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Water Framework Directive – Integration, Negotiation and Communication of Optimal Measures with Stakeholders (WINCOMS)

STRIVE

Environmental Protection Agency Programme

2007-2013

SSTI Strategy for Science, Technology and Innovation

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

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EPA STRIVE Programme 2007–2013

Water Framework Directive – Integration, Negotiation and Communication of Optimal Measures with Stakeholders (WINCOMS)

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STRIVE Report

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The EPA STRIVE Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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DEDICATION

This report is dedicated to the memory of Dr Mary Kelly, School of Sociology, University College Dublin, who died suddenly as the report was being finalised.

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Executive Summary

The management of water resources in catchments as envisioned in the Water Framework Directive (European Parliament and Council 2000) requires a diverse, yet highly integrated, approach to the implementation of techniques that address pressures on those resources. Because time and financial resources are always limited, the real challenge for catchment managers is to choose those techniques that offer the greatest return on investment, that is, that achieve the greatest impact (by preventing or minimising pressures) for a given input of time, energy and money. A key element in achieving impact is the promotion of public consultation in the preparation of river basin management plans. The Water Framework Directive legislation acknowledges that 'the success of this Directive relies on the close cooperation and coherent action at Community, Member State and local level as well as on information, consultation and involvement of the public, including users'.

The objective of the WINCOMS (Water Framework Directive – Integration, Negotiation and Communication of Optimal Measures with Stakeholders) project was to provide a detailed assessment of available measures, recommendations for and practical demonstrations of decision support systems (DSSs) that can be used by stakeholders and others for decision analysis, negotiation and mediation in developing WFD policy and measures. These DSSs should be able to integrate knowledge of the performance of the best available measures with the criteria and preferences of all the relevant stakeholders. Work was divided into three main activities:

1 Reviewing the realistic measures available that would meet the requirements of the WFD and developing a way of ranking their suitability.

2 Surveying existing DSSs and identifying a shortlist of two or three of the most suitable for WFD decision-making. Implementing and testing these in a case-study, evaluating their performance and recommending the most suitable system or approach – both for stakeholders and decision-makers involved in WFD activities.

3 Identifying and studying the knowledge, opinions and preferences of all relevant stakeholders and reporting on stakeholders' attitudes and preferences in relation to decisions, negotiation, and mediating in developing policy/measures.

These activities spanned a broad range of subjects. To facilitate these, the project team included both water-related technical expertise and sociological expertise. A variety of techniques were used in the project:

- Detailed review and an assessment of measures and of existing DSS;
- Development of case studies to let stakeholders use shortlisted DSSs;
- Workshops to demonstrate the shortlisted DSSs to stakeholders and to evaluate their responses and feedback;
- Comprehensive sociological observation of meetings of the Advisory and Technical Councils of the Eastern River Basin District (ERBD) to study the communication between the various actors involved.

The main conclusions/recommendation of the project are:

1 There is a need for better Irish data on the costs and performance of most measures, especially those for controlling diffuse sources of pollution.

2 An educational/technology transfer element is a fundamental adjunct to any programme of measures.

3 While measures currently required by existing legislation/regulations are choices, river basin districts should not limit themselves to these.

4 A targeted approach to implementing measures in a catchment will produce superior results to a 'one-size-fits-all' strategy. 'Demonstration' sites can promote state-of-the-art techniques.

5 There was no single ideal DSS for use by all stakeholders in all circumstances. However, the DEXi system was found useful for stakeholders to explore the choice of measures for specific cases, but it required external supporting technical material. There is considerable scope for further efforts to develop DSSs suitable for stakeholders.

6 Considerable effort was invested by the ERBD to provide information to the public who were consulted and given opportunities to comment. However, these initiatives were of limited success due to a variety of factors associated with engaging the public in complex, technocratic decision-making.

7 Public participation was to some extent constrained by factors *beyond the control* of the ERBD: the substantive content of the WFD, budgetary restrictions, time constraints, national templates and deadlines all curtailed options and limited choices. These should be addressed. From European Union to river basin level, the meaning and value of participation (and its various forms) was unclear or open to interpretation.

