Initial Review of the key requirements of the Economics and Environment Guidance and Accompanying Documents insofar as they apply to implementation of the Water Framework Directive in the Shannon Pilot River Basin

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Abbreviations

BAT:	Best Available Technology
CAP:	Common Agricultural Policy
EEGD:	Economics and the Environment Guidance Documents
ESB:	Electricity Supply Board
DoEHLG:	Department of Environment Heritage and Local Government
DBO:	Design Build Operate
DBOF:	Design Build Operate Finance
DBF:	Design Build Finance
FCR:	Full Cost Recovery
GDP:	Gross Domestic Product
WFD:	Water Framework Directive
WATECO:	Economics/Water Framework Directive Working Group
NDP:	National Development Plan
PRB:	Pilot River Basin
RBD:	River Basin District
RBMP:	River Basin Management Plan
REPS:	Rural Environmental Protection Scheme
SRBD:	Shannon River Basin District
IPC:	Integrated Pollution Control

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Executive Summary

The EU Water Framework Directive (WFD) (2000/60/EC) is the legal framework within which stakeholders using the water resource have to operate. The Directive aims to achieve good water status for all waters, in the most effective manner by 2015. The WFD clearly integrates economics into water management and policy making. The Directive calls for the application of economic principles (e.g. the polluter pays principle), approaches and tools (e.g. water pricing) for achieving its environmental objectives, i.e. good water status for all waters, in the most effective manner.

The Department of the Environment, Heritage and Local Government is currently funding the establishment of river basin management projects, through the National Development Plan, as a key element of implementing the Water Framework Directive in Ireland. The overall objective of the projects is to develop River Basin Management Systems, including a programme of measures designed to maintain and/or achieve at least good water quality status for all waters by 2015. These projects, primarily co-ordinated through the Local Authorities, are established on the basis of River Basin District (RBD) areas.

A range of *Guidance Documents* (and related annexes), where developed by specific working groups and disseminated by the European Commission to assist member states in implementing the elements of the WFD. Ireland has established the Shannon River Basin as a Pilot River Basin (PRB), which is one of a network of fifteen PRBs in the EU tasked with testing these guidance documents in advance of actual WFD implementation. The *Economics and Environment Guidance Documents* (EEGD) and related Annexes aid member states implement economics into water management. Annex 1 of this report outlines member states economic assessment obligations under the WFD to 2015. Article 5 of the WFD requires member states to submit a report for each RBD by December 2004 on the following three elements: an analysis of its characteristics; a review of the impact of human activity on the status of surface waters and on groundwater; and an economic analysis of water use.

This small-scale study reviewed, using the *Economics and the Environment Guidance Documents* (EEGD) with data collated from the Shannon PRB and key stakeholders, the following key issues – analysis of these issues is required to fulfill obligations under Article 5 due in December 2004:

- Assessment of Economic Significance of Water Uses;

The review identified agriculture, municipalities and industry as significant water users at the PRB (herein referred to as Basin). Agriculture is the principal activity in the Basin with dairying, pig and poultry production the principal water users. Surface water and groundwater remain key sources of drinking water for municipalities, with per capita demand for water increasing as a consequence of economic development in the Basin. Pharmaceutical, medical components, clothing, telecommunications, light mechanical and electrical plants, hydro-generation power, aquaculture and tourism (angling/boating) are the key industrial sectors and additional significant water users in the Basin. There are 118 Integrated Pollution Control (IPC) License holders in the Basin.

- Projection of Trends in Key Indicators and Drivers up to 2015;

An overarching driver likely to affect pressures in the Basin is the implementation of the National Spatial Strategy (through the establishment of Regional Gateways and strategic urban centres) and the National Development Plan (NDP) 2000-06 (by altering output/economic strength and income/economic welfare from a regional perspective) – impacting on infrastructure, demography, investment and growth patterns – and influencing demand for the development of water services. While the National Spatial Strategy and National Development Plan provide a good overview of trends, it is notable that more detailed assessment at River Basin District (RBD) scale is required in

order to meet the requirements of Article 5. The National Development Plan (2000-06), through the Water Services Investment Programme, provides for significant capital investment in water and wastewater services. Critical uncertainties revolve around issues such as the type of agricultural production and climate change. Nationally, the decoupling of production from grants under the reformed CAP programme will have further implications for farm sizes and water usage in the coming decade, while climate change will see a lowering of water tables and ability to abstract groundwater.

- Assessment of Current Cost Recovery.

Assessing current levels of recovery of costs of water services, in accordance with Article 9 of the WFD, requires investigation of key elements such as: the status of water services; the extent of the recovery of costs (financial, environmental and resource cost) of these services; the institutional set-up for cost-recovery and the contribution of key water uses to the costs of water services. Due to the lack of information available at the RBD scale for this review, the assessment of cost recovery was viewed nationally. Generally, the Department of Environment, Heritage and Local Government, in co-operation with Local Authorities through the Water Pricing Framework and Water Services Bill, is progressively augmenting cost recovery levels nationally. Nevertheless, several factors inhibit comprehensive cost recovery including the lack of contribution to cost recovery of environmental costs – such as public amenity values/social and community benefits, resource and opportunity costs; the lack of comprehensive estimates of costs of water services in the domestic sector; the lack of comprehensive metering of all water users and the lack of cost information on water abstractions and leakages. The development of proper baseline data by local authorities on water and wastewater systems must be a priority, in order to permit proper quantification of the true cost of providing these services.

This small-scale study was undertaken within a limited timeframe. It is evident that if data had been more accessible a more rigorous assessment could have been carried out. An overarching issue was that of scale. Information sources while available nationally, were not readily available at RBD scale. In order to undertake the economic characterisation report under Article 5, further efforts need to be employed by organisations to facilitate efficient information gathering. Education and awareness of water management issues is essential to get acceptance of economic measures.

Section 1

1.1 Theoretical Background

In the increasingly popular debate over the sustainable use of natural resources, of particular interest to natural resource managers are the problems associated with resources that are held in common. In this debate, Hardin's 'Tragedy of the Commons' thesis (1968), which predicts overexploitation, degradation and eventual ruin of collectively used resources as a result of the user's rational incentive to maximize his own utility, has become a strong symbol of the problems of common-pooled resources.

Increasingly it is acknowledged that the important resource management issue is balancing the interests of different users involved in different *types* of uses. This implies, *inter alia,* that collective action among the user groups is required to agree rights about access to, allocation of and control over the resource, since resource uses by the separate user groups are interdependent.

1.2 Practical Background and Context

Environmental capital comprises those facets of our natural existence that we somehow share in common, which are not easily appropriated and transacted in markets, water being a prime example. Water consumption is an income-elastic good, which is to say, as incomes grow, people tend to consume more. Nevertheless, development levels of cities, towns and rural localities must be commensurate with their natural endowments.

Charging for water which reflects the long run marginal costs of supply, i.e. treatment costs increase (spanning primary to biological and chemical) as volume consumed increases, is a pre-requisite for effective management, and for stabilizing or even reducing per capita consumption. Most cities in the EU apply water charges, but for many the levels are too low to reflect costs fully and to induce the variety of users to conserve. Efficient management of scarce resources requires that users be charged prices that reflect the costs at the margin of supplying the good or service; it is also the essence of the 'polluter pays' principle. This concept is gradually being applied in many Member States in regard to resources such as water.

The EU Water Framework Directive (WFD) (2000/60/EC) is the legal framework within which stakeholders in the resource have to operate. The Directive aims to achieve good water status for all waters, in the most effective manner by 2015. The WFD clearly integrates economics into water management and policy making. The Directive calls for the application of economic principles (e.g. the polluter pays principle), approaches and tools (e.g. water pricing) for achieving its environmental objectives, i.e. good water status for all waters, in the most effective manner.

Ireland has established the Shannon River Basin as a Pilot River Basin (PRB) in the Ireland and Northern Ireland ecoregion of the WFD. The Department of the Environment, Heritage and Local Government is currently funding the establishment of river basin management projects, through the National Development Plan, as a key element of implementing the Water Framework Directive in Ireland. The overall objective of the projects is to develop River Basin Management Systems, including a programme of measure designed to maintain and/or achieve at least good water quality status for all waters by 2015. These projects, primarily co-ordinated through the Local Authorities, are established on the basis of River Basin Districts (RBD).

The Shannon RBD Management System is the second project implemented in support of this catchment based national strategy, following on from the South Eastern RBD Management System initiated in Spring 2002. The Shannon RBD comprises Hydrometric Areas 23, 24, 25, 26, 27 and 28,

including all areas of the following Local Authorities: Cavan, Longford, Clare, Mayo, Cork, Meath, Galway, Offaly, Laois, Roscommon, Leitrim, Sligo, Kerry, North Tipperary, South Tipperary, Limerick and Westmeath. Limerick City Council is also included.

The EU Common Strategy on the Implementation of the WFD provides for the preparation of Guidance Documents by Working Groups on several technical issues and for the integrated testing of these guidance documents in PRBs. PRB testing is currently being carried out through a research fellowship under the Environmental Protection Agency's ERTDI Programme 2000-2006.

The overall aim of the PRBs at European level is to ensure that the guidance documents produced by the Common Implementation Policy Working Groups are applicable to and workable within all River Basin Districts across Europe. Guidance documents produced at a pan-European level may be expected to be incomplete or to ignore particular local conditions within an individual RBD on the one hand, and on the other they may impose unnecessary burdens at national or local River Basin District (RBD) level. Further information on the activities of the PRB network are available at the website of the Joint Research Centre of the European Commission (http://viso.ei.jrc.it/wfd_prb/index.html).

1.3 Outputs

The purpose of this small-scale study is to *undertake an initial review*, using the *Economics and the Environment Guidance Documents* with data collated from the Shannon PRB and key stakeholders, of the following key issues:

1. Assessment of Economic Significance of Water Uses;
2. Projection of Trends in Key Indicators and Drivers up to 2015;
3. Assessment of Current Cost Recovery.

Additional issues contained in the Terms of Reference were:

1. Collation and documentation of all available information (from the EU WATECO Group) on economic analysis for WFD;
2. Liaise, assess and report on the current understanding of the economic aspects of the WFD by government and key stakeholders.

Section 2

2.1 Introduction to the Guidance and Accompanying Documents

The EU Water Framework Directive (WFD) establishes a framework for the protection of all water bodies (including: inland surface, transitional, coastal and groundwater) and achievement of good water status for all waters by 2015, primarily through the development of River Basin Management Plans (RBMPs). The *Economics and the Environment Guidance Documents – The Implementation Challenge of the Water Framework Directive* (EEGD) and related illustrative Annexes, referred to below, provide a framework for Member Countries to tackle the analysis of economic components required by the WFD. Because of the diversity of circumstances within the European Union (EU), it is expected that the methodology outlined in the EEGD may need to be tailored to specific circumstances i.e. it is important to refine the boundaries and focus of the economic analysis in line with the water policy and water management reality faced by each Member State. Thus, developing the economic analysis in Ireland needs to account for Irish water conditions, concerns and on-going policy process[1]. Deadlines for the completion of the economics analysis tasks required by the Directive arise towards the end of the River Basin Management Plan (RBMP) period (2009).

The EEGD documents propose an overall methodological approach for this economic analysis, focusing on its implementation in the broader context of the development of integrated RBMPs as required by the Directive.

Key issues in relation to the WFD that are ***not*** contained in the EEGD include:

- How to develop incentive pricing policies (Article 9);
- How to develop and implement other economic and fiscal instruments as mentioned in Annex VI;
- How to develop an economic analysis for supporting the development of penalties that provide incentive according to Article 23.

2.2 The role of economics in water policy

The analysis of economic components required by the WFD is a process of providing valuable information to aid decision-making by stakeholders and the public. For example, discussing significant water management issues in a river basin is likely to require information not only on users, polluters and environmental impacts but also on costs, who pays (via water prices, pollution charges, environmental taxes etc), who gains and who suffers from the current situation within and between sectors.

The WFD calls for the application of economic principles (e.g. polluter-pays principle), economic approaches, tools (e.g. cost effectiveness analysis) and instruments (e.g. water pricing) to water management / river basin management.

[1] This is a resource intensive exercise, requiring money, capacity and people (specialist training comprising technical training for economists and economic training for technical experts). If resources are not available, it is crucial to assess and agree on priorities with stakeholders/experts responsible for the development of the River Basin Management Plans (RBMPs) and the implementation of the Water Framework Directive (WFD). However, the financial resources required for developing the right process for the economic analysis will remain minimal as compared to those required for implementing measures to achieve the environmental objectives of the Directive.

