strula	H467759	H432749	01/09/Q001	13	FB
Drumquin	Source to conf. with Blackwater	H360694	H328740	-	-	FB
Drumquin	Conf. with Blackwater to Conf. with Fairywater	H328740	H353771	01/09/Q705	181	FB
Blackwater	Source to Conf. with Drumquin	H245746	H328740	-	-	FB

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Strule	Conf. Owenkillow to Conf. Derg	H409861	H367879	01/06/Q001	7	FA*
Strule	Conf. with Cappagh Burn to Conf. with Owenkillow	H435795	H409861	01/08/Q002	10	FA
Strule	Conf. with Fairywater to Conf. with Cappaghburn	H431749	H435795	01/08/Q003	11	FA
Strule	Omagh STW to Conf. with Fairywater	H443737	H431749	-	-	FA
Strule	Source to Omagh STW	H45478	H443737	01/08/Q004	12	FA
Cappaghburn	Source to Conf. with Strule	H502818	H435795	01/08/Q952	281	FA
Owenreagh	Source to Conf. with Unnamed Tributary Receiving Effluent from Dromore STW	H272626	H364651	-	-	FA
Owenreagh	Unamed tributary receiving effleuent from Dromore STW to Major Unamed trib.	H364651	H378649	01/11/Q355	261	FA
Owenreagh	Unnamed Tributary to Confluence with Quiggery	H364651	H446681	01/11/Q003	17	FA
Routing Burn	Source to Confluence with Eskragh Water	H591622	H501618	01/11/Q905	207	FB
Eskragh Water	Source to Confluence with Routing Burn	H546565	H501618	-	-	FA
Routing Burn	Confluence with Eskragh to Confl. with Quiggery Water	H501618	H456650	01/11/Q830	206	FA
Quiggery	Source to Fintona STW.	H426553	H447615	01/11/Q705	260	FA
Quiggery	Fintona STW to Confl. with Eskragh	H447615	H456650	01/11/Q575	205	FA
Quiggery	Conf. with Eskragh to conf. with Drumragh	H456650	H446681	01/11/Q002	16	FB
Drumragh	Source Conf. with Quiggery to conf. with Camowen	H446681	H453728	01/11/Q001	15	FA
Cloghfin	Source to Confl. with Glenannes Burn	H643663	H573671	-	-	FA

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Cloghfin	Conf. with Glenannes Burn to Camowen	H572671	H509707	01/10/Q605	206	FA
Glencordial Burn	Source to reservoir	H502795	H481752	-	-	FB
Killyclogher Burn	Reservoir to Bridge	H481752	H472737	01/01/Q133	258	FB
Killycloger Burn	Bridge to confluence with Camowen	H472739	H467728	01/10/Q128	200	FB
Camowen	Source to Conf. with Grannagh Burn	H605745	H603712	-	-	FA
Camowen	Conf. with Grannagh Burn to Conf. with Cloghfin	H603712	H510708	01/10/Q430	259	FA
Camowen	Conf. with Cloghfin to Confluence with Strule	H510708	H453728	01/10/Q001	14	FA
Glencurry	Source to Glenyeast Discharge	H508708	H483730	-	-	FA
	Glenyeast Discharge to Conf. with Camowen	H483730	H471723	-	-	FB
Faughan	Tidal Limit to Drumahoe Bridge	C463150	C488201	02/01/Q001	19	FA
Faughan	Conf. Burntollet to Drumahoe Bridge	C500108	C464150	02/01/Q390	175	FA
Burntollet	Source to Conf. with Faughan	C610160	C500108	02/01/Q903	174	FB
Faughan	Claudy to Conf. with Burntollet	C545071	C547124	02/01/Q492	173	FA
Glenrandal River	Source to Conf. with Inver River	C578967	C545015	-	-	FA
Glenrandal River	Conf. with Inver to Conf. with Faughan	C545015	C539069	-	274	FA
Faughan	Crooked Bridge to Claudy	C616012	C545071	02/01/Q003	20	FA
Faughan	Source to Crooked Bridge	C640975	C616012	-	272	FA
Burndennet	Source to Essbeg Bridge	C552955	C510978	-	-	FB

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Burndennet	Essbeg Bridge to Conf. with Altinaghree Burn	H510978	C445043	01/02/Q525	196	FB
Burndennet	Conf. with Altinaghree Burn to tidal limit	C445043	C360043	01/02/Q001	2	FA
Glenmornan River	Source to Artigarvan	H430974	C382011	-	-	FB
Glenmornan River	Artigarvan to Tidal Limit	C382011	C359041	01/01/Q615	199	FB
Douglas Burn	Source to Conf. with Mourne	H433952	H363898	-	281	FA
Mourne	Conf. Derg to Weir at Sion Mills	H367879	H347932	01/04/Q640	269	FA*
Mourne	Weir at Sion Mills to Strabane	H347932	H346974	01/01/Q001	1	FB*
Mourne	Strabane to Conf. with Finn	H346974	H333981	-	-	FB
Altinaghree Burn	Source to Bunowen Bridge	H490999	C502025	-	-	FB
Altinaghree Burn	Bunowen Bridge to Conf. with Burndennet	C502025	C445043	01/02/Q455	197	FB
Roe	Source to Hillhead	C755005	C715067	02/02/Q007	27	FA
Roe	Hillhead to Conf. with Owenrigh	C715067	C684088	-	-	FA
Owenrigh	Conf. with Altnaheglish to Conf. with Roe	C670049	C684088	02/02/Q008	28	FA
Altnaheglish	Altnaheglish Reservoir to Conf. with Owenrigh	C696041	C670049	-	-	FA
Altnaheglish	Source to Reservoir	C733019	C696041	-	-	FA
Cushcapal Water	Source to Conf. with Altnaheglish	H680988	C670049	-	-	FA
Roe	Conf. with Owenrigh to Conf. with Owenbeg	C684088	C684098	02/02/Q005	29	FA
Owenbeg	Source to Conf. with Roe	H655990	C684098	02/02/Q805	29	FA

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Roe	Conf. with Owenbeg to Conf. with Gelvin River	C684098	C689143	02/02/Q004	24	FB
Gelvin	Source to Conf with Roe	C735095	C689143	-	-	FB
Roe	Conf. with Gelvin River to Dogs Leap	C689143	C672211	02/02/Q003	23	FA
Curly River	Source to Conf. with Roe	C755251	C674244	02/02/Q006	26	FA
Castle River	Source to Conf. with Curly River	C775163	C681245	-	282	FA
Roe	Dogs Leap to Conf. with Curly River	C672211	C674244	02/02/Q002	22	FB
Roe	Conf. with Curly River to Roe Bridge	C674244	C670298	02/02/Q001	-	FB
Davaghwater (Owenkillow)	Source to Evishessan Bridge	H739862	H663835	-	-	FA
Owenkillow	Evishessan Bridge to Conf. with Coneyglen Burn	H663835	H599866	01/07/Q340	265	FA
Coneyglen Burn	Source to Conf. with Owenkillow	H685916	H598867	01/07/Q305	256	FA
Owenkillow	Conf. with Coneyglen to Conf. with Owenreagh	H598867	H529866	01/07/Q205	177	FB
Glenark	Source to Conf. with Owenkillow	H655924	H574871	01/07/Q243	204	FA
Owenreagh	Source to U/S Greencastle STW	H652754	H590821	-	-	FA
Owenreagh	U/S Greencastle STW to Conf. with Glensavish Burn	H590821	H571830	01/07/Q879	254	FA
Glensawisk Burn	Source to Conf. with Owenreagh	H512805	H571830	01/07/Q960	253	FA
Glenmacoffer	Source to Conf. with Owenkillow	H512817	H51865	01/07/Q175	252	FA
Owenreagh	Conf. with Glensawisk Burn to Conf. with Owenkillow	H571830	H529866	01/07/Q810	178	FA
Owenkillow	Conf. with Owenreagh to Conf. with Glenelly River	H529866	H453881	-	-	FA

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Glenelly	Source to Goles Bridge	H704944	H672946	-	-	FA
Glenelly	Goles Bridge to Sperrin Lodge	H672947	H634941	01/07/Q750	267	FA
Glenelly	Sperrin Lodge to Plumbridge	H593925	H484914	01/07/Q650	176	FA
Glenelly	Plumbridge STW to Conf. with Owenkillow	H484914	H453881	01/07/Q003	9	FA
Owenkillow	Conf. with Glenelly to Conf. with Strule	H453889	H409862	01/07/Q001	8	FA
Finn	Source to conf. with Cummirk River	G960026	G995017	-	-	FA
Finn	Cummirk River to Reelan Confluence	G995017	H040978	-	-	FA
Cummirk River	Source to Finn Confluence	G	H995017	-	-	FA
Reelan (Finn)	Source to Conf. with Finn	H	G040978	-	-	FA
Finn	Reelan Conf to Glenmore Bridge	H040978	H803962	19	-	FA
Finn	Glenmore Bridge to Ballybofey	H803962	H145948	15	-	FA
Burndaunet	Source to Weir	H089911	H135938	17	-	FA
Burndaunet	Weir to Conf. with Finn	H135938	H144943	16	-	FB
Bunadowen	Source to Confluence with MourneBeg	H058852	H082876		-	FB
Finn	Ballybofey to Stronolar STW	H145948	H153946	13	-	FB
Finn	Stranolar STW to Killgordon Bridge	H153946	H205938	9	-	FB
Finn	Killygordon Bridge to U/S Castle Finn STW	H205938	H262947	6	-	FB
Finn	Castlefinn STW to Clady STW	H262947	H295942	01/03/Q001	-	FB

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Finn	Clady STW to Conf. with Foyle	H295942	H333980	-	-	FB
Trib. of Finn	Source to Conf. at Killygordon	H161893	H205939	-	-	FA
Deele	Source to Conf. with Cloghroe	H077058	H173008	-	-	FB
Deele	Conf. with Cloghroe to Convoy	H173008	H222014	-	-	FA
Deele	Convoy to Conf. with River Foyle	H173008	H222014	21	-	FA
Swillyburn	Source to Raphoe STW	H247049	H260019	25	-	FB
Swillyburn	Raphoe STW to N14 Bridge	H260019	H304026	27	-	FB
Swillyburn	N14 Bridge to Conf. with Foyle	H304026	H355047	28	-	FB
St Johnston Burn	Source to U/S St Johnston	H283068	H345099	29	-	FB
St Johnston Burn	St Johnston to Conf. with Foyle	H345099	H350099	30	-	FB
Carrickgans Burn	Source to Weir at Carrigans	H345160	H365118	31	-	FA
Carrickgans Burn	Weir to Foyle	H365118	H370113	33	-	FB
Muff	Source to U/S Muff STW	H440243	H465246	37	-	FB
Muff	U/S Muff STW to Lough Foyle	H465246	H475247	39	-	FB
Foyle	Source (Conf. of Finn and Strule) to D/S Strabane STW	H134981	H341990	-	-	FB
Foyle	D/S Strabane STW to Conf. with Burn Dennet	H341990	H357042	-	-	FB
Foyle	Conf. with Burn Dennet to U/S Saint Johnson STW	H357042	H355100	-	-	FB
Foyle	D/S Saint Johnson STW to U/S New Buildings STW	H355100	H410132	-	-	FB

River	Reaches	U/S	D/S	WQ Sampling Site	RIVPACS Site	Overall Target Class
Foyle	D/S New Buildings STW to Craigavon Bridge	H410132	H437161	-	-	FB
Foyle	Craigavon Bridge to New Bridge	H437161	H442193	-	-	FB
Foyle	New Bridge to Culmore Point	H442193	H478223	-	-	FB
Muff	Source to Tidal Limit	H509141	H545222	02/01/Q112	266	FB
Faughanvale	Source to Tidal Limit	H558162	H581222	02/01/Q422	267	FB
Burnfoot	Source to Tidal Limit	C172643	C638252	02/01/Q831	268	FB

NOTES: * These reaches were placed in Class FA as a consequence of the presence of freshwater mussels in these reaches. These reaches have been defined using information from the Environment Service.

Source: Reach limits defined by the FCC, WQ data from the Environment Service, ERU and DCC

SECTION F

STATE OF THE CATCHMENT

F. STATE OF THE CATCHMENT

In this section the state of the catchment is assessed by comparing conditions with the targets set in Section E. Firstly an assessment of water quality in the freshwater reaches is made. Secondly, water quality in the estuary is assessed. Thirdly, nutrient loads are evaluated. Fourthly, a range of other assessments are made, including an analysis of chemical and biological trends, and comparison of water quality parameters with the relevant EC Directives.