8 The existing Advisory Council (AC) mechanism may *not* provide a forum where social learning can occur and 'active participation' of stakeholders may not be distinguished from 'information provision' and 'consultation'. The composition of the AC should be considered carefully as should the potential benefits of independent facilitation at its meetings.

The main report (available at http://erc.epa.ie/safer/reports) contains a complete description of the outputs of the project. This synthesis report is a summary of the main report and of its conclusions.

1 Introduction

1.1 Background

Managing water resources in catchments as envisaged in the Water Framework Directive (WFD) (European Parliament and Council 2000) requires a diverse, yet highly integrated, approach involving the implementation of techniques that address pressures on those resources. Resources are limited, so a particular challenge for catchment managers is to choose those techniques that both satisfy WFD requirements and also offer the best return on investment, that is, achieve the greatest impact (in preventing or reducing pressures) for a given input of time, energy and money, while involving all stakeholders and particularly the general public.

Activities that affect water quality are most often those that cause water pollution – the introduction of contaminants to water that impair the suitability of the water for one or more specific purposes. In addition, there is an intimate connection between water quality and water quantity and both aspects of water-resources protection must be addressed simultaneously in a co-ordinated fashion. The complexity of the interactions demands the use of integrative catchment modelling (Mahmoud, Liu et al. 2009) in order to forecast the effects of change, as well as appropriate long-term monitoring strategies to confirm that the desired changes have occurred.

The main contaminants contributing to water-quality degradation are inorganic chemicals (mainly species of nitrogen and phosphorus), inorganic particles (eroded soil, metals from road surfaces, etc.), organic compounds (pesticides, oils and greases from roadways, for example), and organic matter (faeces, bacteria, virii, detritus, etc.). The origins of these contaminants may be well-defined point sources (e.g. discharges from easily identifiable locations, such as discharge pipes) and/or may be diffuse sources (e.g. the landscape, including agricultural fields, forestry plantations, construction sites, etc.). Regardless of the nature and origin of the pollution, it must be addressed in a river basin management plan (RBMP). The content of the plan is prescribed in Annex VII of the WFD and includes a description of the current water quality status of the basin, the pressures impacting on water quality and describes the measures to be taken to achieve WFD objectives for the basin.

A key element of the WFD is the promotion of public consultation in the preparation of RBMPs. The Introduction to the WFD legislation affirms that 'the success of this Directive relies on the close cooperation and coherent action at Community, Member State and local level as well as on information, consultation and involvement of the public, including users'. However, the concept of involvement is not described in detail and, in the subsections of article 14, the WFD requires only that the public must be kept informed and given the opportunity to comment on the preparation of plans for the implementation of the WFD in each RBD/a reactive rather than a proactive role.

To facilitate meeting the water-management requirements of the WFD, the EU has been divided into river basin districts (RBDs), delineated according to river basins, natural geographical and hydrological units, rather than administrative or political boundaries. In Ireland, the Eastern River Basin District (ERBD), which is the focus of this project, has been set up as one of eight such RBDs. Covering a geographical area taking in all or parts of the counties of Cavan, Dublin, Kildare, Westmeath, Wexford and Wicklow, it requires the cooperation of 12 local authorities.

The most significant means of promoting public participation in Ireland has been through the formation of Advisory Councils (ACs) for each RBD. Composed of stakeholders from a range of fields, these councils were intended to be the primary means of achieving public representation on how to meet the terms of the WFD. In the ERBD, the 48-member AC consisted of local authority representatives, including elected councillors and individuals from interested fields, such as agriculture, fisheries, business and environmental non-governmental organisations (NGOs). In addition, public authorities

responsible for the production of a management plan by 2008 were required by Irish legislation to 'have regard for the advice and recommendations of the Advisory Council for the district'. However difficult to implement, this type of approach is intended to improve the quality and appropriateness of decisions and to reduce conflicts arising from controversial decisions. Although the 'average citizen' may not know all of the scientific details concerning hydrological and water-quality dynamics and behaviour, he or she – because of their personal involvement and direct experience – may be able to identify important practical aspects that may have been given less weight by professional decision-makers with less 'local' knowledge. It is hoped that by greater participation in the decision-making process, the public will feel that decisions affecting their lives do take account of their needs and expectations.The WFD distinguishes between three types of public participation in decision analysis: (i) information exchange between stakeholders (including the public) and other actors; (ii) consultations in relation to specific plans; and (iii) active involvement in implementation (Tippet, Searle et al. 2005). In order to improve the quality of decisions, all three types should occur during decision analysis.