The key requirements of the EEGD are summarised in the following section.

2.3 Providing a coherent frame for the economic analysis

The EEGD provides a coherent and logical framework for the economic analysis required by the WFD through a three-step approach, spanning 2004 to 2010:

Step 1: **Characterising the river basin in terms of the economics of water uses,** looking at both the economic importance of water uses and the dynamics of the river basin in terms of expected changes in key economic drivers and driving forces up to 2015:

Step 2: **Identifying water bodies or groups of water bodies at risk of not achieving the environmental objectives of the WFD by 2015**, i.e. identifying the gap between likely water status and good water status (risk of non-compliance). This step integrates the assessment of today's pressures and impacts with the analysis of likely future trends in key economic drivers and driving forces. Here, the economic analysis will use a high level of input from more technical analysis.

Step 3: **Supporting the development of the programme of measures to be integrated into the RBMPs through cost-effectiveness analyses** and justifying, from an economic point of view, (through cost/benefit assessments) possible derogations required.

Collectively, the three-steps required between 2004 to 2010 aid the assembly and analysis of key economic components required for the preparation of the RBMP (Article 13). Post 2010 requirements include operational measures of the programme by 2012 (Article 11) and implementing the programmes of measures and achieving the environmental objectives by 2015 (Article 4).

The requirements for Step 1 - Characterisation of river basin in terms of the economics of water uses -, which is the focus of this document, are summarised below, with the full framework for all three steps outlined in more detail in Annex 1.

Step 1 - Characterisation of river basin in terms of the economics of water uses

Step 1.1 Assessing the Economic Significance of Water Uses at the RBD

- Identify human pressures on water bodies.
- Localise water uses in the river basin district.
- Identify water uses and services by socio-economic sector (agriculture, industry households and recreation).
- Assess the relative socio-economic importance of water uses.
- Identify areas designated for the protection of economically significant aquatic species (an implicit economic function of the economic analysis).
- Initial characterization of Heavily Modified Water Bodies[2] (**EEGD-Annex *II)*** (an implicit economic function of the economic analysis).

Step 1.2 Projecting Trends in Key Indicators and Drivers up to 2015[3]

- Assess trends of key hydrological and socio-economic drivers that are likely to affect pressures (demography, climate, sector policies, e.g CAP).

[2] Post 2004, the designation of Heavily Modified Water Bodies requires an assessment of 'significant adverse effects' and 'disproportionate costs'. See page 21 of the EEGD for further linkages. Also see **EEGD-*Annex IV.II***

[3] This will aid planning investments for the water industry.

- Identify proposed measures and planned investments for implementing existing water legislation.
- Forecast changes in pressures based on changes in economic and physical drivers and proposed water-related measures.
- Construct a Business as Usual (BAU)[4] scenario, identifying optimistic and pessimistic scenarios (with sensitivity analysis).

Step 1.3 Assessing Current Cost-Recovery

- Estimate costs of water services, including financial, environmental and resource costs.
- Estimate the price/tariff currently paid by users.
- Assess the extent of cost recovery by water services and sector.
- Assess the contribution to cost recovery from key water uses.
- Description of the institutional mechanisms in place for cost recovery.
- Optional (unrealistic at this stage for the SRBD): to initiate a review of incentive pricing properties of existing tariffs.

2.4 2004 - The First Milestone for the Economic Analysis

The first key milestone in the WFD implementation process is the characterisation of the river basin districts by 2004 (as referred to primarily in Article 5 of the WFD and related EEGD-Annexes). It is also the first milestone for the economic analysis, requiring the river basin district to:

- **Undertake the economic analysis of water uses**[5]
  The main objective is to assess how important water is for the economic and socio-economic development of the RBD. This involves investigating economic sectors that have significant pressures and impacts on water resources (see **EEGD-*Annex II***), and identifying uses such as water recreation, angling, etc that benefit from a good-quality water environment. These general economic indicators are to be computed at the scale of the RBD. For economically significant aquatic species, greater resolution according to location within the river basin maybe required. By investigating potential tradeoffs between socio-economic development and water protection, this analysis paves the way for the identification of significant water management issues to be reported to the public by 2007 and the following cost-effectiveness analysis of measures. This analysis will use primary data (easily available statistics and information) to the scale of the RBD;

- **Investigate the dynamics of the river basin and provide economic input into the development of the baseline scenario and the water body 2015 risk-assessment.**
  The economic analysis will assess forecasts in key economic drivers and driving forces likely to influence pressures and ultimately the gap between likely water status and good water status (risk of non-compliance). The focus will be on changes in general socio-economic variables, key sector policies and investments in the water sector. This analysis will feed into the identification of significant water management issues for 2007, while also providing content for the subsequent cost effectiveness analysis of measures;

- **Assess current levels of recovery of water services' costs, in accordance with Article 9 of the WFD.**
  The main elements to be investigated include the status of water services, their institutional framework, the extent of the recovery of the costs of these services (financial, environmental

[4] See for example the Oise case study (in **EEGD-*Annexes IV and VI***).
[5] Overall, the analysis should remain proportionate and not entail extensive collection of new data.

and resource costs versus prices) and the contribution of key water users to the costs of these services. This assessment of cost recovery for the 2004 characterisation report will focus on these costs being described in a qualitative manner. Gaps in information and knowledge will be flagged in the characterisation report for ensuring a full scale cost-recovery assessment can be reported in the RBD by 2009;

- **Prepare for the cost-effectiveness analysis**
  This will include the collation of data on costs associated with measures[6], in particular financial and non-site specific costs and basic measures (i.e. measures that need to be implemented because of existing European legislation). Identifying and filling in data and knowledge gaps will ensure that the economic characterisation can be improved and the follow-up cost-effectiveness analysis adequately and timely performed by 2008.

The Water Framework Directive contains specific reporting obligations for the economic analysis component. Most of the obligations refer to computed indicators at the scale of the river basin or river basin district and are shown in Table 1.4 below:

Table 1.1 Specific Reporting Obligations for the Economic Analysis

Component of the Economic Analysis	Reporting requirements defined in the Water Framework Directive
Characterisation and trend analysis	1. Economic importance of water uses (River Basin Scale) 2. Trends in key drivers and pressures, e.g. water supply and demand (River Basin Scale) 3. When required: trends in investments (River Basin Scale)
Economic Analysis for selecting measures	1. Total costs of cost-effectiveness set of measures (River Basin Scale) 2. Benefits and costs of alternatives measures in case of derogation (Water Body Scale or possibly Sub-River Basin or coherent group of Water Bodies scale)
Assessing cost-recovery and pricing	1. Cost-recovery for water services (River Basin Scale) 2. Contribution of water uses (agriculture, industry, households) to cost-recovery (River Basin Scale/Economic Sector Scale) 3. Social, economic and environmental impact for justifying proposed cost-recovery (River Basin Scale/Economic Sector Scale)
Key Assumptions and Information Use	1. Quality and uncertainties of information used and assumptions made (River Basin) 2. Proposed data collection (and related costs) for filling key information gaps (River Basin Scale, possibly national proposals).

The *WATECO* EEGD stresses key principles for implementing the economic elements of the WFD. Overall, the economic analysis needs to be:

- **Integrated** with other disciplines and technical assessments: Economic elements are linked and must be integrated e.g. with technical information. This is a central concept and is seen as the key to management of water protection within the RBD. It applies throughout the river basin planning process, from the characterisation of the river basin district to the selection of measures based on cost-effectiveness or cost/benefit assessments. Integration of the following variables is seen as key: environmental objectives; all water resources; all water uses, functions, values and impacts; disciplines, analyses and expertise; a common and coherent framework of legislation; a common management approach to pricing, economic and financial

[6] It is proposed to develop a cost-database for a wide range of measures likely to be investigated. The database will contain variables such as cost information on infrastructure costs and measures such as wetland restoration, demand management measures, new pricing and voluntary agreements such be included. A range of cost should be collated (minimum, average, maximum) as opposed to single average values. Costs should include all costs that are non-site specific, e.g. limited to financial costs of measures or specific environmental costs (e.g. air related), and also indirect economic costs when considered relevant. Wider economic costs that are non-site specific may also be added to the database if required. This information will facilitate follow-up disproportionate cost analysis and provide support for possible derogations.

instruments; the inclusion of stakeholders and civil society in decision making; different decision making levels influencing water resources and water status; and the integration of water management lessons from different Member States;

- **Proportional:** i.e. putting emphasis and efforts where there is something at stake, be it conflicts over water resources or between socio-economic development and water protection;
- **Policy-relevant:** clearly helping better decision-making in terms of identifying significant issues, selecting measures or justifying possible derogation.
- **Iterative and gradual**: The economic analysis is unlikely to be initially as complete as required but, while not all the required information may be available at the start, it is important to commence the analysis and develop it in iterations. This will also help to identify gaps in information and knowledge that will need to be filled to ensure the analysis can be improved and adapted to requirements;
- **Participatory**: The economic analysis builds on stakeholder information and knowledge[7]. Stakeholders need to be informed and consulted about proposed approaches, methodologies and expected output, and may be directly involved in relevant parts of the economic analysis;
- **Transparent:** All methods, tools and results need to be explained and presented in a transparent manner within the wider obligations relating to the promotion of active *participation*[8] of all interested parties in the development of RBMPs (Article 14 of the WFD).

There is an overarching emphasis in the EEGD on collaborative/shared, practical and operational approaches that can be applied by practitioners dealing with the development of integrated river basin management plans in order to enhance the information and knowledge base at each step.

[7] Table 1, p 50 of the EEGD – *'Key Stakeholders can be Very Important Source of Information and Expertise'* - highlights where stakeholders can help with information and expertise. There are different approaches for integrating stakeholders' and public concerns and knowledge into the economic analysis and **EEGD-*Annexes IV.I and V.II*** highlight country case studies in this regard.

[8] The Directive only specifies key dates for consultation. Specific dates for the *participation process* are not specified: this will depend on local institutions and socio-economic set-up. However, it will be important to start the *participation process* early (as part of the characterization of the river basin before 2004) to improve effectiveness.

Section 3

3.1 Introduction

This section details analysis of Step 1.1, 1.2 and 1.3 (and related tasks) in relation to Step 1 of the EEGD – Characterisation of the river basin in terms of economics of water uses. The core objective of Step 1 of the EEGD is to assess how important water is for socio-economic development of the RBD: investigating economic sectors that have *significant pressure and impacts* on water resources. The deadline for submission of Step 1 by relevant Member States is December 2004.

3.2 Step 1.1 Assessing the economic significance of water uses at the RBD

Task 1. Identify human pressures on water body

Agriculture, municipal areas[9] and industry impose pressures and impacts on the water body within the SRBD. Urban/rural/septic tank sewage continues to cause surface water pollution. The main concern regarding the quality of groundwater is its protection as a source of drinking water and for use in food processing and related industrial operations. Special measures are needed to protect the quality of groundwater in areas where large amounts of waste are stored or where wastes are applied to land.

The major lake in the SRBD is Lough Derg. Previous studies by the Environmental Research Unit (ERU) (1992/93) concluded that Lough Derg's water quality had deteriorated as a result of increased amounts of nutrients such as phosphorous and nitrogen being discharged to surface waters in the lake catchment, causing increased algal growth and subsequent eutrophication or excess demand for oxygen. The ERU recommended improved effluent[10] treatment facilities at a number of locations together with changes in farm practice and other measures. Subsequent monitoring of the lake has shown a significant amelioration in the symptoms of eutrophication and chlorophyll concentration, due to in part the completion of a major programme of remedial measures, such as waste treatment works serving the major urban centres and but also to the invasion of Zebra mussels, which filter off the algae from the water.

Many of the point-source or end of pipe discharges from industrial sites have been greatly reduced through market-driven technological changes and legislative/licensing requirements such as Integrated Pollution Control (IPC). Nevertheless, far more numerous and harder-to-control non-point sources of pollution, including many illicit discharges from small pipes, still remain undetected.

Task 2. Localise water uses in the RBD

Groundwaters in counties Carlow, Cork, Kerry and Waterford have been identified by a panel of experts as being polluted or susceptible to pollution by nitrates from agricultural sources[11]. The areas with the highest levels of total diffuse nitrates from all sources are the more productive land areas in the South and East of the country.