F1. FRESHWATER WATER QUALITY

The present conditions in the catchment have been evaluated by assessing conditions against the integrated targets in Section E. There are two elements to this framework; chemical and biological (macro-invertebrates). In this section the water quality in each reach is assessed in terms of these elements and the results of the assessment are combined to provide an integrated assessment using the classification system discussed in Section D.

F1.1 CHEMICAL TARGETS - RUNNING FRESHWATER

In this section the results of routine monitoring data for 1992 are compared with the River Ecosystem component of the targets. The state of each reach in the catchment is compared with the relevant RE target class which applies to the reach. Map 31 shows the classes for 1992 and Map 35 shows the reaches which failed to meet their overall target class.

F1.1.1 Drumragh

The target River Ecosystem (RE) class for the majority of the Drumragh sub-catchment is RE1. The upper reaches of the Owenreagh achieve their target RE class. Below the confluence of a tributary which receives effluent from Dromore STW the RE class drops to 2, as a consequence of low DO values. Further downstream the Owenreagh achieves RE1 class (Table F1.1.1).

The upper reaches of the Routing achieve RE2, but the target is RE1. Low DO levels and high BOD and ammonium levels cause the failure to meet the target class.

The Eskragh Water is RE3, with a target class of RE1. The RE3 classification is caused by low DO levels.

The upper portion of the Quiggery achieves its target class of RE1. Below the Fintona STW the Quiggery achieves RE2, but the target is RE1. Low DO levels cause the slip in class. Below the confluence with the Eskragh the Quiggery is RE2, which is the target class.

The Drumragh between the Quiggery and the confluence with the Camowen achieves its target class of RE1.

F1.1.2 Camowen

Many reaches within the Camowen sub-catchment generally fail to meet their target classes. The lower Killyclogher Burn achieves class RE4, which is well below the target of RE2. Both BOD and ammonium cause the Killyclogher to be placed in class RE4. The upper reach of the Killyclogher achieves RE2, which is the target class (Table F1.1.2).

The Cloghfin has a target class of RE1, but achieves RE2 as a consequence of low DO levels.

The upper portion of the Camowen achieves RE2, but the target is RE1. DO levels are the cause of the reduction in RE class. The lower portion of the Camowen achieves RE2, as a consequence of low DO levels, but the target class is RE1.

F1.1.3 Fairywater

The Fairywater has significant water quality problems, with the upper reaches being class RE5. Low DO is the cause for the reduction in class. The lower reaches of the Fairywater achieve RE3 and RE2; the target is RE2. The remainder of the catchment, which includes the Drumquin, achieves its target class of RE2 (Table F1.1.3).

F1.1.4 Owenkillew

The entire Owenkillew catchment meets its target class of RE1 (Table F1.1.4).

F1.1.5 Derg

The target class for the Derg system is RE1. However, the majority of the catchment is RE2 (Table F1.1.5).

The Mournebeg achieves RE2 and the downgrading from RE1 is a consequence of elevated BOD levels. There is a fish-farm upstream of the chemical sampling site. Similarly the Upper Derg achieves RE2 as a consequence of elevated BOD levels, and again there is a fish-farm upstream of the sampling site. BOD levels also cause the Glendergan to be downgraded to RE2. There are no known discharges in the Glendergan.

The remainder of the Derg system achieves its Fishery Ecosystem Class targets.

F1.1.6 Mourne

Between the confluence with the Derg and Sion Mills the target class for the Mourne is RE1, but the actual class is RE2 as a consequence of elevated BOD levels. Downstream of Sion Mills the Mourne maintains its RE2 class, which is the target class over this reach (Table F1.1.6).

F1.1.7 Glenmornan

The target class for the Glenmornan is RE2, but it only achieves RE4 as a consequence of high BOD levels. It should be noted that the sampling site is located downstream of a discharge from a dairy and two STWs (Table F1.1.7).

F1.1.8 Burndennet

The target class for the lower Burndennet is RE1 and for the upper reaches the target is RE2. The river attains RE1 over its entire length, and therefore meets its target class (Table F1.1.8).

F1.1.9 Finn

The upper reaches of the Finn meet their target class of RE1 (Table F1.1.9). Downstream of Ballybofey the Finn achieves RE3 as a consequence of elevated BOD levels. Throughout the rest of the catchment the target classes are met.

F1.1.10 Deele

The Deele achieves class RE1 (Table F1.1.10).

F1.1.11 Swillyburn

The Swillyburn above Raphoe achieves RE1, but downstream of Raphoe drops to RE3 as a consequence of a high ammonium level. Further downstream the Swillyburn achieves its target class of RE2 (Table F1.1.11).

F1.1.12 Faughan

The target for most of the Faughan is RE1. The majority of the catchment meets the target class, with the exception of the lowest reach which achieves class RE2 as a consequence of elevated BOD levels (Table F1.1.12).

F1.1.13 Roe

The majority of the Roe catchment achieves its target class. The exception is the Curly River (Table F1.1.13).

The target class for the Curly is RE1, but the Curly achieved RE2 as a consequence of low DO levels.

F1.1.14 Strule

The Strule has a target River Ecosystem Class of RE1 (Table F1.1.14). Most of the Strule achieves RE2. The reason for the failure to comply with the target class is either elevated BOD levels, reduced DO levels, or both.

F1.1.15 Actual RE chemical classes of streams flowing into Lough Foyle are detailed in Table F1.1.15.

TABLE F1.1.1: ACTUAL RE CHEMICAL CLASS IN 1992 DRUMRAGH CATCHMENT

River	Reaches	U/S	D/S	Target RE class	Actual RE class	WQ Sampling Site
Owenreagh	Unnamed tributary receiving effluent from Dromore STW to major unnamed tributary.	H364651	H378649	1	2	01/11/Q355
Owenreagh	Unnamed tributary to confluence with Quiggery	H364651	H446681	1	1	01/11/Q003
Routing Burn	Source to confluence with Eskragh Water	H591622	H501618	2	2	01/11/Q905
Eskragh Water	Confluence with Routing to confluence with Quiggery Water	H501618	H456650	1	3	01/11/Q830
Quiggery	Source to Fintona STW	H426553	H447615	1	1	01/11/Q705
Quiggery	Fintona STW to confluence with Eskragh	H447615	H456650	1	2	01/11/Q575
Quiggery	Conf. with Eskragh to conf. with Drumragh	H456650	H446681	2	2	01/11/Q002
Drumragh	Source (conf. Quiggery) to conf. with Camowen	H446681	H453728	1	1	01/11/Q001

TABLE F1.1.2: ACTUAL RE CHEMICAL CLASS IN 1992 CAMOWEN CATCHMENT

River	Reaches	U/S	D/S	Target RE class	Actual RE class	WQ Sampling Site
Cloghfin	Conf. with Glenannes Burn to Camowen	H572671	H509707	1	2	01/10/Q605
Killyclogher Burn	Reservoir to Bridge	H481752	H472737	2	2	01/01/Q133
Killyclogher Burn	Bridge to confluence with Camowen	H472739	H467728	2	4	01/10/Q128
Camowen	Conf with Grannagh Burn to conf. with Cloghfin	H603712	H510708	1	2	01/10/Q430
Camowen	Conf with Cloghfin to confluence with Strule	H510708	H453728	1	1	01/10/Q001

TABLE F1.1.3: ACTUAL RE CHEMICAL CLASS IN 1992 FAIRYWATER CATCHMENT

River	Reaches	U/S	D/S	Target RE class	Actual RE class	WQ Sampling Site
Fairywater	Clare Bridge to Conf. with Drumquin	H293802	H354771	2	5	01/09/Q400
Fairywater	Conf. with Drumquin to Gauging Station	H354771	H467759	2	3	01/09/Q200
Fairywater	Gauging Station to Conf. with Strule	H407759	H432749	2	2	01/09/Q001
Drumquin	Conf. with Blackwater to Conf. Fairywater	H328740	H353771	2	2	01/09/Q705

TABLE F1.1.4: ACTUAL RE CHEMICAL CLASS IN 1992 OWENKILLEW CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE class	WQ Sampling Site
Owenkillew	Evishessan Bridge to conf. with Coneyglen Burn	H663835	H599866	1	1	01/07/Q340
Coneyglen Burn	Source to conf. with Owenkillew	H685916	H598867	1	1	01/07/Q305
Owenkillew	Conf. with Coneyglen to conf. with Owenreagh	H598867	H529866	2	1	01/07/Q205
Glenark	Source to conf. with Owenkillew	H655924	H574871	1	1	01/07/Q243
Owenreagh	U/S Greencastle STW to conf. with Glensawisk Burn	H590821	H571830	1	1	01/07/Q879
Glensawisk Burn	Source to conf. with Owenreagh	H512805	H571830	1	1	01/07/Q960
Glenmacoffer	Source to conf. with Owenkillew	H512817	H51865	1	1	01/07/Q175
Owenreagh	Conf. with Glensawisk Burn to conf. with Owenkillew	H571830	H529866	1	1	01/07/Q810
Glenelly	Goles Bridge to Sperrin Lodge	H672947	H634941	1	1	01/07/Q750
Glenelly	Sperrin Lodge to Plumbridge	H593925	H484914	1	1	01/07/Q650
Glenelly	Plumbridge STW to conf. with Owenkillew	H484914	H453881	1	1	01/07/Q003
Owenkillew	Conf. with Glenelly to conf. with Strule	H453889	H409862	1	1	01/07/Q001

TABLE F1.1.5: ACTUAL RE CHEMICAL CLASS IN 1992 DERG CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Mourne Beg	Meenreagh Bridge to confluence with the Derg	H142852	H230838	2	2	01/05/Q003
Derg	Glendergan to Mourne Beg Conf.	H149791	H230838	1	2	01/05/Q002
Derg	Castlederg STW to WTW	H272841	H325862	1	1	01/05/Q155
Derg	WTW to Conf. with Strule	H325862	H367878	2	2	01/05/Q001
Glendergan R.	Source to conf. with Derg.	H053839	H149791	1	2	01/05/Q855
Killen Burn	Source to conf. with Derg, (includes Lough Lee)	H222745	H230828	2	2	01/05/Q365

TABLE F1.1.6: ACTUAL RE CHEMICAL CLASS IN 1992 MOURNE CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Mourne	Conf. Derg to Weir at Sion Mills	H367879	H347932	1	2	01/04/Q040
Mourne	Weir at Sion Mills to Strabane	H347932	H346974	1	2	01/01/Q001

TABLE F1.1.7: ACTUAL RE CHEMICAL CLASSES IN 1992 GLENMORNAN CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Glenmornan River	Artigarvan to Tidal Limit	C382011	C359041	2	4	01/01/Q615

TABLE F1.1.8: ACTUAL RE CHEMICAL CLASSES IN 1992 BURNDENNET CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Burn Dennet	Essbeg Bridge to conf. with Altinaghree Burn	H510978	C445043	2	1	01/02/Q525
Burn Dennet	Conf. with Altinaghree Burn to tidal limit	C445043	C360043	1	1	01/02/Q001

TABLE F1.1.9: ACTUAL RE CHEMICAL CLASSES IN 1992 FINN CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Finn	Reelan conf to Glenmore Bridge	H040978	H803962	1	1	19
Finn	Glenmore Bridge to Ballybofey	H803962	H145948	1	1	15
Burn Daunet	Source to Weir	H089911	H135938	1		17
Burn Daunet	Weir to conf with Finn	H135938	H144943	2	2	16
Finn	Ballybofey to Stranolar STW	H145948	H153946	2	3	13
Finn	Stranolar STW to Killygordon Bridge	H153946	H205938	2	2	9
Finn	Killygordon Bridge to U/S Castle Finn STW	H205938	H262947	2	1	6
Finn	Castlefinn STW to Clady STW	H262947	H295942	2	2	01/03/Q001

TABLE F1.1.10: ACTUAL RE CHEMICAL CLASSES IN 1992 BURNDENNET CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Deele	Conf. with Cloghroe to Convoy	H173008	H222014	1	1	
Deele	Convoy to Conf. with River Foyle	H222014	H355047	1	2	21

TABLE F1.1.11: ACTUAL CHEMICAL CLASSES IN 1992 SWILLYBURN CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Swillyburn	Source to Raphoe STW	H247049	H260019	2	1	25
Swillyburn	Raphoe STW to N14 Bridge	H260019	H304026	2	3	27
Swillyburn	N14 Bridge to conf. with Foyle	H304026	H355047	2	2	28