The public's willingness to participate in achieving the WFD's ambitious goals varies considerably. However, there are certain social and technical constraints that, if addressed, may facilitate stakeholders' contributions. The WINCOMS workshops (described below) showed that modern computer-based, technology and software, including geographic information systems (GIS), numerical models, DSSs and the Internet, are potentially useful tools when encouraging people to take part in the development of water-management policy in their region. On the other hand, if the systems and software are chosen badly, they become another barrier to participation and people may just lose interest. Forgionne (1999) claims that some 'experiments demonstrate that DSS what-if analysis creates an "illusion of control" that causes users to overestimate its effectiveness'. Therefore, the choice of an appropriate tool (or tools) is critical for success. The detailed and clear evaluation followed by the selection of a few DSSs for use by WFD stakeholders is the main aim of this study.

1.2 WINCOMS Project

The WINCOMS acronym stands for 'Water Framework Directive – Integration, Negotiation and Communication of Optimal Measures with Stakeholders', and its objective was to provide a detailed assessment of available measures, recommendations for and practical demonstrations of DSSs that can integrate knowledge of the performance of the best available measures with the criteria and preferences of all relevant stakeholders, and which can be used by stakeholders and others for decision analysis, negotiation and mediation in developing WFD policy and measures.

1.3 Aims and Objectives

The main objective was broken down into a number of activities undertaken by WINCOMS, including:

- Produce a comprehensive scientific and technical description of all measures available to meet the requirements of the WFD together with a ranking on the basis of all relevant criteria, using formal multicriteria methods.
- Survey existing DSS and identify two or three of the most suitable for WFD decision-making. Implement, adopt and test these in a case-study situation (using the ERBD project), evaluate their performance (particularly in respect of their interactions with stakeholders); and recommend the most suitable system or approach.
- Identify and study the knowledge, opinions and preferences of all relevant stakeholders and integrate the results with the DSSs implemented in Objective 2 (i.e. report on stakeholders' attitudes and preferences, on the use of DSSs as decision, negotiation and mediating tools in developing policy/ measures).
- Initially a three-year project, the time was extended by one year to allow the project to analyse the public responses to the draft RBMP (for which the consultation period closed on 22 June 2009) and incorporate them into this report.

In the course of its work, WINCOMS organised three workshops where practical demonstrations of DSSs were undertaken; in two workshops the participants had

hands-on experience of selected systems. The overall structure of the project is shown in Appendix 1.

The main report (available at http://erc.epa.ie/safer/reports) gives a complete description of the outputs of the project. This synthesis report is a summary of each of the chapters of the main report and of its conclusions. Section 2 begins with a discussion of measures and criteria and then moves on to report on stakeholder involvement activities in Section 3. The review of DSSs and the selection of demonstration systems are synopsised in Section 4, while Section 5 provides an analysis of the outcomes of stakeholder participation. Section 6 gives the project's conclusions and recommendations.

2 Overview of Measures

This section primarily addresses pressures that affect water quality, on the assumption that in general catchment water quantity pressures must (in Ireland) be addressed at a higher level of authority than is represented by RBDs. The WFD mentions, in Article 1, that water supply and flood and drought mitigation are some of the purposes of the Directive. Both of these require the management of water quantity as well as quality. However, RBD activities to date have concentrated on water-quality objectives. In fact, both are linked intimately – for example, critical quality conditions occur during low flows in rivers, while major amounts of pollutants are transported during floods. Ultimately, these linkages must be taken into account in management plans, but this avenue has not yet been developed in depth.

The WFD uses the term 'measure' to mean a specific component of a water-management plan. It could, for instance, be an activity, a structure or a law. It divides measures into two categories: (i) basic measures, that is, already required by existing legislation and (ii) supplementary measures (see WFD, Annex IV). Although this report categorises measures according to their physical attributes, where appropriate they are linked to the appropriate WFD category. The results, described below, are targeted principally at RBD decision-makers, but also add to stakeholder and general technical understanding of the performance, advantages and disadvantages of potential measures.