[9] The significant source of urban pollution is run-off from impervious surfaces and significant source of agricultural pollution is excessive nitrates and phosphates mostly in non-point source run-off.
[10] Effluent databases installed in each of the local authorities with the specific purpose of standardizating data capture/reporting procedures are not in all cases being used.
[11] Lehane et al (2002).

High nitrate loadings from animal manure occur in counties Cork, Tipperary and Limerick and are accounted for by intensive dairying in these areas[12]. Intensive agriculture – associated water use for landspreading etc. in the SRBD comprises of pig and poultry rearing (such enterprises in the Lough Derg & Lough Ree Catchment[13]), generating high volumes of organic materials, disposed of by landspreading. The areas of pig production have expanded into the counties of Westmeath and Longford, adjoining the traditionally strong production counties of Cavan and Monaghan, which have declined[14]. Bye-laws[15] implemented in the SRBD to tackle phosphate levels in surface water include Cavan County Council (Water Pollution) (Agriculture) Bye-Laws 2000; Cork County Council (Regulation of Agriculture Practice in the Catchments of the River Lee and River Gradogue and the River Funshion) Bye-Laws 1999; Tipperary (North Riding) County Council (Water Pollution) (Agriculture) Bye-Laws 2000; Offaly County Council (Water Pollution) (Agriculture) Bye-Laws 2001; Roscommon County Council Bye Laws for the Control of Agricultural Waste, 2001.

In Ireland, about 25% of the drinking water we use comes from groundwater and this figure will undoubtedly rise in tandem with socio-economic development. However, a much higher proportion of water comes from groundwater in some SRBD areas such as Roscommon, Laois and Offaly. Fifty per cent of Ireland's groundwater is considered 'developable' meaning that we could extract it relatively easily. At present we extract less than 2% of the developable groundwater and of this, public bodies use 36%, industry uses 37% and the remainder is used for rural domestic supplies.

Task 3. Identify water uses and services by socio-economic sector

Information on the principal socio-economic water users: **Agriculture, Municipalities** and **Industry** is detailed below.

Agriculture

Large-scale development of farmyards has been required to accommodate the growing numbers of livestock made possible by the increasing the use of fertiliser and the change to silage for winter-feeding. Post-EEC membership, national cattle numbers increased from 7.5 million in 1978 to 7.9 million in 1998, and sheep numbers increased from 3.3 million to 8.4 million during the same period. From 1981 to 1988, sales of nitrogen fertilisers nearly doubled[16]. Nationally and regionally, agriculture plays a sizeable role in the Irish economy, with a distinct spatial distribution of agriculture sub-regions evident – tillage, lowland sheep, dairying. Agriculture is the principal activity in the SRBD, dominated by pasture/grassland (circa 70% cover- with prominent milk and meat processing – all intensive water users). Tillage crops, evergreen trees and deciduous broadleaf trees are comparatively minor

[12] The potential economic impact of policies to constrain nitrogen use was stimulated for a sample of specialise dairy farmers in Munster, using individual farm Positive Mathematical Programming (PMP) models. The results showed that compliance with restrictions on nitrate use would reduce income on all of the selected farms. The results also indicate that these farms could partly or wholly offset the loss by increasing the efficiency of nitrate (N) use, or by increasing milk production per cow. However, the more the farm was above the regulation 2 Livestock Units (dairy cows) per hectare the larger the potential loss of income and the more difficult it would be to make good this loss. Farms starting with fewer than 2LU/ha but applying in total more than 260kgN/ha (REPS rule) would find that meeting this target would cause a lesser reduction in income. This loss would also be made easier to offset by efficiency increasing measures. With regard to the scenario of imposing a 10% tax on sales of manufactured N fertilisers, the results showed this to be very ineffective in reducing the amounts used. In some cases the imposition of a tax would have no effect whatsoever on the amount of N used yet would slightly reduce incomes on all of the nations farms (Lally & Riordan 2001).

[13] Areas of high concentration in the Lough Derg/Ree include the Camlin River catchment, the Lough Sheelin catchment and the Ollatrim River catchment – it was recommended that significant pig and poultry rearing installation be required to prepare a Nutrient Management Plan or alternatively an IPC license (Lough Derg/Ree, 2001).

[14] See National Spatial Strategy (2002).

[15] Phosphorus Regulations; S.I. No. 258 of 1998. Local Government (Water Pollution) Act, 1977 (water Quality Standards for Phosphorus) Regulations, 1998.

[16] See Encyclopedia of Ireland, 2003

Approximately 11% of the SRBD is covered by peat bogs[17]. Intensive agriculture, in the form of pig and poultry production (and associated water demand) has been undergoing major structural change. The main thrust of the reform in both sectors has been the concentration of production into a smaller number of larger units, as well as an overall increase in actual pig and poultry numbers. Primary agriculture represents 3% of national gross domestic product (GDP); nevertheless it contributes, together with food processing, 27% of net exports.

The introduction of such simple efficiency measures and avoidance of leakage represent a valuable opportunity for water saving without far-reaching changes[18]. For example, considerable amounts of irrigation water are lost due to evaporation because of the time of day chosen for irrigation. The more productive water is for a farmer, the more inelastic is his water demand. This means that if it is possible for a farmer to make considerably more profit with than without irrigation then price increases need to be considerable in order to make this farmer think over his production method. This is of course not only true for agriculture but for each and every water user. Local Authorities in the SRBD play an active role in monitoring compliance with water pollution legislation, and to a varying degree, meter agricultural water use[19].

The Common Agricultural Policy (CAP) may maintain and promote the expansion of irrigation in an area and thus contribute to the overexploitation of an aquifer. The move to decouple production with grants under the reformed CAP programme will have significant implications for farm sizes and water usage in the coming decade, which are presently unquantifiable in the SRBD.

The REPS scheme and guidelines issued by the DoEHLG impose conditions in relation to the prevention of groundwater pollution and nutrient management planning[20] respectively. Increased participation in REPS is a positive environmental indicator. Nutrient Management Plans have resulted in reduced use of chemical phosphorous fertilizer without compromising grass yield; leading to significant costs savings to the farmer. Responses by farmers to Teagasc's advice on REPs has included: improvement of farmyard facilities and reduction in the volume of uncontrolled soiled water with only modest expenditure. In addition, a number of farmers up-graded their slurry storage facilities in preparation of joining REPS. REPS aims to enhance farm practices/production, prevent water pollution and enhance/conserve habitats'. It plays a positive environmental role through reducing nutrient inputs to rivers and lakes from agricultural sources and therefore active participation is recommended. As REPS uptake has increased, there has been a corresponding significant improvement in the water quality of rivers sub-catchments[21].

Notably, national farm surveys undertaken by Teagasc on an annual basis have shown that farms within the REPS scheme have achieved and maintained a 4kg/ha reduction in phosphorus application rates[22]. Nationally, there has been a significant reduction in the use of phosphorous fertilizers in recent years as a result of the Government's National Strategy for Sustainable Development (1997), with a 20% reduction over the period 1996-00[23]. During the first period of REPS, 1994-99 up to 46,000

[17] Industrial harvesting of peat can release suspended particles that settle in lakes, smothering invertebrates and plants, blocking channels and contributing to flooding.
[18] See Roth (2001).
[19] Of ten Local Authorities surveyed during this study, six replied. On average between 50-80% of agricultural and industry water users are metered.
[20] All farmers who had land and farmyards were invited by Teagasc to participate in Nutrient Management Planning. Recommendations for nutrient applications to achieve optimum yields were provided and also advice was given on farmyard management and facilities.
[21] See Lough Derg & Lough Ree, 2001.
[22] The quantification of the actual phosphorous loading reduction as a result of the implementation of the management measures is dependent on the availability of national datasets in addition to information held by Teagasc and the Local Authorities.
[23] The National Strategy for Sustainable Development did not contain new actions; rather it targeted reductions in P usage through promotion of Teagasc guidelines – see p.38 of Strategy.

farmers participated. Under EU regulations a new scheme modeled closely on the first one, was launched in November 2000 and it is hoped to attract the participation of 70,000 farmers[24].

Municipalities

Point source emissions from urban agglomerations[25] are a significant source of nutrient enrichment within the SRBD. With the increasing investment towards eliminating untreated discharges, secondary treatment facilities are standard. In an average town, the sewerage system will collect the sewage from domestic, commercial, and industrial premises.

It is estimated that nationally[26] a domestic population of around 157,000 is not connected to a public sewerage system and therefore relies on septic tanks for wastewater treatment[27]. Such tanks are generally located on poorer soils that do not have the capacity to properly absorb the effluent. The majority of the towns (between 1,000 and 20,000 inhabitants) that discharge into inland waters now have full secondary treatment[28]. The urbanized area in the coastal zone increased by 10.3% and the number of houses in the coastal counties increased by between 47% and 180% in the period 1994-97[29] - with the overall effect of increasing both impervious surface cover and pollution pressures. Notably, most municipal sewage sludge in other EU countries is spread on tillage land but the land farmed for tillage in Ireland is extremely limited[30].

Approximately 75% of drinking water abstracted from surface waters[31] and groundwater supplying 20-25% of drinking water. Groundwater resources need to be protected because, once polluted, they cannot be used for many years[32]. In many rivers more than 60% of the annual flow is derived from groundwater. Groundwater supplies many private wells and provides a source of water for many industries. A considerable increase in water-use efficiency could be reached by simply reducing leakage from supply systems.

The implementation of the Urban Waste Water Treatment[33] Regulations/Directive and Government policies is delivering a significant investment programme aimed at upgrading the sewerage networks

[24] See Encyclopedia of Ireland, 2003.
[25] The discharge of untreated sewage from combined stormwater overflows within the urban centres remains a significant source of pollution - effluent monitoring programme including the measurement of flow, in most instances, does not comply with the requirements of the Urban Waste Water Treatment regulations.
[26] No figures exist at the SRBD scale.
[27] See Lough Derg/Lee, 2001.
[28] See ENFO, 1997, Sewage Treatment, Briefing Sheet 28.
[29] See National Spatial Strategy, 2002. Note: no figures exist at the SRBD scale.
[30] See National Spatial Strategy, 2002.
[31] O'Sullivan, G., 2001.
[32] The publication "Groundwater Protection Schemes" was launched in 1999, by Mr. Joe Jacob T.D., Minister of State at the Department of Public Enterprise. It provides guidelines for local authorities on the preparation of groundwater protection schemes. and aims to maintain the quality of groundwater by applying risk assessment to groundwater protection and sustainable development. One of the components of a protection scheme is a land surface zoning map, which is based on the geological and groundwater conditions in any area or county. These zoning maps indicate the degree of risk or threat to groundwater from human activities, and are therefore a powerful tool for environmental protection. The second component is groundwater protection responses for various zones. These indicate the acceptability of a particular activity in each zone and the planning or licensing conditions required to prevent pollution. The groundwater protection responses to the "Landspreading of Organic Wastes" and the "Siting of landfills" were published in 1999.
[33] The EPA Act 1992 (Urban Waste Water Treatment) Regulations, 1994 [S.I. No. 419 of 1994] which give effect to the UWWTD require the provision of collection systems and secondary treatment facilities for all inland discharges with a population equivalent (p.e.) of 2,000 or more. The deadline for compliance of the end of 2000 applied to all towns in excess of 15,000 p.e. and the end of 2005 for lesser discharges. The Regulations also designate lakes and rivers as sensitive on the basis that they are eutrophic or likely to become eutrophic, if protective action is not taken. The designated lakes include Lough Derg and Lough Ree. As a consequence, phosphorus reduction was required by 31 December 1998, in respect of urban discharges to freshwaters of more than 10000 p.e. Appropriate treatment allows receiving waters to meet the relevant quality objectives.

and Wastewater Treatment plants at the main population centres within the SRBD. This catchment-based initiative is sponsored by the Department of the Environment, Heritage and Local Government and co-financed by the EU Cohesion Fund.