TABLE F1.1.12: ACTUAL RE CHEMICAL CLASSES IN 1992 FAUGHAN CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Faughan	Tidal Limit to Drumahoe Bridge	C463150	C488201	1	2	02/01/Q001
Faughan	Conf. Burntollet to Drumahoe Bridge	C500108	C464150	1	1	02/01/Q390
Burntollet	Source to Conf. with Faughan	C610160	C500108	2	1	02/01/Q903
Faughan	Claudy to Conf. with Burntollet	C545071	C547124	1	1	02/01/Q492
Faughan	Crooked Bridge to Claudy	C616012	C545071	1	1	02/01/Q003

TABLE F1.1.13: ACTUAL CHEMICAL CLASSES IN 1992 ROE CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Roe	Source to Hillhead	C755005	C715067	1	1	02/02/Q007
Owenrigh	Conf. with Altnaheglish to conf. with Roe	C670049	C684088	1	1	02/02/Q008
Roe	Conf. with Owenrigh to conf. with Owenbeg	C684088	C684098	1	1	02/02/Q005
Owenbeg	Source to conf. with Roe	H655990	C684098	1	1	02/02/Q805
Roe	Conf. with Owenbeg to conf. with Gelvin River	C684098	C689143	2	1	02/02/Q004
Roe	Conf. with Gelvin River to Dogs Leap	C689143	C672211	1	1	02/02/Q003
Curly River	Source to conf. with Roe	C755251	C674244	1	2	02/02/Q006
Roe	Dogs Leap to conf. with Curly River	C672211	C674244	2	2	02/02/Q002
Roe	Conf. with Curly River to Roe Bridge	C674244	C670298	2	1	02/02/Q001

TABLE F1.1.14: ACTUAL RE CHEMICAL CLASSES IN 1992 STRULE CATCHMENT

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
Strule	Conf. Owenkillew to conf. Derg	H409861	H367879	1	2	01/06/Q001
Strule	Conf. Cappagh Burn to conf. Owenkillew	H435795	H409861	1	2	01/08/Q002
Strule	Conf. Fairywater to conf. Cappaghburn	H431749	H435795	1	2	01/08/Q003
Strule	Source to Omagh STW	H45478	H443737	1	2	01/08/Q004
Cappaghburn	Source to conf. with Strule	H502818	H435795	1	2	01/08/Q952
Altinaghree Burn	Bunowen Bridge to conf. with Burndennet	C502025	C445043	2	1	01/02/Q455

TABLE F1.1.15: ACTUAL RE CHEMICAL CLASSES IN 1992 STREAMS FLOWING INTO LOUGH FOYLE

River	Reaches	U/S	D/S	Target RE Class	Actual RE Class	WQ Sampling Site
St Johnston Burn	Source to U/S St Johnston	H283068	H345099	2	2	29
St Johnston Burn	St Johnston to conf with Foyle	H345099	H350099	2	3	30
Carrickgans Burn	Source to Weir at Carrigans	H345160	H365118	1	3	31
Carrickgans Burn	Weir to Foyle	H365118	H370113	2	2	33
Muff	Source to U/S Muff STW	H440243	H465246	2	3	37
Muff	U/S Muff STW to Lough Foyle	H465246	H475247	2	2	39
Muff	Source to tidal limit	H509141	H545222	2		02/01/Q112
Faughanvale	Source to tidal limit	H558162	H581222	2		02/01/Q422
Burnfoot	Source to tidal limit	C172643	C638252	2		02/01/Q831

F1.2 BIOLOGICAL MONITORING - RUNNING FRESHWATER

In this section the biological component of the Integrated Framework is assessed. There are two elements to this assessment; macro-invertebrates and miscellaneous biological considerations such as the absence of macrophytes and the presence of sewage fungus.

F1.2.1 Available data

A substantial amount of macro-invertebrate data are available for the Foyle catchment, the most recent reports being:

Invertebrate Survey of Northern Ireland, 1990-1992
There are 66 sites in the Foyle system that are sampled on a regular basis. These sites are distributed throughout the major tributaries as follows:

Roe System:	9 sites
Faughan System:	9 sites
Burndennet River:	3 sites
Glenmornan River:	1 sites
Douglas Burn:	1 site
Derg system:	6 sites
Owenkillew:	12 sites
Camowen:	5 sites
Drumragh:	8 sites
Cappagh Burn:	1 site
Fairywater:	4 sites
Finn:	1 site
Strule River:	3 sites
Mourne River:	3 sites

A biological investigation into the source of the stress affecting the Gorticross Stream, a tributary of the River Faughan (TI/91/1438)
The purpose of this report was to investigate pollution in the Gorticross Stream and to determine why midge larvae were absent from the lower River Faughan.

A biological survey of the Killyclogher Burn, July 1992 (TI/92/1376)
The purpose of this investigation was to assess the pollution status of the entire length of the Killyclogher Burn. Routine monitoring of the Killyclogher and the lower Camowen had highlighted a significant pollution problem and this report sought to identify the source of the pollution.

A biological assessment of the River Derg system, July 1992 (TI/92/1375)
This investigation sought to investigate the causes of biological stress in the lower and upper reaches of the Derg catchment.

A biological assessment of the Killen Burn, June 1991 (TI/91/1415)
The purpose of this investigation was to assess the impact of a creamery discharge on the Killen Burn.

An investigation into the cause of a fish kill affecting the Drumragh system, June 1990 (TI/322/90)
This investigation considered a range of possible causes of a fish kill, including unconsented discharges and oxygen depletion associated with eutrophication.

An investigation into the cause of environmental stress affecting the River Derg at Millbrook New Bridge, May 1990 (TI/320/90) and An investigation into the River Derg, December 1990 (TI/340/90)
The purpose of these investigations was to pinpoint the cause and possible location of a discharge that was affecting the lower Derg River.

An investigation into the biological impact of the discharge from Leckpatrick Creamery on the Glenmornan River, 1992 (TI/92/1409)
This investigation sought to assess the extent of the impact of the discharge from the Leckpatrick creamery on the macro-invertebrate community.

A biological assessment of a number of streams which discharge to the Foyle River and Lough Foyle, 1992 (TI/1445/91)
This report presents the results of a biological survey of small streams in the Foyle River and Lough Foyle areas.

An investigation into the biological status of the Faughan River, February 1993 (TI/92/1429)
This survey sought to assess the pollution status of the Faughan, with particular regard to assessing the impact of a major pollution incident and to identifying the cause of variable biological data between 1990 and 1992.

Water quality in Ireland 1987-90
This report contains the results of biological monitoring in the ROI sections of the catchment. In the ROI biological samples are collected once every few years, with the period between samples being collected varying from river to river.

F1.2.2 Biological Monitoring Results

We have analysed the macro-invertebrate data on a sub-catchment basis. The sub-catchments are as follows:

1 Drumragh
2 Camowen
3 Fairywater
4 Owenkillew
5 Strule, including the Cappagh Burn
6 Derg
7 Mourne
8 Glenmornan
9 BurnDennet
10 Finn
11 Deele
12 Swillyburn
13 Faughan
14 Roe
15 Minor streams flowing into Lough Foyle

The biological classes are presented on Map 32 and the reaches which failed to meet their target overall class are presented in Map 35.

A summary of the results is presented below.

F1.2.2.1 Drumragh sub-catchment

The results of the Biological River Monitoring Programme (BRMP) for the Drumragh system are presented in Table F1.2.2.1 together with the target class. The Owenreagh system is of good quality as is the Routing Burn. The Quiggery Water is mainly of good quality, although, in 1992 the reach below Fintona achieved only moderate status. A biological survey of the reach in 1990 (Report TI/322/90) indicated that the discharge from Fintona STW may be a contributing factor to the reduced invertebrate scores. Overall, the Owenreagh, Quiggery and Routing systems meet their biological class.

The Eskragh Water achieved good quality status in 1991 but this was downgraded in 1992 to moderate status which is below the target class. A detailed macro-invertebrate survey of the Eskragh in 1990 (Report TI/322/90) indicated that an unconsented discharge of organic material into the reach was having an impact on the macro-invertebrate community but that this discharge could not have caused the widespread decline in invertebrate scores that was observed in the Eskragh during the detailed sampling exercise.

An alternative hypothesis put forward in the survey report (TI/322/90) was that the decline in invertebrate scores was attributable to a strong diurnal fluctuation in dissolved oxygen concentrations. The diurnal variation in DO had not been measured, but the reach was choked with aquatic plants and flow velocities were very slow which would tend to result in large fluctuations in DO. Analysis of the chemical monitoring data indicates low 90 precentiles, which adds weight to the hypothesis that depressed DO levels are having an impact on the macro-invertebrate community.

F1.2.2.2 Camowen

The BRMP classifies the Camowen River system as being of good quality, with the exception of the Killyclogher Burn, which is of poor quality (Table F1.2.2.2 (a)). The upper reaches of the Camowen produce very high biotic scores, indicating unpolluted conditions. Scores from the sampling site in the Camowen River below the Killyclogher Burn are variable and were low in Spring 1991. Coincidentally, monitoring results from spring 1991 indicated that the Killyclogher was suffering from extreme pollution stress.

A detailed biological survey of the Killyclogher Burn and the Camowen adjacent to the Killyclogher confluence was undertaken in July 1992 (Report TI/92/1376). The monitoring results are summarised in Table F1.2.2.2(b). The results indicate that in the Killyclogher Burn above the Glenhordial Water Treatment Works (WTW) there is little pollution stress (site 1). However, below the WTW there is a significant decline in biotic scores, indicating severe pollution stress (site 2). The biotic scores improve with distance downstream from the

WTW (sites 3,4,5), but there is a marked decline below a sewerage pumping station (site 6). Chemical monitoring shows high ammonia levels (River Ecosystem Class RE2) in the lower Killyclogher.

Biological monitoring in the Camowen indicate that there is a decline in biotic score adjacent to the confluence with the Killyclogher (sites 7,8,9). In the area of the Camowen that is influenced by the plume from the Killyclogher (site 9) there is a particularly noticeable reduction in the biotic score. It would appear likely that discharges into the Killyclogher are having a detrimental impact on water quality in the lower Camowen.

F1.2.2.3 Fairywater sub-catchment

The results of the BRMP class the upper Fairywater as being of poor quality, the lower reaches as moderate to good quality and the remainder of the catchment, including the Drumquin, as being of good quality (Table F1.2.2.3). The poor quality in the upper reaches is below the target level of moderate and is therefore of concern. Other reaches in the Fairywater system achieve the target class.

No special surveys have been undertaken on the Fairywater, therefore the only data available are from the BRMP. Biological monitoring results from the upper Fairywater have consistently been moderate and there has not been one high scoring sample. The samples tend to be dominated by pollution sensitive species which would suggest that there is a discharge in the upper catchment, although, there are no known discharges. An alternative explanation is that the reach suffers from extreme diurnal fluctuations in DO caused by the excessive aquatic plant growth. The comments for this reach in the BRMP Report indicates that there is extensive plant growth. In addition, the Fisheries Ecosystem Class, based on chemical monitoring, is Class 5 as a consequence of very low DO levels. Therefore, it seems highly likely that excessive plant growth is causing the reduction in water quality in this reach, coupled with very low aeration caused by very slow flow velocities.

F1.2.2.4 Owenkillew sub-catchment

The BRMP classifies much of the Owenkillew catchment as being of good quality (Table F1.2.2.4). However, at some sampling sites the biotic scores were variable and in particular biotic scores at a number of sites were depressed during 1990. In the lower catchment there are signs of intermittent pollution stress with the classification at site 8 verging on moderate quality. The sources of pollution in the catchment are unknown and there are no detailed studies of the biology of the catchment. The BRMP report comments that the biotic scores are not as high as would be expected when the physical characteristics of the catchment are considered.

F1.2.2.5 Strule including the Cappaghburn

The BRMP classifies this part of the catchment as being of good quality (Table F1.2.2.5). The target for this reach, which is good, is met. At site 11 the BRMP report notes pollution tolerant taxa tend to dominate. Apart form this minor problem the biological monitoring indicates that this section of the catchment suffers little pollution stress.

F1.2.2.6 Derg sub-catchment

There have been a number of biological surveys of the Derg system and substantial amounts of data are available. We have divided the catchment into 3 sections. The first section covers the upper catchment above the confluence with the Mourne Beg including the Mourne Beg, Glendergan River and the Killen Burn. The second section is from the Mourne Beg confluence to the Water Treatment Works (WTW), and the third section covers the portion of the river below the WTW.