2.1 A Simple Recipe for Controlling Pressures on Water Resources

As regards the control of anthropogenic pollution pressures, assuring a favourable return on investment requires not only selecting the appropriate techniques, but also applying these in strategic locations. (The same is true for controlling pressures on water quantity.)

This recipe for success has three fundamental ingredients:

1 Knowledge of the reasons for pressures on water quality (and/or quantity);

2 Knowledge of the locations of these pressures; and

3 Knowledge of the performance of measures that can address pressures.

Implicit in this strategy is the tailoring of actions to particular problems, and then targeting these in some priority order to those locations in a catchment that require the most attention, that is, are causing the biggest problems. In general, a control strategy using site-specific, targeted measures is superior to a so-called 'one-size-fits-all' strategy, in which a uniform approach is taken to address a particular problem regardless of site-specific conditions (e.g. Sharpley, Daniel et al. 1993; Sharpley 1995). When the above three ingredients are available, decisions about what to do to address water pollution pressures or threats to quantity, and where to take action, are straightforward. If, in addition, the cost of each particular strategy is known, it is a simple matter to select appropriate measures within any given budget.

2.2 Impediments to Controlling Pressures on Water Resources

The recipe above presumes that the implementation/ adoption of selected measures is not an issue. However, this presumption is tenuous as regards measures for controlling diffuse pressures because controlling these sources of water pollution impinges on private property rights. Although under civil law, individuals can be prevented from causing a nuisance (including pollution of water resources), the nature of diffuse water pollution precludes, except in catastrophic events, establishing a causal link between activities at a specific location in a catchment and water quality. Consequently, measures that control diffuse pollution are either adopted voluntarily by some (but usually not all polluters), or the measures are imposed on all polluters by law or regulation. A long-running debate over whether voluntary or regulatory approaches are more effective in controlling diffuse pollution has ardent supporters on both sides of the argument, particularly in regards to diffuse agricultural pollution (Braden and Lovejoy 1990). (In general, controls on diffuse pollution consist primarily of incentivised voluntary measures supplemented by a mix of regulatory measures.) Nevertheless, whether voluntary, regulatory or a mixture

of measures are used, human behaviour becomes as important a consideration in developing a successful and effective control programme as the technical merits of the measures themselves.

Characterisation studies (EPA and RBDs 2005) that have already been completed in the various river basins have identified the pressures, and to some extent, the locations of those pressures, on water resources. It remains to devise appropriate strategies for addressing these pressures. Unfortunately, the recipe for accomplishing this, described so simply above, is really not so simply or easily achieved.

Catchments are complex and dynamic environmental systems. Nevertheless, they obey an inescapable important law of nature: whatever enters a catchment must eventually leave the catchment, unless it is stored in the catchment. This fundamental law pertains equally to water itself and to materials that may ultimately become water pollutants. The storage capacity of a catchment for any physical material, such as phosphorus or water itself, is finite. In the case of water *quantity* management, the challenge is to assure that an adequate quantity of water (with acceptable quality) is available to meet demands. This requires that water inputs, storage and demand be integrated with water-quality management.

In the case of water-*quality* management, catchment management activities must collectively endeavour to keep the total catchment system, as well as each of its component sub-parts, in balance such that inputs do not overwhelm the 'assimilative capacity' of the natural system and create *unwanted* outputs, i.e. pollutants. In the United States, this strategy has been based on first determining the assimilative capacity of a catchment, and second implementing strategies that assure it is not exceeded by human activity. Assimilative capacity is expressed as a total mean daily load (TMDL) for a given pollutant, and 'is a calculation of the maximum amount of a pollutant that a water-body can receive and still safely meet water quality standards' (United States Environmental Protection Agency 2007). 'Assimilative capacity' is the key to 'sustainable use' of the planet (Cairns 1999).

Techniques for managing water *quantity* are well advanced as a result of many decades of research and practice in this field. In the main, quantity-management measures will not be addressed in this document.

2.3 Point versus Diffuse Pressures on Water Quality

Anthropogenic pressures on water quality are as complex and dynamic as catchments, although for convenience these pressures are grouped into just two categories: point and diffuse. Examples of these two types of pollution pressures are given in Table 2.1, compiled from 'Characterisation Studies' reports. The measures required to address these two types of pressures are vastly different.