As a consequence of economic prosperity, nationally there has been a reduction in the average occupancy per dwelling unit, which in turn has been shown to give rise to increased per capita demand for water. For example, the use of water per person in a two-person dwelling has been estimated to be one-third greater than that in a four-person dwelling[34]. All raw water and drinking water monitoring conducted to-date through the National Rural Water Monitoring Committee (NRWMC) and the Local Authorities proves conclusively that the problem of deficient water quality is overwhelmingly confined to the privately sourced group water sector. There are some 5000 plus group water schemes – public (800 schemes nationally) and private - throughout the country. The main thrust of the Rural Water Investment Programme is the provision of high-quality water to rural dwellers. The National Federation of Group Water Schemes (NFGWS) vision for 2015 includes clean quality water for all rural householders at an affordable "local" rate, plus full implementation of the polluter pays principle, in addition to a developed National Water-Policy, which would provide adequate incentives for users to use water resources efficiently and an adequate contribution of different users to the recovery of the costs of water services[35].

Industry

Industry typically associated with the SRBD include pharmaceutical, medical components, clothing, telecommunications, light mechanical and electrical plants, hydro generation power and aquaculture. There are 118 IPC holders in the SRBD. Nationally the amount of industrial land increased by 16.6% over the 1975-90 period[36], thus increasing the amount of impervious land cover. Given that IPC licensed industries within the Lough Derg and Lough Ree catchment generally complied with their license conditions during 2000, it is expected that the estimated total phosphorus loadings provides a good representation of actual loadings to the catchment. The Water Quality Monitoring Programme (April 1999 – March 1999) identified four IPC license holders in the meat-processing sector which were causing adverse impact on water quality in the SRBD. Bord Na Mona bogs greater than 50 ha became subject to IPC licensing during 2000. Since the implementation of the polluter pays principle and related metering of industry water usage the resulting wastewater hydraulic loads from industry decreased significantly[37].

When activities are subject to IPC Licensing, the EPA is obliged to specify conditions corresponding to the Best Available Technology (BAT) when issuing licenses. In the event of BAT being insufficient to ensure compliance with the environmental quality objectives/standards, more stringent conditions are to be specified by the Agency. Measures required by the Local Authority or EPA could entail the up-grading of industrial waste treatment facilities and/or greater emphasis on reducing inputs at source. Where industrial effluents are licensed for discharge to urban wastewater facilities for treatment, Local Authorities or the EPA are to impose appropriate controls[38].

Water is a key environmental asset for the development of the tourism and recreation industry. The Shannon water system has evolved into one of Ireland's greatest recreational resources, facilitating sailing, cruising [39]and angling along with other passive and active recreational sports – all valuable

[34] O'Sullivan, G., 2001.
[35] O'Sullivan, G., 2001.
[36] See National Spatial Strategy, 2002.
[37] O'Sullivan, G., 2001.
[38] They are also obliged to take into account the EQS proposed for the 14 List II substances arising under the Dangerous Substances Directive (76/46/EEC) - Water Quality (Dangerous Substances) Regulations, 2001. Also the Directive for Integrated Pollution and Prevention Control (IPPC), adopted in 1996, addressing pollution from large industrial organizations.
[39] There are currently in the order of 3,500 boats registered on the Shannon Navigation (see Lough Derg/Lough Ree, 2001)

economic receipt activities (especially when including the multiplier effect for the communities[40]). Demand for locks[41]and moorings along the system outstrips supply, due to the large increase in the number of vessels and levels of usage on the Shannon. Other services such as fishing stands and carparks are generally widespread throughout the system. Pump-out facilities to remove wastewater from boats with holding tanks have been installed at thirteen centres where waste is collected and subsequently treated. The impact on water quality due to the discharge of nutrients from cruising activities can be minimised by effective enforcement of the existing By-laws, and Waterways Ireland is responsible for identifying and prioritising new facilities, for which the DoEHLG grant funding. Local Authorities are responsible for operating the majority of the required facilities, with the following Local Authorities managing pump-out facilities on the Shannon Navigation: Leitrim; Roscommon; Westmeath; Offaly; Galway; Clare and Tipperary (North Riding). Additional facilities are managed by Waterways Ireland[42]. Eutrophication - caused by an excess of nutrients such as nitrogen and phosphorus - impairs water quality, fisheries and recreational use of these waters.

Non-use sectors

We have a collective necessity to protect and enhance the natural and built environment and the unspoilt nature of the physical environment because of the intrinsic (or passive) use values – such as amenity – which have the potential to improve the quality of life[43]. The economic importance of non-use sectors is difficult to calculate at a national scale or river basin district scale due to the fragmented nature of data and understanding. The hypothetical markets are reliant on perceived benefits that contribute social value to the environmental asset[44]. Contingent valuation studies[45], i.e. placing values on non-marketed goods in cost benefit analysis have become useful tools as for environmental policy making. In addition, 'willingness to pay/accept' models also contribute to this arena. In order to reach Full Cost Recovery (FCR), environmental and social/community cost/benefits need to be ascertained – leading to an understanding of the true resource use and more importantly, the opportunity costs/investment required. Indicative of such benefits is the results of a survey carried out by Fort & Scarlett (1993[46]) in the United States, focusing on the desirability of various types of community benefits – over 90% of the responses were in favour of having a water quality guarantee. This compares to 58% of responses in favour of supporting road development.

Task 4. Assess the relative socio-economic importance of water uses

Apart from the increase in pig and poultry in the SRBD, general agricultural output is in decline when compared to industrial output. Agriculture, municipalities (as population projections increase plus the resultant increase in impervious land cover and associated water quality disadvantages) and industry remain significant water users and this trend will continue until the incentive to reduce water demand is driven by the successful implementation of the polluter pays principle. Fisheries remain a significant water user, with in excess of 16,000 persons employed in the fisheries sector[47].

[40] See Banagher Economic Action Plan (1999). Also see, Lough Derg Study (2000).
[41] The total number of Shannon Lock Passages has increased from 54,596 in 1990 to 76,962 in 2002. Source Waterways Ireland – personal communication.
[42] See Lough Derg/Lee, 2001.
[43] There is a legal provision for local authorities to seek contributions from developers for engineering and infrastructure provision, such as support of nature conservation and environmental improvements. These contributions could be used to fund the contingent valuation/willingness to pay studies. See *Key Waste Management Issues in Ireland* (2001), by Forfas.
[44] See Irvine (2002).
[45] See Clinch & Murphy (1998).
[46] Fort & Scarlett, (1993).
[47] See 'Sustainable Marine Resources' Briefing Sheet. ENFO, Dublin.

Task 5. Designation of protected/identifying economically significant aquatic species

The major species found in the SRBD are salmon, brown trout, pollan, pike, perch, bream, roach, roach/bream hybrids, rudd, tench and eel. Fish kill summary data shows continuous fluctuations in the regional numbers killed, with the main causes attributable to enrichment and agriculture. Fish kill in the summer months is prominent. Farm effluents continued to be the major source of trouble, although responsible for less than half the incidents in 1999. Enrichment is usually the result of leaching from excessive use of phosphate fertiliser on the land. The distribution of salmon has traditionally been restricted to the River Brosna, Boyle River tributaries and Mulcair River. Trout are found throughout the basin. The national Electricity Supply Board (ESB) is responsible for preserving and maintaining salmon and eel throughout the SRBD. However aspects of its management function have been devolved to the Central Fisheries Board, and through the Central Fisheries Board, to the Shannon Regional Fisheries Board. The Fishery Boards' have a statutory duty to conserve, manage and protect the fishery as conferred by the Fisheries (Consolidation) Act 1959[48]. There is little in the way of fish farms or hatcheries.

Aquaculture, including finfish and shellfish, is a growing sector of Irish marine industry. By 1997, nationally it accounted for 30% of Ireland's fish production, and provided employment for over 3,000 people, mainly in remote coastal communities. Nationally, the estimated value of the output from the sector in 1997 was some £59 million up from £49 in 1995. This represents a more than doubling of the value of aquaculture production since 1989. The Operational Programme for Fisheries, 1994-99, targeted aquaculture as a key growth area, and the Government is committed to supporting the sustainable development of this industry due to its value in terms of jobs and economic activity[49]

The structure and economic value of angling is not available at the SRBD level. There are substantial gaps in regard to linking economic values to angling. Nevertheless, a Central Fisheries Board report (2003[50]) indicates that nationally the Salmon angling resource would be valued at Euro 91.6 million in present value terms – furthermore the report suggests that the balance of advantage on economic/socio-economic grounds can best be achieved through a rebalancing of wild salmon exploitation from the commercial fisheries towards tourist angling. In order to determine the economic value of angling, an assessment of expenditure and related benefits is necessary.

Overall, as can be seen in Table 1.2, the growth and economic value of significant aquatic species is increasing, with further growth and investment expected covering all species below[51]. The salmon-farming sector have the most extensive plans for expansion, with indicative investment intention of £9.2m up to 2006, covering production expansion and development of added value products. The development of new species is the next significant plan, with an estimated £2.8m earmarked for development up to 2006. All producers are conscious of the benefit of developing a range of products taking the advantage of Ireland's green image[52].

[48] See Lough Derg & Lough Ree, 2001
[49] See Sustainable Marine Resources' Briefing Sheet. ENFO, Dublin, 1999.
[50] Central Fisheries Board (2003).
[51] See BIM (2000).
[52] See BIM (2000).

Table 1.2. Growth in Output and Value of Economically Significant Aquatic Species				
Species	**Tons/1979**	**Value £'000/1979**	**Tons/1997**	**Value £'000/1997**
Bottom mussels	3170	158.5	9,758	3,413
Rope mussels	124	49.6	6,217	2,541
Edulis oysters	308	760.2	773	2,237
Gigas oysters	23	47.0	3,540	3,698
Clams & scallops	-	-	275	701
Freshwater trout	240	344.5	1,101	2,110
Sea trout	60	132.0	698	1,535
Salmon /exported salmon ova	13	47.8	15,441	42,659
Total	**3,938**	**1,540**	**37,803**	**58,894**
Adapted from BIM (2000), Strategic Review of the Aquaculture Industry, 2000-2015.				

Data on the spatial location of economically significant species is only available on a county and not RBD scale. Using 1997 data[53], the following spatial/output picture exists:

- Clare: output of 281 tonnes of Gigas Oysters;
- Cork: output of 2040 tonnes of Salmon, 30 tonnes of fresh water trout; 3179 tonnes of Rope Mussels and 644 tonnes of Gigas oysters;
- Galway: output of 7284 tonnes of Salmon, 10 tonnes of fresh water trout; 1088 tonnes of Rope Mussels and 70 tonnes of Gigas oysters;
- Kerry: output of 1407 tonnes of Salmon, 190 tonnes of fresh water trout; 536 tonnes of Rope Mussels and 89 tonnes of Gigas oysters;
- Limerick: output of 150 tonnes of Rope Mussels and 120 tonnes of Bottom Mussels;
- Louth: output of 1700 tonnes of Bottom Mussels and 133 tonnes of Gigas Oysters;
- Mayo: output of 761 tonnes of Salmon, 878 tonnes of Rope Mussels and 1093 tonnes of Gigas oysters;
- Tipperary: output of 60 tonnes of fresh water trout.

3.3 Step 1.2: Projecting Trends in Key Indicators and Drivers up to 2015

Task 1. Trends and critical uncertainties

A significantly greater amount of fresh water is stored in aquifers than is visible on the surface as streams, rivers and lakes. Impervious surfaces and drainage networks (which increase as town and urban centres develop) shunt runoff directly from road surfaces to streams and thereby inhibit the function of the natural hydrological cycle. There is a need to assess these variables within the SRBD and other RBDs. An overarching driver likely to affect pressures in the SRBD is the implementation of the National Spatial Strategy (through the establishment of Regional Gateways and strategic urban centres) and the National Development Plan (NDP) 2000-06 (by altering output/economic strength and income/economic welfare from a regional perspective)[54] – impacting on infrastructure, demography, investment and growth patterns –influencing demand for water services[55]. Notably, while the National Spatial Strategy and National Development Plan provide a good overview of trends, more detailed assessment at River Basin District (RBD) level is required to augment the information contained in these documents in order to meet the requirements of Article 5.

Demographically, the predicted increase in the State's population (estimated to be 4.5 million in 2020) and the redirection of settlement patterns/densities (housing, roads[56]) will alter pressures on water resources, impacting on water supply networks, sewerage services and greater levels of impervious

[53] Adapted from BIM (2000).
[54] The economy of a region is defined in terms of both output and income.
[55] O'Sullivan, G., 2001.
[56] The National Roads Authority road investment programme under the NDP will add significantly to impervious cover. This supports an increase in transportation volumes.

land cover and associated run-off within the SRBD. The reduction in the average occupancy dwelling unit combined with the increase usage of pump showers and electrical water-using 'white goods' will continue to give rise to increased per capita demand for water.