(a) Upper catchment of the Derg

The BRMP classifies the upper reaches as being of good quality (Table F1.2.2.6 (a1)). However, the monitoring results for site 5 indicate that there are significant variations in biological status between samples. In addition site 202 is prone to mild stress, as reported in the BRMP Report.

A biological survey of the catchment was conducted in July 1992 (TI/92/1375). The results for the sites in the upper catchment are presented in Table F1.2.2.6 (a2). In the upper Derg (site 1), the upper Glendergan (site 14) and the upper Mournebeg (site 16) the biotic scores of 84, 51 and 98 respectively are below those expected in an unpolluted river. As a "rule of thumb" biotic scores in an unpolluted river would be expected to be greater than 100. There is an improvement in the biotic scores further downstream.

It would appear that there are two possible causes for the variability in scores in the upper Derg catchment. The first is fishfarms, the second is forestry. There are two fishfarms located in the upper reaches of the Derg and Mourne Beg Rivers. There are no fishfarms on the Glendergen. These fishfarms could explain the stress observed in the upper Derg and Mourne Beg, but cannot explain the stress observed in the Glendergen. Given that the biological stress appears to be similar in each river, it seems plausible that another factor is causing the stress and that this factor affects all the sites. The common factor between the catchments is forestry. It is possible that forestry is causing biological stress, either through acidification or through the use of pesticides.

The results of monitoring by the ERU lend weight to the hypothesis that forestry is causing acid related stress. Monitoring by the ERU indicates that parts of the upper Mournebeg catchment are suffering from acid stress. The stress was observed in both the mainstream of the Mournebeg and a side tributary, the Bunadaown. However, the stress is not sufficient to warrant the upper

catchment being downgraded to the moderate class. It should be noted that the land-use in the catchment is coniferous forest plantation.

(b) Middle reaches of the Derg (confluence with the Mourne Beg to the Water Treatment Works)

The BRMP classifies the middle reaches as being of good quality (Table F1.2.2.6(b1)). The results of the study undertaken in July 1992 (TI/92/1375) show that the reach is of good quality (i.e. the biotic scores are well in excess of 100), but that there is a slight decline downstream of the Castlederg STW (Table F1.2.2.6(b2)).

(c) Lower section (below the Water Treatment Works)

The BRMP classifies the lower section of the Derg as being of generally good quality, although in 1990 it was of moderate quality (Table F1.2.2.6(c)). However, there was a considerable variation in the biotic scores during the sampling period with a minimum score of 45, which indicates that there is some form of severe pollution stress.

Intensive biological surveys of the lower catchment have been undertaken between 1990 and 1992 (TI/320/90, TI/340/90 and TI/92/1375) in an attempt to locate the source of the pollution stress. The sampling results are extensive and beyond the detail required in this plan. We have summarised the findings of the studies rather than presenting the large amounts of data that have been collected.

The results of the surveys clearly indicate that there is an intermittent discharge into the Derg approximately 750 meters upstream of the Ardstraw Bridge. The type of impact on the invertebrates suggests that the discharge is of a toxic and probably non-organic nature. Despite the intensive studies the source of the contamination has not been located but the relevant reports (listed above) suggest that sheep dip effluent or herbicide run off may be the cause. Two pipes have been identified as being the potential source of the pollution. It is also possible, however, that spay drift from the spraying of crops with pesticides is the cause of the pollution stress.

Monitoring of the tributary streams in the lower Derg indicate that overflows from the WTW's lagoon and the Greenville STW are having a major impact on the receiving streams. However, these discharges are small and have no detectable impact on the biology of the mainstem Derg itself.

F1.2.2.7 The Mourne and Douglas Burn

There are two BRMP sites in this section of the catchment. One is located on the Mourne, the other on the Douglas Burn, a minor tributary. Both sites are new sites. The Mourne site has been sampled over a full year, but the Douglas Burn has only been sampled once.

The Mourne site is classified as being of good quality, with reasonably high biotic scores. The Douglas Burn is classified as being of moderate quality which is below the target class of good (Table F1.2.2.7). The source of pollution stress in the Douglas Burn has not been identified, according to the BRMP report.

F1.2.2.8 Glenmornan

The BRMP classifies the Glenmornan as being of moderate quality (Table F1.2.2.8). The biological target for the Glenmornan is "good". Therefore the Glenmornan fails to meet its target class.

The BRMP sampling station is located below the discharge from a creamery. A biological survey of the area upstream and downstream of the creamery discharge (Report: TI/92/1409) indicates that the sections of the catchment above the creamery discharge are of good quality (biotic scores of between 123 and 128), whilst below the creamery the river is stressed, with biotic scores down to between 40 and 60. It would therefore appear that the creamery discharge is having a significant impact on water quality and is likely to cause the failure of the Glenmornan to meet its target class.

F1.2.2.9 Burndennet

In 1992 the BRMP classed the Burndennet as being of good quality but in 1990 the river was classed as moderate quality (Table F1.2.2.9(a)). The target class for the lower river is good and for the upper reaches the target class is moderate. Therefore the Burndennet generally meets its target class. However, the Class B status in 1990 indicates that the river was stressed.

A detailed biological survey of the river was conducted in December 1992 (Report TI/92/1409). A summary of the results of the survey are presented in Table F1.2.2.29(b). The upper reaches of the Burndennet are of good quality, with biotic scores ranging from 119 to 164. At Dunamanagh, above the STW, the biological quality declines and a biotic score of 73 was recorded. This decline occurs upstream of the STW and is probably attributable to the influence of a tributary that appears to be significantly stressed, with a biotic score of 46.

On the Altinaghree biological monitoring indicates that there has been severe pollution stress in the recent past, although the river has now recovered.

Below the Altinaghree the biotic scores vary between 105 and 122, indicating the possibility of some stress. The tributaries in this lower section have varying biotic scores (Table F1.2.2.9(a)). In some of the tributaries (sites 11, 15) the low biotic scores can be attributed to poor quality habitat which is a naturally occurring phenomena. However, on the Burngibbagh (site 16) the habitat appears to be good but the low biotic score (78) indicates a pollution problem.

Thus, the mainstream of the Burndennet is of reasonable quality. However there appears to be some pollution problems associated with tributaries.

F1.2.1.10 Finn sub-catchment

The results of biological monitoring conducted in 1990 by the ERU indicate that the Finn catchment is generally of good quality (Table F1.2.2.10). The upper sub-catchments, including the Reelan, Elatagh, Cummirk and Clogher are of particularly good quality. However, the biotic scores indicate pollution in the downstream reaches of the Finn and in some of the lower tributaries, and biology is particularly variable at Clady.

In the Burn Daurnet stream, which joins the Finn at Ballybofey, the biology indicates moderate quality in the upper reaches and poor quality in the lower reaches. The biology appears to indicate that the source of the pollution is of a toxic nature.

The Finn itself is of moderate quality between Ballybofey and Stranolar, but throughout the rest of its length is of good quality.

F1.2.2.11 Deele sub-catchment

The Deele is of good quality throughout, with all sites achieving good status. Compared with 1985 the biology has improved downstream of Convoy, when samples only achieved moderate status. The results of biological monitoring are presented in Table F1.2.2.11.

F1.2.2.12 Swillyburn

There are no biological data available for the Swillyburn.

F1.2.2.13 The Faughan

The results of the BRMP place the upper reaches of the Faughan into the good class, but the middle and lower reaches are of moderate quality. The target for the entire river is good, therefore substantial portions of the catchment do not meet the target set. The BRMP results are presented in Table F1.2.2.13(a).

There have been two biological surveys of the Faughan that are relevant to this plan. One study, carried out in February 1992 (Report: TI/92/1429), sought to provide detailed information on the biological status of the catchment and sought to assess the impact of an oil spill in the Burntollet which occurred in December 1991. The other study, conducted in December 1991 (TI/91/1438), sought to identify the source of pollution in the lower Faughan, which was attributed to the Gorticross Stream.

The results of the survey into the biological quality of the catchment indicated that the section of the catchment above Claudy was of high quality with biotic scores ranging between 140 and 150 (Table F1.2.2.13(b)). Downstream of Claudy sewage treatment works there is a slight decline (biotic score: 138) and further downstream the score increases to 152 which is indicative of good quality. A grossly polluted stream (biotic score 16), which in the past received regular diffuse discharges of mineral oil, enters the Faughan between Claudy

and the Burntollet. Above the Burntollet the biological score is 125, indicating that the highly polluted stream could be having an impact on the Faughan.

Downstream of the confluence with the Burntollet the biotic scores decline significantly to approximately 60, indicating pollution stress. Further downstream, above Drumahoe, there is evidence of recovery (score 101), but below Drumahoe the scores decrease to around the 80 mark.

The survey of the biology in the lower section of the catchment below Drumahoe focused on discharges into the Gorticross Stream system (TI/91/1438). The study focused on very small drains. Rather than present the data gathered during the survey we will summarise the key findings.

The survey of the Gorticross system indicates that there are two discharges into the stream system which are having a marked impact on the biology. The first discharge appears to contain organic material (TI\91\1438). The second discharge is thought to be responsible for the pollution stress recorded in the Faughan at Mobouy Bridge by routine biological monitoring. The exact location of this second discharge was not established during the survey because the pollutant appeared to enter a culverted stretch of stream and could therefore not be viewed. Investigations are currently being carried out by Environment Service to locate the pollution source.

Very low biotic scores (less than 5) were recorded in the drain downstream of the suspected second discharge. Drains in the area that has similar physical characteristics were associated with biotic scores of between 50 and 60. Therefore, it would appear that this discharge is causing significant stress (TI/91/1438).

F1.2.2.14 Roe system

The BRMP classifies the upper reaches of the Roe as being good quality, and the middle to lower reaches as moderate quality (Table F1.2.2.14). In the upper reaches, although the overall quality is "good", there is a high degree of variability in biotic scores between seasons and many of the samples are indicative of moderate quality. The only site that consistently produces high quality scores is on the Owenrigh River (site 29). Therefore much of the catchment experiences significant pollution stress. In the middle reaches the BRMP classification of moderate is below the target class of "good".

There is no obvious cause for the stress observed throughout much of the catchment. The results of biological sampling and site observations (detailed in the BRMP report) indicate that there is little evidence of organic contamination and the BRMP report suggests that some other source of pollution or stress is likely.

A comparison of sites 27, 28 and 29 (Table F1.2.2.14), shows that only 29 is of consistently good quality whilst sites 27 and 28 have variable biotic scores. All three sites would normally be expected to produce consistently high scores, given that the sites are located in upland locations and therefore upstream of polluting influences. Upstream of sites 27 and 28 there are forestry plantations (see section - land-use), but there is no forestry upstream of site 29. There is the possibility, therefore, that forestry operations could be a factor in the pollution stress observed at sites 27 and 28. Biological monitoring on the Derg

system has indicated that forestry operations may be having an impact on the in-stream biology and the same situation could be occurring on the Roe system.

Another potential source of pollution stress is the discharge from the Caugh Hill WTW. This discharge is upstream of site 28 and could possibly explain the variability in biotic scores at this site.

F1.2.2.15 Small streams entering Lough Foyle

Three small streams flowing into Lough Foyle, (the Muff, Faughanvale and Burnfoot) are monitored as part of the BRMP. The monitoring results indicate that these streams are of good, moderate and poor quality respectively (Table F1.2.2.15(a)). However, the biotic scores for the Muff are variable and some samples are more representative of moderate quality. The target class for these streams is moderate; therefore the Muff and Faughanvale meet this class, but the Burnfoot does not.

The results of a detailed biological survey of 20 sites on 16 small streams that flow into Lough Foyle (TI/1445/91) indicates that 8 sites are of good quality, 7 are of moderate quality, 4 are of poor quality and 1 is of very poor quality. The appropriate target class for these streams is moderate.

Discussion of the results of the monitoring programme are limited in this plan to those sites that failed to achieve moderate status.

The monitoring results for the sites showing stress are presented in Table F1.2.2.15(b). The sampling site on the Faughanvale indicated poor quality. The source of pollution at this site is unknown. The Caw stream is highly stressed although this could be expected because the stream receives run off from urban sources which are likely to be contaminated. Given that this stream is, in effect, a drain, a lower biological target class would probably be warranted. The Tullyburn is highly stressed and the source of the pollution stress appears to be leachate from a landfill (TI/91/1445). The Dunnalong Burn appears to be subject to intermittent pollution from agricultural sources (TI/91/1445).

The Saint Columba's Park stream is highly stressed. This stream flows through an urban park and thus has amenity value. The source of the pollution is likely to be urban run off and possible storm sewer overflows but should be investigated further.