Historically, point sources have been viewed as those from which emissions to the environment can be pinpointed physically, such as the discharges from municipal and industrial wastewater treatment facilities. The emissions from such sources are relatively easy to quantify, and are relatively consistent over time. In addition, the operational processes by which to alter the emissions from point sources are 'mature', and

Table 2.1. Examples of significant point and diffuse pollution sources and type of resource affected.

Point sources		Diffuse sources	
Surface water	**Groundwater**	**Surface water**	**Groundwater**
Urban waste water treatment plants	Contaminated land	Agriculture	Agriculture
Storm overflows	Waste disposal sites	Non-sewered population	Non-sewered population
Sludge treatment plants	Oil industry infrastructure	Urban land uses	Urban land uses
Integrated pollution prevention control (IPPC) and industries	Discharges from mines	Transport	Transport
Non-IPPC industries	Discharges from 'soakaways'	Peat exploitation and forestry	Peat exploitation and forestry

Source: EPA and RBDs, 2005

both their cost and performance are predictable. The application of point-source control techniques produces immediate effect, that is, emissions are measurably diminished (although it may take considerable time afterwards for an ecosystem to exhibit an improvement as a result of the controls implemented). Not surprisingly, in Europe and elsewhere, strategies to address water-quality problems have focused almost entirely on point sources until relatively recently, and (at least in the US) improvements in water quality have largely been attributed to point source control measures (Office of Management and Budget [OMB] 2006). (Nevertheless, in the 30 years that have passed since the enactment in the US of the Federal Water Pollution Control Act Amendments of 1977, the goal of making all waters in the US 'fishable and swimmable' has yet to be achieved.)

In contrast to point sources, diffuse sources of environmental emissions are characterised by the fact that no unique, physical discharge point can be identified. Diffuse sources seem to emanate from everywhere and thus include all activities that are distributed across the landscape of catchments. Because agriculture is typically the largest and most intensive user of land in (rural) catchments, this sector often receives the most attention for diffuse emissions to water. As seen in Table 2.1, other diffuse sources of emissions include urban land use, forestry, construction, and, in un-sewered areas, rural housing.

The transport of contaminants from diffuse sources to water resources is intimately linked to hydrologic processes, which in turn are influenced by topography, geology, soil characteristics, vegetation and anthropogenic activity (Table 2.2). For these reasons, unlike the emissions from point sources, those from diffuse sources are difficult to predict and cannot, in general, be collected and remediated. Consequently, measures to address diffuse sources of environmental emissions must be aimed at a myriad of locations that may be scattered about the landscape, and must focus on preventing/minimising the emissions and/or disrupting the transport of the emitted substances to water resources.

As a result, in comparison to point source control measures, the performance of diffuse source control measures is highly variable and difficult to predict except in broad terms. Such is the influence of site-specific conditions on the performance of these measures that data are often difficult to transfer across large distances. This is because – in contrast to point source control techniques – the influence of fundamental parameters that influence the performance of diffuse source control techniques has, in general, not been described adequately with process-oriented relationships. A case in point are vegetated buffers. These are specially maintained vegetated areas contiguous to surface waters that attempt to separate land-use activities (especially agricultural activities) from the receiving water. Despite research on these measures that dates back approximately 30 years (e.g. Barfield, Tollner et al. 1979; Magette, Brinsfield et al. 1989; Muñoz-Carpena, Parsons et al. 1999; Dosskey, Helmers et al. 2008), a process-based description of buffer effectiveness on a site-specific basis remains elusive.

This conundrum is not limited to the agricultural sector. Despite the perception that forestry best-management practices are effective in producing desirable trends in water quality, there is also considerable scepticism in their site-specific impacts because of a lack of scientifically defensible assessments (Ice, Dent et al. 2004).

Table 2.2. Factors influencing anthropogenic emissions from rural landscapes to water.