Census data from recent years shows an increase in the urban population, primarily in the five main centres -Dublin, Cork, Limerick, Galway & Waterford[57]. The 1996-2002 period experienced a substantial change in these patterns. A continuous band of population increase now evident from east Limerick to north and west of Ennis. Other parts of east Clare further consolidated their growth, probably as a result of commuting into Ennis and Limerick, especially from the Lough Derg area. North Clare also generated significant increases. In County Limerick, growth continued under the influence of main roads, with an improvement also evident in North Tipperary, particularly around Nenagh and Thurles. Sectorally, growth in the SRBD has occurred in industrial, services, building and construction.

Critical uncertainties revolve around issues such as the type of agricultural production and climate change. Nationally, intensive agriculture, in the form of pig and poultry production has been undergoing major structural change, with the main thrust of the reform in both sectors being the concentration of production into a smaller number of larger units, as well as an overall increase in actual pig and poultry numbers. As existing areas of intensive pig/poultry production reach capacity in terms of slurry disposal, they are expanding into adjoining counties and it remains to be seen how will this be reconciled with maintaining surface and ground water quality.

The period to 2010 will see the rapid expansion of forestry especially the planting of broadleaf species. There is expected to be significant broadleaf development on wet mineral soils that are currently in marginal agricultural production[58]. The CAP resulted in concentrated output, resources and income to a reducing number of farmers[59]. The decoupling of production from grants under the reformed CAP programme will have further implications for farm sizes and water usage in the coming decade.

Climate change will see a lowering of water tables and ability to abstract groundwater. Linked to this are the expected alterations in weather patterns, where predicted increased rain in winter and dryer summers will place pressures on water (either flooding or drought) and affect land use in the SRBD. This is particularly an issue for the South-East of Ireland, as problems associated with drought are well known[60].

Task 2. Proposed measures and planned investments for implementing existing water legislation

EU Directive 91/271/EEC on urban waste water is driving considerable investment in the building of new and up-grading of wastewater treatment plants in both inland and coastal areas and Directive 91/676/EEC on nitrates from agriculture is driving a number of initiatives in place to redress excessive nutrient usage[61]. Under the Government's polluter pays policy framework, non-domestic users of water and sewerage services must meet the costs of providing these services. Water services will continue to be provided to householders without any direct charge. Nevertheless, the operation of the polluter pays principle – through cost recovery – would make a significant contribution to the funding investments.

[57] O'Sullivan, G., 2001.
[58] See National Spatial Strategy, 2002.
[59] One estimate concludes that the number of farms will fall by 40,000 in the period 1998-2010, with the greatest fall off in the farms that are currently not viable [see National Spatial Strategy, 2002]. This will have important implications for water quality. It maybe warranted to attempt to re-estimate this figure in light of the CAP reform.
[60] See John Sweeney et al. EPA, 2003
[61] See EPA, Water Quality Report, 2001.

Ireland's National Development Plan (NDP) 2000-06 provides for strategic capital investment of approximately Euro 3,800 million in water and wastewater services. This represents an almost threefold increase in capital spending on water services in the seven years up to 2006, in comparison with the 1994-99 period. It is intended that €250m of this investment will be funded by capital contributions from non-domestic users. Current expenditure of over €250m (year 2000) per annum is being incurred on the operation and maintenance of water and wastewater services. This expenditure is set to substantially increase over the period of the NDP due to a number of factors including the commissioning of new treatment works (wastewater and water), increased monitoring arising from the WFD and ongoing costs of water conservation programmes, sludge treatment and reuse/disposal, etc. In addition, extensive mains rehabilitation will be funded.

Once-off data collection costs will also arise in the development of a comprehensive database on water and wastewater infrastructure (above and below ground assets, connections, meters, etc.). These trends are indicative of substantial prospective increases in operating costs for local authorities in the water and wastewater area, a significant proportion of which could be recouped by full cost recovery from the non-domestic sector for services provided to them[62]. The programme for the provision of wastewater treatment facilities, [estimated at €1.6 billion] which includes the schemes required for compliance with the EU Urban Wastewater Treatment Directive, will be carried out through Design, Build and Operate [DBO] contracts[63]. The use of PPP in water services is being advanced under a number of headings:

[I] major wastewater treatment works [DBO]

[ii] grouped catchment wastewater facilities [DBO]

[iii] expansion of water treatment works in major cities [DBOFinance]

[iv] rural group water [improvements to supply] schemes [DBO]

[v] operation of major treatment works [service contracts]

[vi] developer-led, serviced land initiative projects [DBFinance]

The Water Services Investment Programme 2003-05[64] provides for the improvement and expansion of public water services through the following: ongoing construction of 41 major schemes; 369 schemes to commence construction in the years 2003-05; 94 new schemes to be advanced through planning to get construction at a later stage in the NDP; 231 schemes under the Serviced Land and Rural Towns and Villages Initiatives and the National Water Conservation Programme 2003. Over 100 projects have been identified as potential Public Private Partnership projects (PPP). Significant progress has already been made in some forms of PPP in water services, particularly in the areas of Design/Build and Design/Build and Operate contracts on schemes such as the Limerick Sludge Treatment Plant[65].

[62] See Circular L4/00 dated 1st March 2000.
[63] See Briefing Note Number 7. Public Private Partnerships in Water Services Sector.
[64] See Circular L13/03
[65] An assessment of individual projects is carried out by local authorities and the Department to determine that the PPP approach is appropriate and, if so, what particular model should be used.

3.4 Step 1.3 Assessing Current Cost Recovery

Assessing current levels of recovery of costs of water services, in accordance with Article 9 of the WFD requires investigation of the following key elements: the status of water services; the extent of the recovery of costs (financial, environmental and resource cost) of these services; the institutional set-up for cost-recovery and the contribution of key water uses to the costs of water services. Due to the lack of information available during this review at the RBD scale, cost recovery was assessed from a national perspective.

Current water pricing/metering and future water pricing mechanisms will ensure that more comprehensive cost recovery can be achieved. Factors inhibiting comprehensive cost recovery include the lack of contribution to cost recovery of environmental costs – such as public amenity values/social and community benefits is lacking[66] and the current unwillingness of the Irish Government to recover full costs from domestic sources owing to the political sensitive nature of charging[67]. Until the contribution from these issues is integrated, full cost recovery[68] (FCR) cannot be determined.

Water pricing levels that reduce or stabilise demand levels are environmentally desirable. The precautionary principle [a key principle in EU environmental policy] promotes the prevention of pollution including the use of substitutes or bans, rather than the use of end-of-pipe solutions. In order to support this principle it is necessary to make water users pay for any pollution they might create, so that they are given an incentive to avoid the output of polluting substances. The Polluter[69]/User Pays Principle is also key to EU environmental policy and is based on the idea that pollution prevention and control costs as well as the costs of environmental damage should be borne by those who cause them. There is generally no full recovery of the cost of the damage caused by pollution. In relation to water resources, this implies that if users are charged a price below FCR for water uses, society at large will bear the costs of water pollution and excessive water use. Therefore polluters do not have to take more sustainable solutions into consideration. Without making the full costs of water use clear to the users by integrating them into the water price, any water pricing policy is thus in breach with the main principles supposed to underlie EU environmental policy[70].

The trade-offs between consumptive and in-stream values are changing constantly[71] making them difficult to quantify as the pressures on the resource fluctuate. It is logical then to charge the users of the water the estimated cost of supplying that water to them (distribution and treatment), as well as the cost incurred by the natural environment and opportunity costs of removing that water. Water-pricing policies should provide adequate incentives for users to use water more efficiently and therefore support the environmental objectives of the WFD. Pricing policies "are dependent on the source and quality of the water resource (the supply of freshwater gets more and more difficult because of increasing pollution and overexploitation), the technologies used for treatment, storage, the service

[66] Some definitions: *abstraction charges*: money charged for the direct abstraction of water from ground or surface; *pollution charges*: developed to explicitly provide incentives for users to improve the quality of their discharges; *subsidies*: difference between actual costs underlying calculations of water price and full costs. Transparency of subsidies is a problem across the EU.

[67] A 1996 survey indicated that 31 of 88 local authorities levied separate fixed charges for domestic wastewater (Irvine, 2002).

[68] In order to determine FCR of water services, data on the recovery of the following cost elements is necessary: operating; maintenance; capital; opportunity & resource costs; social costs; environmental damage costs; long run marginal costs; costs arising from transport, distribution, collection and treatment; costs in raising finance for infrastructure investment and opportunity costs, i.e. difference between the return [e.g. to tourism, green image, community prosperity, recreation, trade] of capital investment in water services.

[69] The OECD defines the polluter pays principle as the "principle to be used for allocating the costs of pollution prevention and control measures to encourage rational use of scarce environmental resources…." It is also in line with EU requirements (the Maastrict Treaty states "that environmental damage should as a priority be rectified at source and that the polluter should pay (Article 103r) and the legislation governing the Cohesion Fund [taken from Circular L4/00].

[70] See Roth (2001).

[71] See Jackson et al (2001).

management, the bulk of investments, the spatial location of the connected population, the leakage rates and the metering system, as well as the seasonal use of infrastructure (peak flows). In discussing metering in the context of volumetric charges, it is important to analyse who gains, who loses and by how much[72]."

The issue of pricing agricultural water use in Ireland is difficult to approach due to the current lack of information on supply. It is crucial that this be addressed so as to determine all withdrawals (including groundwater abstractions) of water for agriculture use within each RBD. According to the Strategy on the environmental integration and sustainable development in CAP established by the Agricultural Council (Council Document 13078/99, 1999), "farmers have to bear compliance with costs up to a reference level of good agricultural practices in the area concerned. In general, beyond this level it is inappropriate to pay farmers for environmental services that they provide through their own private resources or factors of production. However, in areas with serious environmental problems, temporary government intervention, consistent with the Treaty, might be needed to improve sustainability up to the reference level"[73]. Another significant issue that needs to be addressed is the loss of water and thus recovery of costs of water loss in distribution and supply systems through leakage.

The sustainable water management should be to establish a balance between the supply and demand of water, at which point social welfare is maximized. If subsidies are granted it should be done in a transparent way, as this is the only way to keep subsidies at the minimum level and to avoid major disturbance of environmental policy objectives as described above. Again, the problem lies not in water pricing as such but in the way the pricing scheme is conceived. As water prices rise, certain enterprises (industrial as well as agricultural), especially smaller ones, may face profitability problems, so water managers have to be realistic about the level of subsidies. Water managers are able to make better decisions on supply/demand based on full cost information. The pattern of increased water metering based on volumetric rates instead of fixed charges is more a more efficient charge and acts as an incentive for water conservation[74]. The coverage of water costs through general taxation revenues also acts as a disincentive for water conservation.

In order to determine the extent of water use by each sector, increased knowledge of the basins is needed. This requires a monitoring station in each sub-basin to assess resource availability, demand and abstraction (quantity, types and their impact) and environmental quality. Once the pressures and demands on the hydrologic systems are understood, improved management approaches can be implemented. However, while the abstraction of water can be metered and its impacts monitored more easily, the impacts from diffuse water sources are not evident, and pricing water with respect to diffuse water is a subjective task that, relies more on surrogate/stimulated market approaches.

In addition to setting out the projected loads and demands from all sectors (domestic and non-domestic), a preliminary report by Local Authorities as a precursor to submission of detailed assessment to the DoEHLG, includes in each case an estimate of the marginal capital costs of providing services for the non-domestic sector. A project will not be authorised to process to tender invitation stage unless the value of the non-domestic capital contribution has been properly addressed and quantified[75].

The identification and charging of all non-domestic customers of water services covers the following cost elements: recovery of the marginal cost of the provision of water services; recovery of the full average operational cost of water services i.e. water supply and wastewater services on the basis of a

[72] See Irvine(2002)
[73] Taken from European Commission (2003).
[74] The analogy can be highlighted through the following example: paying for a huge 'all you can eat' buffet and only eating a slice of dry bread is highly unlikely. Logically everybody would try to get as much food as possible for money paid. Excessive water usage is likely to occur because unnecessary consumption is not reflected in the water bill.
[75] See Circular L11/01 dated 1st October 2001.

consolidated charge for water supplied, using the water in/water out principle; and metering of all non-domestic customers by 2006. Government policy framework[76] provides that the full operational cost, including administrative, maintenance and repair costs, in respect of the provision of water and wastewater services to non-domestic users should be recovered.