Monitoring data collected by the ERU for the Carrigans Stream shows the stream to be of moderate quality above Carrigans and of poor quality below Carrigans (Table F1.2.2.15(c)). The target class for this stream is moderate, therefore the lower part of the stream fails to meet its target. The other small streams on the ROI side of the lough are of good quality in their upper reaches, but are of poor quality in their lower reaches, below discharges from industrial sources or STW's.

TABLE F1.2.2.1 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE DRUMRAGH SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class (Biological)	Biotic Score (Composite)	Actual Class	RIVPACS Site	Comments
Owenreagh	Unnamed tributary receiving effluent from Dromore STW to major unnamed tributary.	H364651	H378649	Good	'91: 213 '92: 238 Minimum: 148	Good Good	261	Consistently high biotic scores.
Owenreagh	Unnamed tributary to confluence with Quiggery	H364651	H446681	Good	'90: 224 '91: 224 '92: 222	Good Good Good	17	Consistently good biological quality.
Routing Burn	Source to confluence with Eskragh Water	H501618	H501618	Good	'91: 171 '92: 183 Minimum: 83	Good Good	207	The lowest biotic score was recorded shortly after a fish kill upstream of the sampling site.
Eskragh Water	Confluence with Eskragh to confluence with Quiggery Water	H501618	H456650	Good	'91: 178 '92: 176 Minimum: 69	Good Moderate	206	Evidence of some stress.
Quiggery	Source to Fintona STW	H426553	H447615	Moderate	'91: 196 '92: 209 Minimum: 131	Good Good	260	The biotic scores are reasonably high on a consistent basis.
Quiggery	Fintona STW to confluence with Eskragh	H447615	H456650	Good	'91: 175 '92: 165 Minimum: 103	Good Moderate	205	Less pollution tolerant taxa than would be expected.
Quiggery	Conf. with Eskragh to conf. with Drumragh	H456650	H446681	Moderate	'90: 195 '91: 214 '92: 199 Minimum: 126	Good Good Good	16	Consistently good biological quality.
Drumragh	Source (conf. Quiggery) to conf. with Camowen	H446681	H453728	Good	'90: 205 '91: 210 '92: 249 Minimum: 104	Good Good Good	15	Consistently good biological quality.

TABLE F1.2.2.2(a) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE CAMOWEN SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Cloghfin	Conf. with Glenannes Burn to Camowen	H572671	H509707	Good	'91: 213 '92: 223 Minimum: 146	Good Good	208	High quality reach
Killyclogher Burn	Reservoir to Bridge	H481752	H472737	Moderate	'91: 147 '92: 161 Minimum: 76	Good Good	258	Variable scores
Killyclogher Burn	Bridge to confluence with Camowen	H472739	H467728	Moderate	'91: 145 '92: 65 Minimum: 27	Good Poor	200	Evidence of extreme pollution stress
Camowen	Conf with Grannagh Burn to conf. with Cloghfin	H603712	H510708	Good	'91: 230 '92: 201 Minimum: 145	Good Good	259	High quality reach
Camowen	Conf with Cloghfin to confluence with Strule	H510708	H453728	Good	'90: 213 '91: 188 '92: 191 Minimum: 74	Good Good Good	14	Some variability in scores. One particularly low score in Spring 1991

TABLE F1.2.2.2(b) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE KILLYCLOGHER AND LOWER CAMOWEN

Site No.	River	Location	IGR	Biotic Score	2ASPT	Comments
1	Killyclogher	Boreagh Bridge	H484759	100	6.25	Reasonable biological quality
2	Killyclogher	Below Glenhordial WTW	H478750	29	5.80	Very low biotic score
3	Killyclogher	Adjacent to Service Reservoir	H474745	61	5.55	Some recovery from stress is evident
4 (RIVPACS: 200)	Killyclogher	Above sewerage pumping station	H472737	78	5.57	Further recovery
5 (RIVPACS: 200)	Killyclogher	Lovers Retreat (below sewerage pumping station)	H467732	94	5.22	Further recovery
6	Killyclogher	Immediately upstream of Camowen confluence	H467729	31	3.88	Very low biotic score and low ASPT, indicating pollution tolerant species are present.
7	Camowen	200 m downstream of confluence, out of plume area	H468729	162	6.00	Good score and ASPT, indicating good biological quality
8	Camowen	200 m downstream of confluence, inside plume area	H466729	137	5.96	A reduction in biological quality is apparent in the plume from the Killyclogher.
9	Camowen	Glashagh (downstream of the Killyclogher)	H466728	101	5.32	A slight reduction in biological quality is still evident.

Source: Report TI/92/1376

TABLE F1.2.2.3 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE FAIRYWATER SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual Class	RIVPACS Site	Comments
Fairywater	Clare Bridge to conf. with Drumquin	H293802	H354771	Moderate	'90: 116 '91: 107 '92: 136 Minimum: 69	Moderate Poor Poor	180	High scores have not been recorded
Fairywater	Conf. with Drumquin to Gauging Station	H354771	H467759	Moderate	'90: 200 '91: 161 '92: 198 Minimum: 71	Good Moderate Good	182	Stressed in 1991, otherwise good scores obtained
Fairywater	Gauging Station to conf. with Strule	H407759	H432749	Moderate	'90: 179 '91: 139 '92: 206 Minimum: 61	Good Moderate Moderate	13	Very variable scores
Drumquin	Conf. with Blackwater to conf. Fairywater	H328740	H353771	Moderate	'90: 231 '91: 241 '92: 235 Minimum: 127	Good Good Good	181	Consistently high scores indicating good quality

TABLE F1.2.2.4 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE OWENKILLEW SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Owenkillew	Evishessan Bridge to conf. with Coneyglen Burn	H663835	H599866	Good	'91: 170 '92: 202 Minimum: 77	Good Good	255	Some variability, but generally high biotic scores
Coneyglen Burn	Source to conf. with Owenkillew	H685916	H598867	Good	'91: 144 '92: 126 Minimum: 77	Good Good	256	Mediocre biotic scores on occasions.
Owenkillew	Conf. with Coneyglen to conf. with Owenreagh	H598867	H529866	Good	'90: 129 '91: 191 '92: 198 Minimum: 66	Moderate Good Good	177	Stress observed in 1990. Since then scores have been good.
Glenark	Source to conf. with Owenkillew	H655924	H574871	Good	'91: 152 '92: 157 Minimum: 65	Good Good	204	Highly variable biotic scores. It is likely that this reach suffers from periodic pollution.
Owenreagh	U/S Greencastle STW to conf. with Glensawisk Burn	H590821	H571830	Good	'91: 199 '92: 179 Minimum: 103	Good Good	254	Generally good scores
Glensawisk Burn	Source to conf. with Owenreagh	H512805	H571830	Moderate	'91: 172 '92: 184 Minimum: 84	Good Good	253	Generally good scores
Glenmacoffer	Source to conf. with Owenkillew	H512817	H51865	Moderate	'91: 183 '92: 167 Minimum: 102	Good Good	252	Generally good biotic scores.

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Owenreagh	Conf. with Glensawisk Burn to conf. with Owenkillew	H571830	H529866	Good	'90: 118 '91: 178 '92: 161 Minimum: 83	Moderate Good Good	178	Very variable scores. Some samples suggest moderate quality rather than good, indicating some form of mild stress.
Glenelly	Goles Bridge to Sperrin Lodge	H672947	H634941	Good	'91: 166 '92: 157 Minimum: 85	Good Good	257	Variable biotic scores possibly indicating some pollution
Glenelly	Sperrin Lodge to Plumbridge	H593925	H484914	Good	'90: 137 '91: 174 '92: 172 Minimum: 83	Good Good Good	176	Some variable biotic scores. The sample in 1990 is more indicative of moderate quality than good.
Glenelly	Plumbridge STW to conf. with Owenkillew	H484914	H453881	Good	'90: 150 '91: 162 '92: 160 Minimum: 79	Good Good Good	9	Variable biotic scores. Some samples indicate moderate quality. Possible pollution stress.
Owenkillew	Conf. with Glenelly to conf. with Strule	H453889	H409862	Good	'90: 146 '91: 176 '92: 144 Minimum: 71'	Good Good Good	8	Mediocre biotic scores. This site "scrapes" into the good quality class.

TABLE F1.2.2.5 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE STRULE SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Cappaghburn	Source to confluence with the Strule	H502818	H435795	Good	'91: 189 '92: 180 Minimum: 133	Good Good	201	Consistently high biotic scores
Strule	Conf. Owenkillew to conf. Derg	H409861	H367879	Good	'90: 226 '91: 193 '92: 228 Minimum: 111	Good	7	Consistently good biotic scores.
Strule	Conf. Cappagh Burn to conf. Owenkillew	H435795	H409861	Good	'90: 204 '91: 209 '92: 204 Minimum: 124	Good Good Good	10	Consistently high biotic scores
Strule	Conf. Fairywater to conf. Cappaghburn	H431749	H435795	Good	'90: 224 '91: 188 '92: 225 Minimum: 109	Good Good Good	11	Generally good scores. On occasions pollution tolerant taxa tend to dominate.
Strule	Source to Omagh STW	H45478	H443737	Good	'90: 257 '91: 198 '92: 196 Minimum: 113	Good Good Good	12	Generally high biotic scores

TABLE F1.2.2.6 (a1)
SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE UPPER DERG SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic Score (composite)	Actual Class	RIVPACS Site	Comments
Mourne Beg	Meenreagh Bridge to confluence with the Derg	H142852	H230838	Moderate	'90: 205 '91: 206 '92: 224 Minimum:129	Good Good Good	6	Consistently good biotic scores.
Derg	Glendergan to Mourne Beg Conf.	H149791	H230838	Good	'90: 197 '91: 182 '92: 208 Minimum: 75	Good Good Good	5	Variability in biological status
Glendergan R.	Source to conf. with Derg.	H053839	H149791	Good	'91: 174 '92: 214 Minimum: 104	Good Good	202	Reach prone to mild stress
Killen Burn	Source to conf. with Derg, (includes Lough Lee)	H222745	H230828	Moderate	'91: 171 '92: 168 Minimum: 114	Good Good Good	203	Normal, unpolluted stream

TABLE F1.2.2.6 (a2) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE UPPER DERG SYSTEM

Site No.	River	Location	IGR	Biotic Score	ASPT	Comments
1	Derg	Legvin	H127777	84	5.60	Low diversity fauna
2 (RIVPACS 202)	Derg	Aghyaran	H191805	127	6.05	Well balanced community
14	Glendergan	Big Bridge	H093815	51	5.10	Low diversity fauna with low invertebrate density
15 (RIVPACS 5)	Glendergan	Sraghcumber	H145796	119	6.26	Diverse and well balanced community
16	Mourne Beg	Laghtcruppan	H177834	98	6.13	Low invertebrate density. The BRMP site is located downstream and returns a higher biotic score which could be a consequence of recovery.
17	Garvagh Burn (tributary of the Mourne Beg)	Garvagh Bridge	H197842	105	5.83	Reasonably diverse community and reasonable invertebrate density
18 (RIVPACS 203)	Killen Burn	Glashagh	H231827	124	5.64	Diverse and well balanced community, dominated by snails, midges and Oligochaete worms

Source: Report (TI/92/1375)

TABLE F1.2.2.6 (b1) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE MIDDLE DERG SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic Score (composite)	Actual Class	RIVPACS Site	Comments
Derg	Castlederg STW to WTW	H272841	H325862	Good	'90: 188 '91: 188 '92: 200 Minimum 107	Good Good Good	179	Slight stress observed

TABLE F1.2.2.6 (b2) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE DERG SYSTEM

Site No.	River	Location	IGR	Biotic Score	ASPT	Comments
3	Derg	Castlederg	H263843	138	5.75	Well balanced community
4	Derg	Upstream of Spamount Bridge	H287848	117	5.57	Well balanced community
5 (RIVPACS 179)	Derg	Crewe Bridge	H315845	133	6.05	Well balanced community

Source: Report (TI/92/1375)

TABLE F1.2.2.6(c) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE LOWER DERG SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic Score (composite)	Actual Class	RIVPACS Site	Comments
Derg	WTW to Conf.Strule	H325862	H367878	Good	'90: 133 '91: 204 '92: 152 Minimum 45	Moderate Good Good	4	Highly variable biotic scores, some indicative of poor water quality

TABLE F1.2.2.7 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE MOURNE AND DOUGLAS BURN SUB-CATCHMENTS

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Douglas Burn	Source to conf. with Mourne	H433952	H363898	Good	Autumn 1992: 55	Moderate	281	Evidence of pollution stress
Mourne	Conf. Derg to Weir at Sion Mills	H367879	H347932	Good	'92: 193 Minimum: 112	Good	269	Consistently good biotic scores

TABLE F1.2.2.8 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE GLENMORNAN SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Glenmornan River	Artigarvan to Tidal Limit	C382011	C359041	Good	'91: 127 '92: 129 Minimum: 49	Moderate Moderate	199	The biotic scores indicate that the river is continuously stressed.