Factors affecting loss of pollutants		
Uncontrollable	**Somewhat controllable**	**Controllable**
Type and history of geologic materials	Soil physical characteristics (e.g. drainage, cultivation)	Soil chemical characteristics (pH, nutrient levels, etc.)
Weather		Vegetation
Topography		Type of anthropogenic activity
Depth to groundwater		'Pollutant' characteristics (chemical formulations, etc.)
Soil type		
Drainage density		

Source: Magette, Hallissey et al. 2008.

Another distinguishing characteristic between control techniques for diffuse emissions and point-source techniques is the need to involve a large number of people in the implementation of the former. Because techniques addressing diffuse emissions must generally be applied at source, potentially every landowner (and site manager) in a catchment has a role to play in controlling these emissions. Engendering a desire or creating the motivation for such participation by a diverse group of individuals, as envisaged in Article 14 of the the WFD, is but one obstacle that must be overcome when implementing diffuse emission controls. The issues involved are discussed in Section 5 below.

It is not enough for individual farmers to be motivated to do something about diffuse emissions to the environment; they must also know what to do, how to do it and be able to do it. Technically viable and practical strategies must be available for farmers to use; these must be communicated to farmers; and the farmers must have the knowledge, skills and the economic ability to implement them (not to mention the motivation). In short, an effective strategy to control diffuse emissions to water is dependent on having participants that are ready, willing and able to take up the challenge. Willingness can be genuine, as in voluntary participation, or it can be forced, as in a mandatory (i.e., regulatory) programme.

The issue of effective participation in pollution-control programmes means that any emissions control strategy that addresses diffuse-source and sometimes point-source control strategies must address behavioural change. Doing something differently than before, that is, improving the control of environmental emissions, is the essence of behavioural change. Any strategy to control pressures on water resources must, therefore, recognise the influence of human psychology.

While the effectiveness (i.e., performance) of emission-control strategies for diffuse sources, as well as for water-quantity management, is dependent on both technical and social factors, the effectiveness of point-source emission control measures is simpler. The design of point-source emission control measures is straightforward from an engineering perspective, and the effectiveness of these is quite predictable. As point sources are highly regulated, the adoption of control strategies is without question. In contrast, the effectiveness of diffuse-source control measures is very difficult to estimate on a site-specific basis. Further, voluntary approaches to implementing these measures very much depend on inducing individual persons (i.e. landowners) to change existing behaviours. (The same can be said of voluntary methods to conserve water.)

2.4 Criteria for Assessing Measures

Seven categories of criteria are considered to assess measures associated with the WFD:

- Economic;
- Social;
- Ecological;
- Physical/chemical;
- Biological;
- Sustainability;
- Aesthetic.

Details of individual criteria in each category are given in the main report (available from http://erc.epa.ie/safer/reports). In practice, a full assessment of measures may involve criteria under all of these headings. The decision-support methods used in WINCOMS Workshops 2 and 3 were selected on the basis that they can readily accomodate criteria under all of the above headings, as well as meet the requirements and preferences of stakeholders as expressed in the questionnaire surveys. In this report, a subset of these criteria is used in the case studies presented to the AC members at Workshop 3. These included physical criteria such as reliability, effectiveness, ease of implementation and time to achieve impact; an economic criterion, cost; and a social criterion, acceptability.

3 Stakeholders' Attitudes to Measures in the Eastern River Basin District

3.1 Introduction

This section reports on stakeholders' attitudes to the measures proposed to address water-quality issues in the ERBD. A broad view is taken of the term 'stakeholder', and here both the attitudes of the AC, as they considered drafts of the *Water Matters* (originally to be called the Significant Water Management Issues [SWMI]) report and then of the general public and all organisations that commented on the measures when they were published are reported. The draft RBMP was produced in December 2008 and followed by a six-month public consultation phase, ending on 22 June 2009. The comments received were analysed by each RBD project team and a final RBMP was prepared by them for consideration by the local authorities involved. Although these results are of wide applicability in the sociology of environmental opinions and preferences and the communication and influence of science knowledge, their principle targets are stakeholders and decision-makers involved in WFD activities.

3.2 Attitudes of the Advisory Council

3.2.1 Water Matters *Report*

In line with WFD requirements, Article 14 of the Irish Water Policy Regulations 2003 (SI No. 722/2003) sets out the statutory public engagement requirements at various stages of preparing RBMPs. It states that the relevant local authorities must (*inter alia*) prepare and publish:

- An overview of the significant water-management issues (SWMI) identified in the River Basin District by 22 June 2007 (two years before the period to which a RBMP was due for publication); and
- Draft copies of the River Basin Management Plan by 22 June 2008.