With the introduction of the new Local Authority financial management and costing systems, operational costs are removed from the commercial rate and charged on the basis of the unit cost of providing water and wastewater services and the achievement of full cost recovery. The achievement of full costs recovery by means of a direct charge should result in a reduction in the amount of income required to be raised by local authorities from commercial rates[77]. To ensure a transparent pricing system, it is important that local authority water and wastewater accounts issuing to non-domestic users clearly set out the constituent costs and provide an audit trail back to these costs. This system will also enable authorities to issue statements to domestic users setting out the average cost of providing water and wastewater services to them[78].

The clear absence of any cross-subsidisation of the domestic sector by non-domestic users is both a key element of policy and an issue which has been repeatedly stressed as a requirement by non-domestic stakeholders including the business group IBEC and others. This sector has made its support of water services pricing policy conditional on the resolution of this issue[79].

The development of proper baseline data[80] by local authorities on water and wastewater systems must be a priority, in order to permit proper quantification of the true cost of providing these services. Furthermore, it will enable authorities to determine existing metering penetration for non-domestic users, the number of new/replacement meters required and also to ascertain the potential for generating additional revenues from non-domestic users that are not currently being charged or who are being charged a flat rate when they should be metered. A comprehensive assessment of the situation in each local authority area is required, including data on current charging practices e.g. who is charged (for both capital and operating costs), the basis for charging, what costs the charges cover (initial capital investment, operating and maintenance, capital replacement, etc) how much is charged, whether different charges apply to different categories of non-domestic users, what type of billing system is in place etc. This will aid the authorities with the objective of universal non-domestic metering by 2006, as required by Government policy.

In general, marginal capital costs are funded initially by the local authority through borrowing, as necessary, and are recovered, as appropriate, by way of:

- Reserved/assigned capacity agreements with significant non-domestic users;
- Consolidated water services charges on general non-domestic users;
- Development contributions under the Planning and Development Act 2000. The amount of funding from development contributions to be allocated to particular water services developments will be decided by the local authority on a case-by-case basis.

[76] See Circular L4/00 dated 1st March 2000.
[77] See Circular L16/00 dated 5th December 2000.
[78] See Circular L16/00 dated 5th December 2000.
[79] See Circular L4/02 dated 28th February 2002.
[80] See Circular L4/00 dated 1st March 2000.

Task 1: Cost Recovery and the Non-Domestic Sector

A comparative study of urban commercial rate pricing policy indicated an average of 32% fewer water services customers than commercial customers[81]. It is acknowledged that some authorities charge all of their commercial rate customers for water services. It is the intention of central government/local authorities to develop a more comprehensive and transparent framework of charging for water and wastewater[82] services in the non-domestic sector, in the context of the more effective application of the polluter pays principle in respect of these services[83] i.e. by fully internalising the costs of water usage and wastewater generation. The policy framework includes:

- Local Authorities to determine the marginal capital cost of providing non-domestic capacity in each scheme – the collection of capital contributions for non-domestic users must be undertaken in a structured and uniform manner in accordance with Polluter Pays Principle. Capital contributions by the non-domestic sector are required at the earliest possible point in the approval process for individual projects and they should cover the full marginal costs of water treatment, distribution and main drainage capacity reserved by them (individual contracts for larger industrial users are also to be negotiated and put in place[84]);
- Full recovery, based on usage of operational costs in respect to the provision of water and waste water services to non-domestic users;
- Provision of lending facilities to local authorities through the Housing Finance Agency to meet the investment required for providing services to non-domestic users who pay capital contributions over time. This is to be done on the basis that loan charges would be recouped from these users through legislative provision made in the Local Government Act, 2001;
- Studies[85] have shown that a major programme of meter installation, replacement and recalibration will be required across the country. In interests of equity and making the provision of water and wastewater services fully transparent, the framework agreed by Government envisages that all non-domestic users would be metered for water regardless of usage. Completion of metering of all non-domestic users by 2006, while ensuring the continuation of the comprehensive implementation of the discharge licensing system under the Water Pollution Acts is a high priority for Local Authorities[86];
- The DoEHLG assists local authorities in metering of non-domestic users with the development of guidance for authorities and the piloting of a Public Private Partnership metering project[87] [undertaken by Sligo Local Authority];
- The DoEHLG prepared standard contracts and guidelines for significant users who reserve capacity.

In order to advance implementation of water services policy, local authorities have been requested to[88] do the following:

- Determine annual operating costs and marginal capital costs of providing water and wastewater services across the functional area of the authority;

[81] See Circular L4/00 and Circular L16/02.
[82] Trade effluent is defined as discharges from any premises carrying on a trade or industry (trade includes agriculture), but excluding domestic sewage and stormwater.
[83] See Circular L4/00 and Circular L16/02.
[84] See Circular L14/01 dated December 10th 2001.
[85] See Circular L4/00, dated March 2000.
[86] The National Water Study [86]showed that Unaccounted for Water (UFW) in the Local Authority systems surveyed is significant and exceeds 50% in some cases (year 2000). While the proportion of the UFW is accounted for by leakage, these high levels of UFW also point to inadequate metering of flows into and within distribution systems, and lack of continuous recording of these flows. Also, not all significant non-domestic water users are being metered and there is an underestimation of numbers of domestic connections.
[87] See Circular L11/01 dated 1st October 2001.
[88] See Circular L10/02 dated 12th July 2002.

- Calculate a (per cubic metre) volumetric rate for the provision of water services and, for the general non-domestic customers, provide in this rate for additional costs including marginal capital costs and unaccounted for water as outlined in the Model Agreements and Guidance[89];
- Charge according to the Model Form of Agreement for Waste Water Services (Reserved Capacity), which contains a number of schedules, each describing a distinct element of the charging mechanism. The customer should be charged for the following: marginal capital costs[90] of the treatment plant; marginal capital costs of the collection system; average operating costs of the treatment plant and average operating costs of the collection system. Total Capital Cost is calculated as the Full Domestic Cost (FDC) + Non Domestic Marginal Cost (NDMC). As the calculation of the NDMC is dependent on the determination of the population equivalent (p.e.) for the domestic and non-domestic effluent streams, it is vitally important that these figures are accurately calculated at the preliminary design stage. The authority must also be willing to reassess the apportionment of the NDMC and offer rebates if it is found after the plant has been commissioned that the p.e. estimates were incorrect.
- Develop and/or refine mechanisms to identify and effectively segregate non-domestic and domestic water services costs;
- Develop a comprehensive, robust customer base;
- Gather data on all non-domestic customers and compile and maintain a database;
- Review metering requirements, including existing meter stock, the development of a programme for implementation and a schedule for achieving universal non-domestic metering within the 2006 timeframe;
- Work towards universal metering of the non-domestic sector – allowing for outsourcing, which is essential to national policy implementation. In this regard all authorities are requested to establish a county or city wide non-domestic metering programme and to notify the DoEHLG of the proposed scheme;
- Confirm if a potential link exists for a metering contract with an adjacent authority or authorities – with the objective of gaining potential economies of scale;
- Permit the continuation of established practice whereby a small number of the larger users reserve capacity in water or wastewater treatment plants. However, such users should be given the option of meeting the marginal capital cost involved either up-front or over a period of up to twenty years[91];
- Introduce contracts for significant customers[92]. The operating, capital maintenance and replacement costs of wastewater services (including collection, treatment, effluent discharge and resultant sludge treatment and disposal) for high volume/strength industrial effluents from non-domestic users will be charged on the basis of individual contracts. These contracts will be based on full cost of services used and other costs such as the monitoring of industrial discharges may also be charged;
- Adopt a more simplified approach to calculating charges in the case of industrial effluents with characteristics closely conforming to those of domestic wastewater. This may be based on metered water usage.

[89] Consultant Engineers WS Atkins were appointed in December 2000 to develop generic type contracts for use by local authorities and significant water service customers for the reserving of capacity on major schemes (see Circular L4/02, 28th Feb 2002 for further details). The significance of a customer will be decided on the basis of their capacity requirements and their effect on particular water services scheme and they will generally not always be Integrated Pollution Control (IPC) licensable activities. Significant customers will be required to reserve or commit to funding capacity as early as possible in the design and planning process. Authorities must ensure a general uniformity of approach and consistency in their categorization of significant and general non-domestic customers.

[90] The marginal capital cost is defined as the additional cost incurred by the authority in the provision of the facility over and above the cost that would have been incurred if it had to service the domestic sector only.

[91] See Circular L16/00, 5th December 2000.

[92] See Circular L4/00, 1st March 2000.

Task 2: Cost Recovery and the Domestic Users[93] Sector

Domestic water consumption can be directed in a more efficient direction by water pricing schemes. For example, consumption in Hungary fell between 1986 and 1997 from 154 lhd to 102 lhd (lhd = litre per head per day) after large real price increases (OECD 1999[94]). Available data also shows that domestic water consumption decreases after introduction of metering. However a certain threshold can be determined up to which price increases do not affect consumption levels. There are reported cases however, such as in New York where the imposition of a premium summer seasonal tariff was able to reduce the peak day ratio by 14 %[95].

The Water Pricing Framework[96] requires that Local Authorities fully recover non-domestic costs. This involves the quantification of all costs or elements of costs that can reasonably be consider applicable and chargeable to water services**.** The Framework also provides for the recovery of domestic capital cost from the Exchequer and domestic operational costs through the Local Government Fund. It is the intention of the government/local authorities to develop a more comprehensive and transparent framework for the provision of water and water and wastewater services to the domestic sector, in a manner consistent with efficiency and environmental sustainability, i.e. by fully internalising the costs of water usage and wastewater generation. Within the Water Services Investment Programme, funding of any particular scheme will now cease when payments have aggregated to the amount determined as being the capital cost of providing service in respect of domestic users.

As domestic users are not charged, they remain unaware of the true costs of the supply of water services and, in order to advance water services policy implementation, local authorities are requested to introduce procedures to notify domestic customers of the true costs (capital and operational) associated with the provision of their water services. This will initiate a conservation message to householders.

The Water Services Bill[97] strengthens the right of a local authority to access private property. The Bill will include a duty on the owner to maintain his internal distribution system leak-free (defined as between the mains and the tap). It is intended that the Sanitary Authority can direct an owner to undertake remedial works or carry out the works itself and recover the costs as a contract debt.

Task 3: Incentives for conservation

The investment necessary for the construction of wastewater treatment plants burdens society with costs that could be reduced if pollution were to be met at the source – thus contributing to a reduction in Exchequer budgetary pressures. More efficient water use can result in significant savings, through reducing demand for infrastructure and, where still required, needing less or no subsidisation by the state. Therefore social costs accruing generally from end-of pipe solutions for pollution problems have to be calculated.

Roth (2001) cites striking evidence for this in a study on economic instruments for environmental policy in four European countries. From 1976 to 1987 the connection of population to sewage plants rose from 75 to 95% in Denmark and from 35 to 90 % in The Netherlands. In Denmark this resulted in costs of US$114 per capita, while in The Netherlands only in costs of US$71 per capita. Sewer networks were excluded from the data so the difference in population density cannot play a role. Denmark invested almost twice as much to increase its capacity by less than half of the increase in The

[93] Domestic use is defined as the supply of water for ordinary household purposes e.g. for drinking, washing and sanitation, to a dwelling house or a group water supply scheme.
[94] OECD (1999)
[95] Roth, 2001.
[96] See Circular L4/0, 28th February 2002.
[97] See Circular L7/02 – WSP.

Netherlands. The author explains this with the fact that in The Netherlands economic instruments were in place in order to reduce water pollution, while in Denmark no such instruments were implemented.

The apportionment of costs associated with the conveyance and treatment of wastewater is a major incentive for industry to implement in-house water conservation policies. The application of marginal cost pricing could lead to significantly increased water prices depending on interest rates or depreciation - nevertheless, a step by step introduction of representative prices and a gradual reduction of subsidies are necessary.

Water conservation policies in agriculture, apart from obligations under the REPS schemes, means that farmers have little reason to think of water conservation – metering of *all* agricultural users would contribute to amending this attribute. Local authorities have been requested to introduce procedures to notify domestic customers of the true costs (capital and operational) associated with the provision of their water services. This will initiate a conservation message to householders. It is crucial that incentive systems are developed in a transparent manner that is sensitive to the physical, social, institutional and political setting as well as the geographic and climate change conditions in the RBD. Furthermore, only when the true costs are identified can the requirement for, and value of, follow up investment be compared to other investments projects. Identification of social and environmental costs is critical to incentivising authorities to further preserve the water resources.