TABLE F1.2.2.9 (a) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE BURNDENNET SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Burndennet	Essbeg Bridge to conf. with Altinaghree Burn	H510978	C445043	Moderate	Missing	Good	196	
Burndennet	Conf. with Altinaghree Burn to tidal limit	C445043	C360043	Good	'90: 148 '91: 170 '92: 183 Minimum: 92	Moderate Good Good	2	Evidence of stress in 1990, but the river has since recovered.
Altinaghree Burn	Bunowen Bridge to conf. with Burndennet	C502025	C445043	Moderate	'91: 152 '92: 177 Minimum: 86	Good Good	197	The biotic scores tend to be slightly lower than would be expected.

TABLE F1.2.2.9 (b) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE BURNDENNET, DECEMBER 1992

River	Site	Site Number	Biotic Score	Class	Comments
Burndennet	Upstream of Dunnamanagh	1 2 7 8 9 12	136 123 164 119 158 140	Good Good Good Good Good Good	Upstream of Dunnamanagh the biotic scores are indicative of good quality.
Tributary	Dunnamanagh	10	64	Moderate	This site appears to suffer from pollution stress and the pollution may be affecting the Burndennet below Dunnamanagh.
Burndennet	Dunnamanagh to confluence with River Foyle.	3 4 5 6	73 111 122 105	Moderate Good Good Good	The lowest score (73) occurs downstream of Dunnamanagh. Scores improve downstream and most of the river would be classed as good quality.
Altinaghree	Entire length	13 14	108 109	Good Good	The biology of the upper site (13, score 109) shows indications of recovery from a pollution incident.
Tributaries	Dunnamanagh to River Foyle	11 15 16	74 62 78	Moderate Moderate Moderate	The low biotic scores at sites 11 and 15 are probably attributable to poor habitat whilst at site 16 the low score is probably attributable to pollution stress.

Source: Report TI/92/1409

TABLE F1.2.2.10: SUMMARY OF RESULTS OF BIOLOGICAL MONITORING OF THE FINN CATCHMENT BY THE ERU

River	Reaches	U/S	D/S	Target Class	ROI class	RIVPACS equivalent class
Finn	Source to conf. with Cummirk River	G960026	G995017	Good	1984: 5 1990: 5	Good Good
Finn	Cummirk River to Reelan Confluence	G995017	H040978	Good	1984: 5 1990: 5	Good Good
Cummirk River	Source to Finn confluence	G	H995017	Good	1990: 4-5	Good
Reelan (Finn)	Source to conf. with Finn	H	G040978	Good	1990: 5	Good
Finn	Reelan conf to Glenmore Bridge	H040978	H803962	Good	1984: 5 1990: 4-5	Good Good
Finn	Glenmore Bridge to Ballybofey	H803962	H145948	Good	1984: 4-5 1990: 4-5	Good Good
Burn Daurnett	Source to Weir	H089911	H135938	Moderate	1987: 4-5 1990: 3	Good Moderate
Burn Daurnett	Weir to conf. with Finn	H135938	H144943	Moderate	1987: 1-2 1988: 2-3 1990: 1	Bad Poor Bad
Finn	Stranrolar STW to Killygordon Bridge	H153946	H205938	Moderate	1984: 3-4 1990: 3	Moderate Moderate
Finn	Killygordon Bridge to U/S Castle Finn STW	H205938	H262947	Moderate	1984: 4 1990: 4	Good Good

TABLE F1.2.2.11: SUMMARY OF RESULTS OF BIOLOGICAL MONITORING IN THE DEELE CATCHMENT BY THE ERU

River	Reaches	U/S	D/S	Target Class	ROI class	RIVPACS equivalent class
Deele	Source to conf. with Cloghroe	H077058	H173008	Moderate	1985: 5 1990: 4	Good Good
Deele	Conf. with Cloghroe to Convoy	H173008	H222014	Good	1985: 5 1990: 4	Good Good
Deele	Convoy to conf. with River Foyle	H173008	H222014	Good	1985: 4 1990: 4	Good Good

TABLE F1.2.2.13(a) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE FAUGHAN SUB-CATCHMENT

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Faughan	Tidal Limit to Drumahoe Bridge	C463150	C488201	Good	'90: 165 '91: 145 '92: 132 Minimum: 46	Moderate Moderate Moderate	19	Highly variable scores. Occasional pollution problems.
Faughan	Conf. Burntollet to Drumahoe Bridge	C500108	C464150	Good	'90: 134 '91: 153 '92: 134 Minimum: 79	Moderate Good Moderate	175	Some variability in scores suggesting stress.
Burntollet	Source to conf. with Faughan	C610160	C500108	Moderate	'90: 148 '91: 143 '92: 166	Moderate Moderate Moderate	174	Some variability, indicative of occasional pollution problems
Faughan	Claudy to Conf. with Burntollet	C545071	C547124	Good	Missing		173	
Glenrandal River	Conf. with Inver to conf. with Faughan	C545015	C539069	Good	'92: 274 Minimum: 175	Good	274	Consistently high biotic scores.
Faughan	Crooked Bridge to Claudy	C616012	C545071	Good	'90: 123 '91: 166 '92: 173 Minimum: 86	Moderate Good Good	20	Variability in scores. Some samples reflect a moderate status rather than good.
Faughan	Source to Crooked Bridge	C640975	C616012	Good	'92: 159 Minimum: 116	Good	272	Consistently high biotic scores.

TABLE F1.2.2.13(b) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE FAUGHAN , FEBRUARY 1992

River	Location	Site Number	Biotic Score	ASPT	Comments
Faughan	Upstream of Claudy STW	1 2 13 14	140 145 139 150	6.67 6.04 5.79 6.52	High biotic scores indicative of good quality
Faughan and tributaries	Downstream of Claudy STW to Confluence with the Burntollet	3 15 4 14 5	138 138 152 150 125	6.57 6.57 6.61 6.52 6.25	One tributary is shows signs of severe pollution which is possibly having an impact on the main-stem Faughan
Burntollet	Entire length	17 18	127 56	6.35 5.60	The biotic scores decrease significantly downstream of a recent oil spill
Faughan	Confluence with Burntollet to upstream of Drumahoe	6 7 8	60 59 101	5.45 4.92 5.61	The biotic scores decrease below the Burntollet confluence but show some recovery downstream.
Faughan	Drumahoe to tidal limit	9 10 11 12	71 83 80 76	5.46 5.53 5.71 5.07	Low biotic scores indicative of pollution entering the Faughan a short distance upstream of Drumahoe.

Source: Report TI/92/1429

TABLE F1.2.2.14 SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR THE ROE SYSTEM

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Roe	Source to Hillhead	C755005	C715067	Good	'90: 142 '91: 137 '92: 160 Minimum: 70	Good Good Good	27	Despite being of good quality overall the biotic scores are mediocre. Some samples would place the river in the moderate class.
Owenreagh	Conf. with Altnaheglish to conf. with Roe	C670049	C684088	Good	'90: 129 '91: 165 '92: 167 Minimum: 76	Good Good Good	28	Variable scores. Some samples indicate moderate pollution stress.
Owenbeg	Source to conf. with Roe	H655990	C684098	Good	'90: 179 '91: 188 '92: 199 Minimum: 109	Good Good Good	29	Consistently good biotic scores.
Roe	Conf. with Owenbeg to conf. with Gelvin River	C684098	C689143	Good	'90: 116 '91: 166 '92: 186 Minimum: 69	Moderate Good Good	24	Highly variable scores indicating a source of intermittent pollution.
Roe	Conf. with Gelvin River to Dogs Leap	C689143	C672211	Good	'90: 145 '91: 130 '92: 124 Minimum: 77	Moderate Moderate Moderate	23	This reach is stressed. It appears the cause is diffuse and varied agricultural inputs.

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Curly River	Source to conf. with Roe	C755251	C674244	Good	'90: 164 '91: 189 '92: 180 Minimum: 112	Moderate Good Good	26	Some evidence of pollution stress, causing the reach to be classified as moderate in 1990
Roe	Dogs Leap to conf. with Curly River	C672211	C674244	Moderate	'90: 125 '91: 121 '92: 138 Minimum: 68	Moderate Moderate Moderate	22	Modest biotic scores at most sampling times.

TABLE F1.2.2.15(a) SUMMARY RESULTS OF THE BIOLOGICAL MONITORING PROGRAMME FOR CERTAIN SMALL STREAMS FLOWING INTO LOUGH FOYLE

River	Reaches	U/S	D/S	Target Class	Biotic score (composite)	Actual class	RIVPACS Site	Comments
Muff	Source to tidal limit	H509141	H545222	Moderate	'92: 156 Minimum: 81	Good	266	The biotic scores are variable, indicating some pollution stress
Faughanvale	Source to tidal limit	H558162	H581222	Moderate	'92: 124 Minimum: 82	Moderate	267	Evidence of mild pollution stress
Burnfoot	Source to tidal limit	C172643	C638252	Moderate	'92: 89 Minimum: 49	Poor	268	Evidence of pollution

TABLE F1.2.2.15(b) SUMMARY OF RESULTS OF A BIOLOGICAL SURVEY OF THE SMALL STREAMS ENTERING LOUGH FOYLE

River	Site	Site Number	Biotic Score	Class	Comments
Ballykelly Burn	Ballykelly Army Camp	F7	54	Poor quality	The source of pollution was identified as two sheep dippers which have now been removed
Faughanvale	Faughanvale Bridge	F8	57	Poor quality	In 1992 the river achieved moderate status
Caw Stream	Above A2 road culvert	F13	34	Poor quality	The steam receives urban run off.
TullyBurn	Tully Bridge at A2 road	F16	26	Poor quality	Leachate from a landfill site could be a potential problem at this site
Saint Columba's Park Stream	Saint Columba's Park	F19	9	Very poor quality	This stream receives urban run off. The stream flows through an area of potentially high amenity value.

TABLE F1.2.2.15 (c) SUMMARY RESULTS OF BIOLOGICAL MONITORING DATA COLLECTED BY THE ERU FOR CERTAIN SMALL STREAMS FLOWING INTO LOUGH FOYLE

River	Reaches	U/S	D/S	Target Class	ROI class	RIVPACS equivalent class
St Johnston Burn	Source to U/S St Johnston	H283068	H345099	Moderate	1985: 3 1990: 3	Moderate Moderate
St Johnston Burn	St Johnston to conf with Foyle	H345099	H350099	Moderate	1985: 2 1990: 2	Poor Poor
Carrickgans Burn	Source to Weir at Carrigans	H345160	H365118	Moderate	1985: 3 1990: 3	Moderate Moderate
Carrickgans Burn	Weir to Foyle	H365118	H370113	Moderate	1985: 3 1990: 2	Moderate Poor

F1.2.3 Other Biological Indicators

F1.2.3.1 Macrophytes

Macrophytes, like macro-invertebrates, are sensitive to the environmental conditions in which they exist. They can be used to assess the quality of a waterway in a similar way to which invertebrates can be used. Macrophytes are particularly useful for assessing the trophic status of the waterway and they are considered further in the following section on eutrophication. Macrophytes can also be used as an indicator of other environmental stress. For example, the absence of macrophytes can indicate pollution from a toxic source. It is in respect of toxic substances that we consider macrophytes briefly in this section.

The data available on macrophytes has been obtained from site observations contained in the Biological Monitoring Report and site observations in the other biological monitoring reports. The site comments indicate that there is an absence of macrophytes in the Millbrook Bridge area of the River Derg. This total absence is very unusual because there are healthy growths of the aquatic plant "water crowsfoot" further upstream. The absence of macrophytes in this area appears to be linked to the poor biology in this reach and is likely to be connected with the suspected toxic discharge. If this is the case then the discharge is likely to be having a significant impact on the in-stream ecology. This discharge must be a cause for concern given the severe impact it is having on the entire aquatic ecosystem.

There were no further comments in the BRMP report of unusual characteristics in the macrophyte community.

F1.2.3.2 Sewage Fungus

Sewage fungus is an indicator of organic pollution. Detailed data on the occurrence of sewage fungus are not available, although, the site comments in the Biological Monitoring Programme do provide some data, albeit limited. The reaches where sewage fungus was observed are listed in Table F1.2.3.2.