On publication of these documents, the relevant local authorities must 'invite the provision of comments in writing by any person and shall allow a period of at least six months for the provision of such comments' (WFD, Art. 14, SI No. 722/2003).

The SWMI report mentioned above was given the name 'Water Matters' in Ireland. The AC was presented with the draft *Water Matters* report at its seventh meeting on 4 December 2007. Some of the discussions concerned:

- That the urgency of the problem of water pollution should be emphasised in *Water Matters*.
- The impact of forestry operations on water quality. The AC expressed concerns about the effectiveness of existing regulations governing specific operations and the adequacy of current monitoring.
- The linkage in the draft *Water Matters* report between quarries and polluting activities. As a result, the following text was included in the final *Water Matters* report at the behest of the AC:

  > The Advisory Council has voiced concern that continued effort is required to locate illegal landfill sites and monitor the effects of historical landfills. The same concerns were shown for identifying illegal or poorly operated quarry sites and implementing existing regulations for them. (*Water Matters*, p. 16)

  and

  > The Advisory Council recommended that regulations regarding quarries and landfill sites should be separated, to reflect the differences in the actions required to mitigate pollution from these sites. (*Water Matters*, p. 17)

- The effect of agriculture on water quality. There was particularly concern about the effectiveness of the implementation of the Nitrates Directive, which influences the locations and timing of slurry spreading on agricultural land, especially in intensely agricultural areas such as the Boyne, Nanny and Delvin catchments.

- The effect on water quality of increased urbanisation, issues such as inadequate infrastructure, especially relating to water supply and sewerage systems and the problem of combined sewer overflows. This relates not only to the Greater Dublin area, but also to its satellite urban centres. The resulting physical changes to river systems and to flood risk were also raised as concerns by the AC.
- Impacts of discharges from sewage treatment works, especially from the smaller facilities:

  > The AC has shown concern over the capacity of existing wastewater treatment works and their ability to deal with expanding populations in smaller towns. Many treatment works, serving populations of less than 500, provide inadequate treatment before discharge to surface waters and the cumulative effect of these needs more monitoring and regulation. (*Water Matters*, p. 13)

- Land application of waste water treatment plant (WWTP) sludge.
- Increased emphasis on coastlines and shellfish.
- Concerns about the powers conveyed by the Liffey Reservoir's Act (1936) which allowed the impoundment of the Liffey for the purpose of generating electricity.
- The introduction of water-metering as a mechanism for reducing water consumption and pricing policy, as the current situation places an unfair burden on small businesses and local authorities. This could be linked to a general concern about sustainable water supply in the future. Again, text was added at the request of the AC:

  > The Advisory Council suggested that in addition to ongoing public education in water conservation metering of domestic supplies, direct charges for domestic use, stricter controls on abstraction licenses and a reduction in leakage may go some way into mitigating these pressures. (*Water Matters*, p. 36)

- The promotion of rain-water harvesting as a mechanism for increasing water supply.
- Infrastructure problems within the structure of the ERBD.
- More detail (precision) needed in recommendations.
- The problem of septic tank maintenance and the influence on newer household chemicals; the following text was added at the behest of the AC:

  > The Advisory Council suggested that domestic users should receive advice concerning the discharge of substances which affect the performance of septic tanks e.g. household bleach. (*Water Matters*, p. 23)

- More emphasis on recycling empty containers (with residues of pesticides and herbicides), with the following text added:

  > The AC has pointed out that facilities to dispose of herbicide and pesticide containers in a controlled manner would reduce the discharge of dangerous substances to the environment. (*Water Matters*, p. 29)

In the final *Water Matters* report, the suggestions and concerns of the AC are mentioned in 12 separate places, covering a wide range of the topics mentioned above. This is a significant contribution.