Domestic charges for sewerage and sewage disposal are in most cases closely related to volumes supplied by public water suppliers: the inputs of water are normally a close approximation for the volume of sewage generated. It should be marked that this is true only for households. Domestic users do not usually pay for the sewerage/sewage treatment according to a marginal cost principle. This means that there are no incentives given to avoid especially polluting effluents. A possibility to overcome this problem is the imposition of pollution charges[98]

If the value of sewerage services is simply calculated as a percentage of the water bill, the value is hidden from the user and a rational response in terms of reduction of polluting effluents cannot be expected. If prices for sewage services provided by the public system rise, industrial users tend to consider whether it is not better for them to self-treat and/or reuse their effluents instead of using the public system. For direct discharges a permit is usually required. The quality of water that can be directly discharged is regulated in most countries and breaking the quality standards leads to imposition of fines. Action can only be taken after discharge limits are breached instead of promoting the avoidance of pollution in the first place.

Task 4: Institutional Framework for Cost Recovery

The Minister for the Environment is responsible for the transposition of EU water services legislation into national legislation. The Principal Acts which empower the Minister to introduce regulations to implement the requirements of EU Directives relating to water bodies are: European Communities Act, 1972; Water Pollution Act 1977, Environmental Protection Act, 1992 and Waste Management Act, 1996. Existing national legislation is in place to bring into effect most EU Directives concerning the management of water.

A key feature of the WFD is the adoption of River Basin Districts (RBD) as the model for future management of water in the EU. This approach recognises that water does not respect political or administrative boundaries and therefore can only be managed sustainably when looked at in terms of its natural physical and hydrological boundaries. Ireland is free to determine competent authorities and to this end may empower administrative departments at regional and municipal level to implement the

[98] See Roth (2001).

Directive. Local Authorities, a single competent authority such as the EPA or combination of stakeholders my be identified as the competent authority (Irvine et al, 2002[99])

The Department of EHLG directs policy and funding for water services and gives guidance to local authorities in regards to rollout of all aspects of water services, including pricing and related issues. Funding to Local Authorities is distributed under the Water Services Investment Programme. User charges are collected by Local Authorities. Other organisations that play a key role/function in relation to the WFD include the Department of Communications, Marine and Natural Resources; Central and Regional Fisheries Boards'; the Department of the Environment, Heritage and Local Government and Local Authorities; the Environmental Protection Agency; the Geological Survey of Ireland; the Marine Institute; the Office of Public Works; Duchas (DoEHLG); the Department of Agriculture and Food and Waterways Ireland.

[99] Irvine et al (2002).

Section 5

5.1 Collation and documentation of all available information from the WATECO Group on economic analysis for the WFD

Individual Pilot River Basin managers (in the following PRBs: Odense/Fjord Mossell-Sarre; Somos; Scheldt; Jucar; Suldasvassdraget) and the European Commission representative were contacted directly and information was requested. The WATECO group has disbanded with representative members subsequently changed function/role. Nevertheless, all the pertinent information generated by the WATECO group has been subsumed in the *Economics and the Environment Guidance and Accompanying Documents*.

5.2 Solicit current understanding of the economic aspects of the WFD by government and stakeholders

Stakeholders were contacted via telephone consultations and a brief questionnaire asking specific questions regarding economic aspects of the WFD in Ireland. Consultations were also used as a data finding/gather tool. The replies indicated that key stakeholders have a detailed understanding of economic aspects of the WFD. Generally, individuals were aware via involvement in a River Basin Project; WFD National Co-ordination Group meetings or from the Directive itself.

Conclusions and Recommendations

This small-scale study was undertaken within a limited timeframe. It is evident that if data had been more accessible a more rigorous assessment could have been carried out. An overarching issue was that of scale. Information sources while available nationally, were unavailable not readily available at RBD scale. In order to undertake the economic characterisation report under Article 5, further energies efforts need to be employed by organisations to facilitate efficient information gathering. Education and awareness of water management issues is essential to get acceptance of economic measures.

The following details the broad conclusions of the study while highlighting areas worthy of consideration for further analysis/data gathering.

- Assessment of Economic Significance of Water Uses;

The review identified agriculture, municipalities and industry as significant water users in the PRB (herein referred to as Basin). Agriculture is the principal activity in the Basin with dairying, pig and poultry production the principal water users. Surface water and groundwater are key sources of drinking water for municipalities, with per capita demand for water increasing as a consequence of economic development in the Basin. Pharmaceutical, medical components, clothing, telecommunications, light mechanical and electrical plants, hydro-generation power, aquaculture and tourism (angling/boating) are the key industrial sectors and additional significant water users in the Basin. There are 118 Integrated Pollution Control (IPC) license holders in the Basin.
Consideration should be given to reporting agricultural statistics by Teagasc and the Central Statistics Office at the RBD level. GIS mapping of all economically significant enterprises and IPC license holders at the RBD level should be undertaken.

- Projection of Trends in Key Indicators and Drivers up to 2015;

An overarching driver likely to affect pressures in the Basin is the implementation of the National Spatial Strategy (through the establishment of Regional Gateways and strategic urban centres) and the National Development Plan (NDP) 2000-06 (by altering output/economic strength and income/economic welfare from a regional perspective) – impacting on infrastructure, demography, investment and growth patterns and influencing demand for the development of water services. While the National Spatial Strategy and National Development Plan provide a good overview of trends, it is notable that more detailed assessment at River Basin District (RBD) level is required in order to meet the requirements of Article 5. The National Development Plan (2000-06), through the Water Services Investment Programme, provides for significant capital investment in water and wastewater services. Critical uncertainties revolve around issues such as the type of agricultural production and climate change. Nationally, the decoupling of production from grants under the reformed CAP programme will have further implications for farm sizes and water usage in the coming decade, while climate change will see a lowering of water tables and ability to abstract groundwater. Identifying current and future trends in land-use patterns and consequent farm numbers in the light of CAP reform will have important implications for water use/quality. Baseline data measuring current trends in impervious land cover at the scale of the RBD is also warranted.

- Assessment of Current Cost Recovery.

Assessing current levels of recovery of costs of water services, in accordance with Article 9 of the WFD requires investigation of key elements such as: the status of water services; the extent of the recovery of costs (financial, environmental and resource cost) of these services; the institutional set-up for cost-recovery and the contribution of key water uses to the costs of water services. Due to the lack of information available at the RBD scale for this review, the assessment of cost recovery was viewed nationally. Generally, the Department of Environment, Heritage and Local Government, in co-

operation with Local Authorities through the Water Pricing Framework and Water Services Bill, is progressively augmenting cost recovery levels nationally. Nevertheless, several factors inhibit comprehensive cost recovery (and thus where further work needs to be undertaken) including the lack of contribution to cost recovery of environmental costs – such as public amenity values/social and community benefits, opportunity costs and resource costs; the lack of comprehensive estimates of costs of water services to the domestic sector; the lack of comprehensive metering of all water users and the lack of cost information on water abstractions and leakages. The development of proper baseline data by local authorities on water and wastewater systems must be a priority, in order to permit proper quantification of the true cost of providing these services.

Certain issues are highlighted in the EEGD as requiring further methodological development by the responsible authorities, namely:

- How to deal with uncertainty: which approaches can be proposed to water managers for integrating uncertainty into decision making, and for developing adequate communication on uncertainty with the public and stakeholders?;

- How to assess the effectiveness of measures or combination of measures: clearly, this issue departs from the scope of pure economics. But it will need to be solved to ensure cost-effectiveness analysis can be performed;

- How to assess the direct and indirect economic impact of a range of measures on key economic sectors: For example, industrial and agricultural economic sectors/sub-sectors.

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ANNEX 1

Step 1.1 Assessing the Economic Significance of Water Uses at the RBD[100]	**Advice**	**Key Outputs**	**Feed into….**
1. Identify human pressures on water bodies 2. Localise water uses in the river basin district 3. Identify water uses and services by socio-economic sector (agriculture, industry households and recreation) 4. Assess the relative socio-economic importance of water uses 5. Identify areas designated for the protection of economically significant aquatic species (an implicit economic function of the economic analysis) 6. Initial characterization of Heavily Modified Water Bodies[101] (**EEGD-Annex *II)*** (an implicit economic function of the economic analysis)	Important indicators to use: income, GDP, employment, volumes of water demanded, social and economic preferences expressed via the public consultation process ***EEGD-Annex V.II*** Highlights country case studies EEGD-Annex II.III Highlights further issues on waters uses and services	Key indicators of economic significant water uses Areas designated for the protection of economically significant aquatic species	Economic Analysis of water uses by 2004 Register of Protected Areas **Step 2**: overall river basin planning process and characterization of water bodies: pressures and trends. All economic analysis ultimately feeds into the RBMP.
Likely information requirements for Step 1.1.	*Advice*		
1. Water abstractions and discharges by socio-economic categories and localities 2. Economic importance of main water uses: turnover, employment, number of beneficiaries etc. 3. Available information (e.g. quantity, prices or turnover) for characterizing economically significant aquatic species	**Key is to collect information that is relevant to water management issues in the RBD.** Combing biophysical and economic information requires agreement on common spatial scale[102] of analysis and reporting.		
Step 1.2 Projecting Trends in Key Indicators and Drivers up to 2015[103]	**Advice**	**Key Outputs**	**Feed into….**
1. Assess trends of key hydrological and socio-economic drivers that are likely to affect pressures (demography, climate, sector policies, e.g CAP) 2. Identify proposed measures and planned investments for implementing existing water legislation 3. Forecast changes in pressures based on changes in economic and physical drivers and proposed water-related measures 4. Construct a Business as Usual (BAU)[104] scenario,	Ensure coherence with projections and trends used for other river basins for national and EU policies and climate change. It is expected that the BAU will need to be updated post 2004 to integrate variations in parameters.	Baseline scenario and trends up to 2015	Overview of significant water management issues/ water status gap/risk of non-compliance Economic Analysis of water uses by 2004

[100] Although the level of reporting to the Commission is based on the RBD scale the development of comprehensive river basin management plans through analyses and consultation is likely to require more disaggregation of economic information and indicators (e.g at the level of sub regions of the basin or sub-economic sectors).

[101] Post 2004, the designation of Heavily Modified Water Bodies requires an assessment of 'significant adverse effects' and 'disproportionate costs'. See page 21 of the EEGD for further linkages. Also see **EEGD-*Annex IV.II***

[102] Case studies to assist RBDs to select the right scale for analysis are contained in **EEGD-*Annexes IV.I and V.II***.

[103] This will aid planning investments for the water industry.

identifying optimistic and pessimistic scenarios (with sensitivity analysis)	Sensitivity analysis is seen as key to the development of the baseline scenario.		
Likely information requirements for Step 1.2.	*Advice*		
1. Prospective analyses of likely development of key economic sectors/drivers influencing significant pressures 2. Information on population growth, economic growth, sector growth patterns, future policies and forecasts of the impact of climate change 3. Studies on existing and projected water balance 4. Inventory of existing measures (and costs) for complying with existing water legislation 5. Identification of technological developments in water sector	An understanding of regional planning is key. Risk assessment is key: try to specify the degree of confidence when forecasting data.		
Step 1.3 Assessing Current Cost-Recovery	**Advice**	**Key Outputs**	**Feed into….**
1. Estimate costs of water services, including financial, environmental and resource costs 2. Estimate the price/tariff currently paid by users 3. Assess the extent of cost recovery by water services and sector 4. Assess the contribution to cost recovery from key water uses 5. Description of the institutional mechanisms in place for cost recovery 6. Optional (unrealistic at this stage for the SRBD): to initiate a review of incentive pricing properties of existing tariffs.	This is needed to evaluate the effort needed to meet the 2010 deadline. Principles for allocating costs of water services to categories of water users will need to be defined in a coherent manner. *Reporting on cost recovery should be done by socio-economic sector (water use) or sub-sector.*[105]	Current extent of cost recovery	Economic Analysis of water uses by 2004 Implementation of Article 9
Likely information requirements for Step 1.3.	*Advice*		
1. Estimation of financial cost (broken down into operating, maintenance and capital costs) 2. Evaluation of tax transfers, administrative costs and any other costs 3. Evaluation of environmental and resource costs[106] 4. Extent of financial and environmental cost-recovery 5. Optional: If incentive prices are reviewed (point 5 above): current pricing structure, price elasticity.	Assessing incentive pricing properties of existing tariffs might be difficult in practice: it should be done to inform the future introduction of incentive in tariff by 2009.		