TABLE F1.2.3.2: REACHES IN WHICH SEWAGE FUNGUS WAS OBSERVED

BRMP Site	River	Location	Details
24	Roe	Downstream of Dungiven	Sewage fungus present
199	Glenmornan	Downstream of the creamery discharge	Sewage fungus present
200	Killyclogherburn	Below sewage pumping station and Water Treatment Works	Extensive growths of sewage fungus
206	Eskragh water	Conf. with Routing Burn to conf. with Quiggery	Sewage fungus present
207	Routing Burn	Source to conf. with Eskragh	Sewage fungus present
256	Coneyglen Burn		Sewage fungus observed in Autumn 1992
268	Burnfoot		Sewage fungus present during all sampling occasions

Source: Site comments contained in the BRMP report.

F1.3 EUTROPHICATION

Eutrophication concerns the impact of nutrient enrichment on water quality. Nutrient enrichment can increase aquatic plant and algal growth which can lead to large diurnal variations in dissolved oxygen concentrations. During the day plants release oxygen and the DO levels in an enriched waterway can become super-saturated. However, at night plants absorb oxygen and DO levels significantly reduce, sometimes to very low levels which can result in fish kills.

Nutrients enter water ways from a number of sources, including discharges from sewage treatment works, industrial discharges and from diffuse run off. In freshwaters the key nutrient that usually controls or "limits" enrichment is phosphate. In coastal waters the limiting nutrient is generally nitrate.

The impacts of nutrient enrichment vary depending on the physical characteristics of a river. There is no single criterion that can be used to assess whether a waterway is eutrophic; a set of criteria is used as defined in Section D.

In this section eutrophication in running freshwater reaches is first assessed, followed by eutrophication in still waters. Eutrophication in the tidal waters is considered in Section F2.

F1.3.1 Eutrophication In Running Freshwaters

The criteria used to determine whether a section of river is potentially eutrophic as follows:

F1.3.1.1 Phosphorus concentration

As a "rule of thumb" if average annual phosphorus concentrations are above 0.05mg/l there is an increased likelihood of eutrophication occurring. It should be noted that there is not a simple relationship between measured phosphate levels in waters and plant growth, as physical factors, including flow velocity and shading (light), influence plant and algae growth. Recent research by English Nature indicates that soluble reactive phosphate (SRP) levels as low as 0.02mg/l may, in certain circumstances, result in a change in plant species. The situation is further complicated when it is considered that plants can also use phosphates in sediments and that this phosphate is not normally detected in water quality sampling.

Phosphate concentrations for the catchment are available from the chemical monitoring programme.

F1.3.1.2 Algal growths

Excessive growths of attached algae, such as cladophora, are indicators of nutrient enrichment. Some information on algal growths in the North are available from the biological monitoring reports (the biological monitoring reports used in this plan are listed in Section F1.2), although no data are available for the South.

F1.3.1.3 Variations in dissolved oxygen

Strong diurnal variations in DO, as a consequence of aquatic plant growth, are an indicator of eutrophication. Data for DO are available from the chemical monitoring programme. Whilst these data do not cover the diurnal cycle they can be used to assess whether super saturated conditions or reduced levels of DO occur.

F1.3.1.4 Invertebrates

Reductions in the diversity and increase in abundance of pollution tolerant invertebrates which can be attributed to nutrient enrichment are an indicator of eutrophication.

F1.3.1.5 Macroflora

Substantial increases in the abundance of some aquatic plants changes in the community structure and reduction in species diversity are also an indicator. Data on macro flora are limited because a detailed survey of macrophytes has not been undertaken. For the Northern portion of the catchment we have used comments in the Biological Monitoring Reports but in the South no data are available.

F1.1.3.6 Water retention time and flow velocities

If the retention time in a section of river is sufficiently long for algal blooms to occur then the chances of eutrophication occurring in the section will increase. There is no information data readily available on retention times. However, an assessment of whether retention time would be large (in the order of days) or small can be made based on the gradient of a section, which can be established using 1:50,000 scale maps.

Low water velocities can affect trophic conditions and are connected with long retention times. Under conditions of extremely low velocities certain macrophytes can become abundant which may cause large diurnal variations in DO.

F1.3.2 **Determination of Eutrophic Status**

As a consequence of a lack of macroflora and algal growth data in the south discussion of eutrophication focuses mostly on the Northern portion of the catchment.

Determining whether a particular reach of a river is eutrophic is not a straight forward procedure because the impact of nutrient enrichment varies depending on the physical characteristics of the reach. In most cases more than one of the criteria above will have to be met to classify a reach as eutrophic. We have determined the reaches that meet the criteria above and placed the relevant information into a matrix format. Using this matrix we have made a judgement of the trophic status of the reaches that met at least one of the eutrophication criteria.

F1.3.2.1 Phosphorus concentrations

Phosphorus concentrations are above 0.05 mg/l at 24 of 87 water quality sampling sites in the catchment. These are identified in Table F1.3.2.1(a).

TABLE F1.3.2.1(a): MONITORING SITES AT WHICH MAXIMUM PHOSPHATE CONCENTRATIONS ARE GREATER THAN 0.1 MG/L

River	Site location	Phosphorus levels (mg/l)
Glenmornan	Ballymagorry Bridge	0.093
Owenkillew	Monanmeal Bridge	0.058
Glenelly	Sperrin	0.062
Owenreagh	Drumlea Bridge	0.058
Owenreagh	Cashel Bridge	0.058
Glensawick Burn	Campbell's Bridge	0.062
Strule	Moyle Bridge	0.076
Strule	Stone Bridge	0.073
Strule	Abbey Bridge	0.088
Fairywater	Fairywater Bridge	0.113
Fairywater	Monaghan's Bridge	0.070
Camowen	Donelly's Bridge	0.070
Cloghfin	Lisboy Bridge	0.067
Drumragh	Campsie Bridge	0.060
Quiggery	Edergoole Bridge	0.093
Owenreagh	Shannaragh	0.080
Quiggery Water	Sessiagh Bridge	0.117
Quiggery Water	Ecclesville	0.053
Eskragh Water	Seskinmore Mill Bridge	0.130
Routing Burn	Browns Bridge	0.135
Roe	Roe Bridge	0.452
Cloghan	Reelan Bridge	0.084
Deele	Downstream of Raphoe STW	0.156
Greencastle		0.129

Source: Chemical monitoring during 1992, from both ES and DCC

It is generally considered that phosphorus is the limiting factor on eutrophication in freshwaters. This is based on the assumption that there is normally an oversupply of nitrogen compounds in freshwaters compared with phosphorus. Research indicates that plant growth is P limited when the ratio of N:P is greater than 10:1, although this ratio is associated with considerable uncertainty. The ratios of N:P for selected sites in the Foyle catchment are presented in Table F1.3.2.1 (b) and at all the sites the ratio of N:P is greater than 10:1.

TABLE F1.3.2.1 (b): AVERAGE NITRATE AND PHOSPHATE CONCENTRATIONS AND N:P RATIO

Site	Phosphate (SRP-P mg/l)	Nitrate (N mg/l)	N:P ratio
Mourne @ Strabane	0.084	1.23	14:1
Burndennet	0.062	1.4	22:1
Mourne @ Victoria Bridge	0.055	0.9	16:1
Derg @ Millbrook	0.051	1.53	30:1
Derg @ Crew Bridge	0.055	0.72	13:1
Owenkillew	0.051	0.57	11:1
Strule @ Moyle Bridge	0.078	1.43	18:1
Fairywater	0.06	0.95	16:1
Camowen	0.079	1.44	18:1
Drumragh	0.073	1.38	19:1
Roe @ Roe Bridge	0.063	0.89	14:1
Roe @ Limavady	0.065	0.9	14:1
Faughan	0.05	1.2	24:1
Finn	0.02	0.36	18:1
Deele	0.02	0.86	43:1

Source: Chemical Monitoring data from 1992.

F1.3.2.2 Algal biomass

Detailed data on algal biomass are not available. However, the biological monitoring reports contain site observation comments on algae and we have used these as a source of data.

Significant growths of Cladophora were noticed at 9 biological monitoring sites in the Northern Ireland section of the catchment. Information for the ROI side is not available. The sites are listed in Table F1.3.2.2. The information should be treated in context - some algal growths are localised above sampling stations and some river reaches are coated in blackweed. A more extensive survey is required to gain a better understanding of the distribution and abundance of algal species.

TABLE F1.3.2.2: BIOLOGICAL SAMPLING SITES AT WHICH ATTACHED ALGAE HAS BEEN OBSERVED

BRMP Site	River	Location	Details
11	Strule	Downstream of confluence with the Fairywater	Heavy growths of macrophytes and cladophora
14	Camowen	Downstream of the Killyclogher Burn	Cladophora present
15	Drumragh	Above the confluence with the Camowen	Cladophora present
22	Roe	Limavady	Heavy growths of Cladophora
29	Owenbeg	-	Cladophora present
180,182	Fairywater	Upstream of the Nestle discharge	Extensive growths of cladophora
203	Killen Burn	Below creamery discharge	Some cladophora present
205	Quiggery water	Below Fintona STW	High degree of nutrient enrichment - cladophora

Source: Site comments contained in the BRMP report.

F1.3.2.3 Diurnal variations in dissolved oxygen

Fluctuations in DO can be detected in chemical monitoring data as very low 10%iles. It is assumed that a "very" large diurnal variation in DO corresponds to the Fisheries Ecosystem Class FE3 or lower for the 10%ile value of DO. The sites where the 10%ile concentration of DO was equivalent to Class RE3 or less are presented in Table F1.3.2.3.

TABLE F1.3.2.3 LOCATIONS IN THE CATCHMENT WHERE STRONG DIURNAL VARIATIONS IN DO PROBABLY OCCUR

River	Site	10%ile DO level (% saturation)	Fisheries Ecosystem Class (DO)
Fairywater	Monaghans Bridge	44	5
Fairywater	Mullinatoomog	67	3
Eskragh	Seskinore Bridge	62	3

Source: Chemical monitoring data for 1992

F1.3.2.4 Reduction in invertebrates

From the analysis of biological monitoring results there are two sections of the catchment in which the biology shows stress and this stress could not be directly related to polluting discharges. These sections are the Eskragh Water and the Fairywater. The background comments on the state of the biology contained in the biological monitoring reports suggest that the stressed biology is a consequence of reduced DO levels that occur diurnally, i.e. eutrophication is the likely cause. It should be noted that nutrient enrichment does not always lead to a reduction in invertebrates as increased abundance of pollution tolerant taxa can result. The Fairywater supports much less dense macrophyte growth then Eskragh water so it likely that other factors are involved over and above elevated macrophyte growth caused by eutrophication.

F1.3.2.5 Macroflora - aquatic plants

A survey of aquatic plants throughout the catchment has not been undertaken therefore rigorous data on macroflora are not available. However, comments contained in the biological monitoring reports do contain useful observations on aquatic plant growths and these observations are used in this section. The locations where there are substantial plant growths were noted in the BRMP report are as follows:

- **Quiggery Water** downstream of Fintona.
- **Eskragh Water**.
- **Fairywater**.
- The **Strule** downstream of the confluence with the Fairywater
- The **Derg**

It should be noted that nutrient enrichment can result in increased abundance, changes in community structure and/or reduction in species diversity.

F1.3.2.6 Water retention time and velocities

It is very difficult to assess water retention times and flow velocities because river channel information is not available. The gradient of channels in the catchment has been considered in order to assess these factors using contour data from 1:50000 scale maps. Channels that are steep will have short retention times and higher velocities whereas channels that have a very flat gradient are likely to have a longer retention times and slower velocities.

Two sections of rivers in the catchment have noticeably flat gradients. These rivers and their gradients are as follows:

- The **Eskragh Water** which falls 10 meters over approximately 12 km.
- The **Fairywater** which falls less than 10 meters over 20 km.

These sections have all been subject to channel maintenance work which in most cases involves widening and deepening the channel and this work will tend to increase retention times. Further work ought to be done to determine retention times.

Research into eutrophication in rivers strongly suggests that a range of factors, including nutrient concentrations, influence plant growth. The relationship between the factors and plant growth is poorly understood although it appears that flow velocity has a strong influence on plant growth. Flow velocity may affect plant growth directly through sloughing processes or may influence the main impact of eutrophication, which is low DO concentrations, through aeration processes.