Step 2.1 Will there be gaps in water status by 2015?	**Advice**	**Key Outputs**	**Feed into….**
1. Translate the forecast analysis of pressures and investments in the water sector into a forecast of impact	Assessing the gaps in water status is equivalent of the more rigorous assessing		Preparatory documents for the RBMP by 2006[108]

[104] See for example the Oise case study (in **EEGD-*Annexes IV and VI***).
[105] Case studies to assist RBDs in selecting the right scale of analysis are contained in **EEGD-*Annexes IV.I and V.II***.
[106] Case studies undertaken in different Member States to support the development of the present guidance have shown that the availability of economic data is likely to represent a short-term constraint for undertaking the economic analysis. Furthermore, it may be difficult and time consuming to collect information from a wide range of private and public organizations. This is particularly true for environmental and resource cost information (e.g. not available in the Corfu and Vouga case studies (see **EEGD-*Annex VII*)**

2. To assess the gap between the Directive's objectives with respect to water status and the water status achieved with the baseline scenario and optimistic and pessimistic variations: • *If gap in water status go to Step 2.2a* • *If no gap in water status go to Step 2.2b*	risk of non-compliance. The assessment of the gap will require a good understanding of the hydrological cycle and relationships between pressures and measures and impacts. The scale[107] at which this assessment is required will be influenced by the identification of water bodies where gaps occur in the concerned river basin. **EEGD-*Annex IV.I***: gives details on estimating costs and reporting for cost-recovery. **EEGD-*Annex V.II***: *gives illustrations using simulation models for assessing the gap in water status and supporting the cost-effectiveness analysis* *Note:* The user must understand the assumptions and information used for building and calibrating the model, and uncertainties in model prediction.		Interim Overview of Significant Management Issues by 2007
Likely information requirements for Step 2.1.	*Advice*		
1. Methods and tools for transforming trends in pressures into trends in water status 2. Potential role of environmental modelling	Information needs to come from relevant experts in charge of determining pressures and impacts		
Step 2.2a What to do when a "Gap" has been identified?	**Advice**	**Key Outputs**	**Feed into….**
1. Identify water bodies where there is a gap 2. Define the main drivers of pressures (particularly, in terms of socio-economic groups) in order to facilitate the selection of appropriate measures in ***Step 3*** 3. Start identification of main options/measures likely to be investigated in subsequent ***Steps*** as guide 4. Evaluate how socio-economic groups may be affected by main options/measures taken to reduce gap	Public consultation is clearly specified in this ***Step***. It will be important to have preliminary assessments of costs and socio-economic impacts to provide a basis for consultation. Detailed analysis might need to be carried out at the level of the concerned water bodies: to obtain a better understanding of pressures and their impact on the status of these specific water bodies.	**Identification of water bodies where there is a gap.** Identification of the key sectors causing the gap and that might be affected and initial estimation of costs of additional measures for reaching good water status.	Preparatory documents for the RBMP by 2006 **Interim Overview of Significant Management Issues by 2007**
Likely information requirements for step 2.2a.	*Advice*		
1. Identification of additional measures, including new	**Economic analysis may play a role in the**		

[107] Case studies to assist RBDs to select the right scale for analysis are contained in **EEGD-Annexes IV.I and V.II**.

investments, sector policies, economic instruments 2. Initial estimation of the costs of these additional measures 3. Preliminary (qualitative) assessment of socio-economic groups	**identification of key drivers of pressures.**		
Step 2.2b What to do when "no Gap" has been identified	**Advice**	**Key Outputs**	**Feed into….**
1. No Gap means that measures for complying with existing water legislation are sufficient to meet the Directive's objectives 2. In the preparatory documents, propose to confirm those objectives and the programme of measures required by existing water legislation 3. If considered necessary, estimate the costs of these basic measures and provide a first assessment of the impact of these measures on socio-economic sectors and cost-recovery – Go to ***Step 3.4***	In ***Step 3,*** it might be necessary to reconfirm the costs of these basic measures and their cost recovery impact in order to incorporate them in the final River Basin Management Plan.	Total costs of basic measures.	Preparatory documents for the RBMP by 2006 Interim Overview of Significant Management Issues by 2007
Likely information requirements for Step 2.2b.	*Advice*		
1. Costs of basic measures 2. Estimation of the impact of basic measures on socio-economic groups	For example, see reports of specific European Water Directives (e.g. Urban Waste Water Directive)		

Step 3.1 Evaluating the Costs and Effectiveness of Potential Measures[109]	**Advice**	**Key Outputs**	**Feed into….**
1. Identify potential measures to achieve the Directive's objectives, including basic and supplementary measures 2. Estimate the costs of each measure 3. Estimate the effectiveness (environmental impact) of each measure	Given the potential interaction between measures, it is important to assess the effectiveness of basic measures and integrate them into the cost effectiveness analysis. Cost Effectiveness analysis is best performed at the river basin scale[110]: ensuring the hydrological integrity of the basin. Specific care needs to be given to the choice of the effectiveness indicator. Effectiveness of measures can often be assessed (qualitatively) for a few environmental indicators only, and not for the range of environmental issues encompassed in the definition of water	This ***Step*** is the key economic input into the preparation of the RBMP (Article 13). It is important that efforts are targeted to areas and issues required for aiding decision-making. Economic justification for possible derogation: Derogations can be justified (based on the assessment of costs and benefits) at the *water body level.*	Programme of measures and River Basin Management Plan

[109] Cost effectiveness analysis is illustrated by the Scheldt, Cidacos, Ribble (see **EEGD-** ***Annexes IV.I and V.II*** and Daugava (see **EEGD-*Annex IV.I*)** case studies.

[110] Case studies to assist RBDs to select the right scale for analysis are contained in **EEGD-*Annexes IV.I and V.II.***

	status. Uncertainty exists when ranking of measures obtained from cost-effectiveness analysis. Sensitivity analysis is seen as key to the development of the cost effectiveness analysis. *Annex IV.I* gives guidance and examples on scale issues; estimating costs; cost-effectiveness analysis; cost and benefit assessment; pricing as an economic instrument; disproportionate costs.		
Likely information requirements for Step 3.1.	*Advice*		
1. Costs of potential measures e.g.: investing to increase available supplies, demand management, wetland restoration, limiting abstractions with permits 2. Effectiveness of potential Measures	If demand management and pricing measures are used, the effectiveness of the programme of measures might need to be revisited to account for elasticity issues.		
Step 3.2 Constructing a Cost Effective Programme of Measures	**Advice**	**Key Outputs**	**Feed into….**
1. Assess and rank cost effectiveness measures 2. Select the most cost-effective programme of measures that can reach environmental objectives 3. Calculate range for the total discounted costs of this programme 4. Undertake a sensitivity analysis to assess robustness of results	Uncertainty on costs, effectiveness and time-lagged effects of measures needs to be considered in the cost-effectiveness analysis.	Estimation of Total Costs of Programme of Measures	**Programme of Measures and River Basin Management Plan**
Likely information requirements for 3.2.	*Advice*		
1. Compile information gathered in ***Step 3.1***			
Step 3.3 Evaluating whether costs are disproportionate	**Advice**	**Key Outputs**	**Feed into….**
1. If total costs are judged to be proportionate – Go to ***Step 3.4*** 2. If the total costs of the proposed programme are judged to be disproportionate, estimate whether derogation might be needed from an economic point of view on which basis: • Compare total costs to financial resources – if costs can be reduced or better managed over longer time horizon, propose time derogation; • Assess total costs and benefits (including water-related environmental benefits) – if total costs disproportionate as compared to benefits, purpose less stringent environmental objectives – account for socio-economic and distributional implications if considered necessary.	How to judge whether costs are disproportionate is not developed here, as it encompasses many complex decisional, institutional and socio-economic elements. Judgement needs to be made prior the analysis to decide weather to embark into the analysis or not. Estimating the need for derogation will be resource intensive and will require co-ordination with other experts and consultation of key stakeholders. **Plan it well and start early!**	Economic Justification for possible derogation: derogations can be justified (based on the assessment of costs and benefits) at the *water body level.*	Programme of measures and River Basin Management Plan

3. Redefine programme of measures accordingly and propose water bodies for derogation 4. Calculate total discounted costs of revised programme			
Likely information requirements for Step 3.2.			
1. Costs are proportionate: compile total costs of programme 2. To assess whether costs are disproportionate: • Estimate financial resources available • Estimate costs and environmental benefits which relate to the water body level.	The economic analysis can only formulate recommendations: estimating the need for derogation will ultimately remain a political decision.		
Step 3.4 Assessing the financial implications of programme of measures.	**Advice**	**Key Outputs**	**Feed into….**
1. Assess socio-economic and distributional impact of selected programme 2. Assess financial and budgetary implications of the selected programme, establish alternative financial plans 3. Identify accompanying (financial, technical, institutional) measures for implementing the selected programme 4. Assess potential impact on cost recovery and incentive pricing.	**This analysis will fit into the definition of pricing policies by 2010. It may also require loops to earlier steps of the cost-effectiveness analysis, e.g. if resulting price changes are likely to change pressures that this the cost-effectiveness analysis.**	**Estimation of Total Costs of Programme of Measures** **Financial and budgetary implications of selected programmes.**	**Programme of measures and River Basin Management Plan**
Likely information requirements for 3.4.			
1. Forecasts of prices by 2010 based on ongoing tariff policies 2. Allocation of costs by water uses 3. Information on price elasticity (effectiveness)			

ANNEX 2.

Table 1. Spatial Regions for Agricultural Data Collection: Teagasc, National Farm Survey 2002.	
Region Please note, there is no region 2.	Please note: Counties in italics are located in the Shannon PRB:
Region 1	Louth, *Leitrim,* Sligo, *Cavan,* Donegal, Monaghan.
Region 3	Kildare, *Meath*, Wicklow.
Region 4	*Laois,* Longford, Offaly, *Westmeath.*
Region 5	*Clare, Limerick, Tipperary N.R.*
Region 6	Carlow, Kilkenny, Wexford, *Tipperary S.R.,* Waterford.
Region 7	*Cork, Kerry.*
Region 8	Galway, Mayo, Roscommon.

ANNEX 3.

Table 2. Fertiliser Usage (Tonnes)

	Nutrients			Total Fertilisers
	Nitrogen	**Phosphorus**	**Potassium**	
1980/81	275,05	63,13	150,34	1,480,398
1981/82	275,20	61,84	148,04	1,468,051
1982/83	295,98	63,39	153,21	1,525,338
1983/84	331,44	66,20	161,64	1,685,811
1984/85	327,70	66,02	163,81	1,686,235
1985/86	322,74	58,08	144,69	1,569,595
1986/87	371,65	65,88	165,49	1,781,792
1987/88	339,40	62,44	155,96	1,641,936
1988/99	349,02	64,66	160,71	1,706,868
1989/90	379,31	64,57	158,43	1,793,290
1990/91	370,12	62,64	152,64	1,744,546
1991/92	358,30	59,42	147,82	1,646,362
1992/93	377,98	61,45	151,62	1,767,485
1993/94	404,81	59,97	145,32	1,820,362
1994/95	428,82	62,41	150,54	1,921,038
1995/96	416,81	61,94	152,12	1,896,019
1996/97	379,46	53,76	132,11	1,699,182
1997/98	431,99	49,92	124,31	1,830,295
1998/99	442,91	50,51	125,72	1,849,657
1999/00	407,59	49,26	122,69	1,730,437
2000/01	368,66	42,69	106,88	1,545,910
Source	Department of Agriculture, Food & Rural Development			
	In recent years the amount of P and K fertilisers used has been in decline. Bad weather conditions and reduced grass growth in both 1998 and 1999 resulted in farmers spreading more chemical N to get a response from grass. The slight upturn in P and K use in 1998/99 was reversed in 1999/00 (Table 9.3). Overall, demand for N, P and K has dropped by 8%, 2% and 2% respectively in the last year. The fertiliser year is from 1 July – 30 June up to 30 June 1992 and from 1 October to 30 September thereafter.			