F1.3.2.7 Summary : Eutrophication matrix

In order to assess whether a section of river is eutrophic it is necessary to consider all the criteria listed above. The sections of the catchment that meet the criteria and are therefore potentially eutrophic are presented as a matrix Table F.1.3.2.7 (a) with the criteria that apply. A number of reaches in the catchment meet only one of the criteria for eutrophication and we have assumed that these reaches are not eutrophic.

The reaches which met two or more criteria are presented in Table F1.3.2.7 (b). Of these we suggest that the Eskragh and Fairywater are probably eutrophic whilst sections of the Quiggery Water, Routing Burn and Strule are potentially eutrophic. It should be noted that the annual average phosphate concentration in the Strule is 0.09 mg/l which is above the guideline concentration of 0.05 mg/l.

Of the 5 reaches classified as being eutrophic or potentially eutrophic it should be noted that only two, the Quiggery and the Strule, are affected by urban waste water discharges (Table F1.3.2.2). At the 3 remaining reaches other sources of nutrient inputs must be considered.

Phosphate levels are not particularly high in the areas which are defined as eutrophic and are low compared with other rivers. For example, average annual SRP-P concentrations on the Lagan are up to 1 mg/l, whereas on the Foyle concentrations are generally less than one tenth this value. Despite the low levels of P, some stretches of the Foyle do show signs of eutrophication and it appears that the Foyle is very sensitive to nutrient enrichment.

Very low flow velocities appear to be contributing to the eutrophication related problems in the catchment. An implication of flow velocity being important is that care must be taken when designing drainage schemes and channel maintenance. In some circumstances channel works may increase the potential of a reach to become eutrophic. Frequently drainage works increase the width and depth of a channel which will increase the retention time and decrease water velocities during low flows and may result in more favourable conditions for aquatic plant and algal growth.

TABLE F1.3.2.7(a): SECTIONS OF RIVER THAT MEET ONE OR MORE OF THE CRITERIA FOR EUTROPHICATION

River	Location	Criteria					
		Phosphate > 0.1 mg/l	Algal Growths	DO	Invertebrates	Aquatic Plants	Retention Time
Glenmornan	Ballymagorry Bridge	•					
Owenkillew	Monamneal Bridge	•					
Glenny	Sperrin	•					
Owenreagh	Drumlea Bridge	•					
Owenreagh	Cashel Bridge	•					
Glensawick Burn	Campbell's Bridge	•					
Strule	Moyle Bridge	•					
Strule	Stone Bridge	•					
Strule	Abbey Bridge	•				•	
Fairywater	Fairywater Bridge	•					
Fairywater	Monaghans Bridge	•					
Camowen	Donnelly's Bridge	•					
Cloghin	Lisboy Bridge	•					
Drumragh	Campsie Bridge	•					
Quiggery	Edergoole Bridge	•					
Owenreagh	Shannaragh	•	•		•	•	
Quiggery Water	Sessiagh Bridge	•					
Quiggery Water	Eccleaville	•		•	•	•	•
Estragh Water	Seskinore Mill Bridge	•					
Routing Burn	Brown's Bridge	•					
Foe	Roe Bridge	•					
Cloghan	Relland Bridge	•					
Deele	Downstream of Raphoe STW	•					
Greencastle		•	•				
Drumragh	Above confluence with Camowen		•			•	
Roe	Limaraday		•				
Strule	Downstream of confluence with Fairywater		•				
Camowen	D/S of Killyoougher Burn		•				
Roe	D/S of Dungiven		•	•	•	•	•
Owenberg	Roe System		•				
Fairywater	Above Nestle discharge		•				
Killen	Below Creamery discharge						

Source : Tables F1.3.2(a), (b) and F1.3.22

TABLE F.1.3.2.7(b): SECTIONS OF RIVER THAT MEET TWO OR MORE CRITERIA FOR EUTROPHICATION

River	Location	Criteria						Eutrophication Status
		Phosphate > 0.05 mg/l	Algal Growth	DO	Inverte-brates	Aquatic Plants	Retention Time	
Quiggery Water	Downstream of Finlona	•		•	•	•		Possible tendency to become eutrophic
Estragh Water		•	•	•	•	•	•1	Probably eutrophic
Routing Burn		•	•					Possible tendency to become eutrophic
Strule	Downstream confluence with the Fairywater	•	•			•		Possible tendency to become eutrophic
Fairywater	Above Nestle discharge		•	•	•	•	•1	Probably eutrophic

Source: Table F1.3.2.3
[1] Retention may be a factor at these sites, although further information is required to confirm this.

F1.3.3 Eutrophication in Freshwater Loughs

Routine water quality data for the freshwater loughs in the catchment are not available. However, the Water Executive have collected water quality data which is specific to eutrophication. In this section this data is used to assess the trophic status of Loughs Braden, Fingrean and Macrory which are the only loughs for which data are available using the classification system presented in Section D. This system and associated targets for the freshwater loughs in the catchment use chlorophyll-a data.

F1.3.3.1 Available data

The Water Executive collect data on algae for the following Loughs:

- Braden: Chlorophyll-a data for the summer months (May-September) over the period 1989-93
- Fingrean: as Lough Braden
- Macrory: Chlorophyll-a data for the summer months for 1990 and 1993.

F1.3.3.2 Results

A summary of the data together with the trophic class and target class are presented in Table F1.3.3.2. The data have been collected for the summer months and do not represent and annual mean. It is suggested that the annual maximum of chlorophyll-a may be a more reliable indicator than a mean which is based on data for the summer months.

Lough Fingrean achieves its target class whilst Lough Braden has failed to meet its target and has been classed as eutrophic in 1989 and 1990. Very limited data exist for Lough Macrory although these data indicate that the lough is eutrophic. The data confirm reports from staff from the Water Executive that Loughs Braden and Macrory do suffer from algal blooms and that these blooms do, on occasions, cause problems for water treatment.

The source of nutrients which are causing the algal blooms is unknown, but probably comprises a combination of septic tanks and agricultural sources.

TABLE F1.3.3.2: QUALITY OF FRESHWATER LOUGHS BASED ON TROPHIC STATUS

Lough	Chlorophyll-a (µg/l)		Number of samples	Trophic class	Target class
	Mean	Maximum			
Fingrean					
1989	8.65	11.47	10	Mesotrophic	Mesotrophic
1990	6.24	12.51	14	Mesotrophic	Mesotrophic
1991	5.04	10.43	12	Mesotrophic	Mesotrophic
1992	9.22	12.5	5	Mesotrophic	Mesotrophic
Braden					
1989	17.83	36.49	10	Eutrophic	Mesotrophic
1990	13.8	48.5	12	Eutrophic	Mesotrophic
1991	3.36	8.34	16	Mesotrophic	Mesotrophic
Macrory					
1993	24.5	59.8	6	Eutrophic	Mesotrophic

Source: Data collected by the Water Executive.

F1.4 OVERALL TARGETS AND DISCUSSION

In this section the overall, or "integrated" targets are considered. The integrated targets are based on an assessment of chemical and biological (macro-invertebrates) criteria. The existing overall classes are shown in Map 33. The reaches which failed to achieve the target class are presented in Table F1.4 and displayed in Map 35 together with a brief description of the reason for the failure. The physical cause of the failure to meet the target class, such as the impact of a point source discharge, is then discussed.

TABLE F1.4: REACHES WHICH FAILED TO MEET THEIR TARGET CLASS

River	Reaches	U/S	D/S	Overall Target Class	Actual Class	Comments
Derg	Glendergan to Mourne Beg conf.	H149791	H230838	FA	FB	Elevated BOD
Derg	WTW to conf. Strule	H32586	H367878	FA	FA/FB	Variable biology above Ardstaw
Glendergan R.	Source to conf. with Derg.	H053839	H149791	FA	FB	Elevated BOD
Fairywater	Source to Clare Bridge	H243785	H293802	FB	FD	DO/Poor biology
Fairywater	Clare Bridge to conf. with Drumquin	H293802	H354771	FB	FD	DO/Poor biology
Strule	Conf. Owenkillew to conf. Derg	H409861	H367879	FA	FB	BOD/DO
Strule	Conf. Cappagh Burn to conf. Owenkillew	H435795	H409861	FA	FB	BOD/DO
Strule	Conf. Fairywater to conf. Cappaghburn	H431749	H435795	FA	FB	BOD/DO
Strule	Omagh STW to conf. with Fairywater	H443737	H431749	FA	FB	BOD/DO.
Strule	Source to Omagh STW	H45478	H443737	FA	FB	BOD/DO
Cappaghburn	Source to conf. with Strule	H502818	H435795	FA	FB	DO
Owenreagh	Source to conf. with unnamed tributary receiving effluent from Dromore STW	H272626	H364651	FA	FB	Low DO levels
Routing Burn	Source to confluence with Eskragh Water	H591622	H501618	FB	FC	Low DO levels, high ammonia, BOD
Eskragh Water	Confluence with Routing Burn to conf. with Quiggery Water	H501618	H456650	FA	FD	DO, moderate biology (eutrophic conditions).
Quiggery	Fintona STW to conf. with Eskragh	H447615	H456650	FA	FB	Low DO levels, biology
Cloghfin	Conf. with Glenannes Burn to Camowen	H572671	H509707	FA	FB	Low DO levels
Killyclogher Burn	Bridge to confluence with Camowen	H472739	H467728	FB	FD	High BOD and ammonium, poor biology.
Camowen	Conf with Grannagh Burn to conf. with Cloghfin	H603712	H510708	FA	FB	DO
Faughan	Tidal Limit to Drumahoe Bridge	C463150	C488201	FA	FB	BOD
Faughan	Conf. Burntollet to Drumahoe Bridge	C500108	C464150	FA	FB	Moderate Biology
Roe	Conf. Gelvin River to Dog's Leap	C689143	C672211	FA	FB	Moderate Biology
Glenmornan River	Artigarvan to Tidal Limit	C382011	C359041	FB	FD	High BOD
Mourne	Conf. Derg to Weir at Sion Mills	H367879	H347932	FA	FB	High BOD

River	Reaches	U/S	D/S	Overall Target Class	Actual Class	Comments
Mourne	Weir at Sion Mills to Strabane	H347932	H346974	FB	FB	High BOD
Burn Daurnet	Weir to conf. with Finn	H135938	H144943	FB	FC	Biology
Finn	Stranolar STW to Killgordon Bridge	H153946	H205938	FB	FD	High BOD
Finn	Killygordon Bridge to U/S Castle Finn STW	H205938	H262947	FB	FC	Low DO
Swillyburn	Raphoe STW to N14 Bridge	H260019	H304026	FB	FC	High BOD
Swillyburn	N14 Bridge to conf. with Foyle	H304026	H355047	FB	FC	Low DO
St Johnston Burn	St Johnston to conf. with Foyle	H345099	H350099	FB	FC	Low DO
Burnfoot	Source to tidal limit	C172643	C638252	FB	FC	Poor Biology
Lough Macrory						Eutrophic
Lough Bruden						Eutrophic

Source: All preceding sections

F1.4.1 Discussion: Reasons for failure to comply with targets

F1.4.1.1 Derg System

Three reaches in the Derg system failed to meet their target class.

- Upper Derg
  Elevated BOD levels cause the failure to comply with the target class in the Upper Derg. Possible sources of BOD include a fishfarm.

- Glendergen
  Like the Derg, high BOD levels caused the failure to reach the target class. There is no obvious source of BOD. Further investigation is required.

- Lower Derg
  A toxic discharge of unknown origin appears to be having a severe impact on the instream ecology.

F1.4.1.2 Fairywater

Two reaches of the Fairywater failed to achieve their target class and the failures are of particular concern because they indicated very poor water quality conditions. The reasons appear to be diurnal variations in DO which are probably caused by a combination of very slow river velocities together with nutrient enrichment, probably from agricultural sources. The low water velocities may be directly attributable to drainage activities.

F1.4.1.3 Strule

The Strule over its entire length failed to meet its target class as a consequence of high BOD and/or low DO. There are a number of discharges to the reach, including dairies, fishfarms and sewage treatment works. The low DO levels are probably attributable to aquatic plant growth, which suggests that the Strule may be sensitive to eutrophication. A lack of data for point source discharges precludes an analysis of nutrient sources (discussed further in section F4). Further investigation on the trophic aspects of the Strule may be warranted in addition to further investigation into sources of BOD.

F1.4.1.4 Cappaghburn

The reason for the low DO in the Cappaghburn is unknown.

F1.4.1.5 Owenreagh

The reason for the low DO in the Owenreagh may be related to eutrophication. The Biological Monitoring Report comments that there is abundant plant growth.