3.2.2 Advisory Council Response to Draft RBMP

Prior to the publication of the draft RBMP, a preliminary working document was circulated for discussion in September 2008 to both the ERBD Technical and Advisory Councils. The Technical Council consisted of technical experts (e.g. scientists, engineers, etc.) who advised on the technical aspects of the proposed plan. The AC had a broader composition and advised on stakeholder attitudes to the plan. The feedback and comments of both councils are in Appendix B of the draft RBMP. The main topics raised were:

- Concerns about the future of marine and fishery interests.
- There were some suggested changes to the reasons why some water bodies have been designated as 'heavily modified water bodies'. There was a query over the designation of the Boyne, Liffey and Vartry rivers and their estuaries as heavily modified water bodies, with proposed exemptions, even though these rivers had some reaches of unique, good quality, conditions that are also EU designated salmonid systems. Parts of these rivers already achieve 'good ecological status'.

- Recommendation to include SI No 293/1998: European Communities (Quality of Salmonid Waters) Regulations, 1988 in the section on 'Protected Areas' in the plan.
- Recommendation to include the EU Freshwater Fish Directive (79/659/EEC) and SI No. 293/1998: European Communities (Quality of Salmonid Waters) Regulations, 1988 in the list of legislation within the plan.
- Recommendation to include a link to a list of legislation proposed for repeal under the WFD.
- With regard to supplementary measures in relation to pressures relating to morphological changes, consider whether the plan should include dredging operations regulated under the Foreshore Licences Acts 1933–1998, planning Acts administered by Local Authorities and the 1945 Arterial Drainage Act of 1945.
- Dredging is regulated either under the Waste Management Act (1996) for disposal on land or by the requirement to have a Dumping at Sea permit for seas. Recommendation that the use of 'comply' with either/both when detailing supplementary measures.
- Recommendation that supplementary measure on shipping activities should state 'Comply with SI 117/2003 (Port reception facilities for ship generated wastes and cargo residues) Regulations 2003, administered by the Department of the Marine and Transport'.
- Recommendation to include the restoration of the Avoca river in the Programme of Measures (POMS) as it has huge amenity potential.
- Recommendation to take account of the relationship between abstraction pressures and climate change when considering low-flow conditions in rivers.
- Opposition to the deferment of the date for meeting the WFD objectives until 2027 in some cases (such as diffused pollution from agriculture, unsewered properties and septic tanks). The work already done to address these issues was noted.
- Suggestion that the AC have access to both the RBMS and the Technical Council meeting minutes and reports.
- Recommendation that item in 'potential measures to improve status under physical modifications' is reworded to 'river barrier removal/habitat restoration/enhancement schemes'.
- Recommendation that parts of 'Forestry' in the 'Programmes of Measures: The Issues' section are reworded.
- Recommendation that information is added on how ecological status is determined.
- Concern over the absence of mention of the Liffey Reservoir Act of 1936, which allows the ESB to shut off the flow of the Liffey if it should desire. Suggestion the plan discuss this and request that Act be changed. This Act also affects the 'Abstractions' section.
- Recommendations for structural changes to document.

What is clear from the broad range of subject matter and the types of comment is that the AC had considerable input into the draft RBMP. In particular, the comments show an appreciation of:

- The variety of water bodies intended to be covered by the WFD (note the concern with coastal and marine);
- The wide range of measures possible, including leakage reduction and various demand-management measures, for example, metering and water pricing and public education;
- The technical details involved in designating water bodies (note the request to alter the reasons for designating certain water bodies as heavily modified).

Some comments also show a concern for the impact and presentation of the report, for example, the suggestions to include more information on how ecological status is determined and also on the structure of the report.

3.3 Response to the Public Consultation Phase of the RBMP

The ERBD draft RBMP was published in December 2008 and made available for public comment. A six-month period was allowed to receive these comments.

The comments were read and analysed for the ERBD and a detailed report was produced by the consultants, CDM, that described the comments and the response of the ERBD to each comment. Here the comments received by the ERBD are described and analysed to assess the effectiveness of the public consultation in relation to the RBMP. The ERBD analysis of comments and its responses to each were made available by CDM to the WINCOMS researchers for this purpose. There were 64 submissions received in relation to the ERBD draft RBMP. The responses are analysed on the basis of the pressure they address.

3.3.1 Wastewater from industrial discharges

Most comments (27 in all) were related to the effect of WWTPs. Comments covered (i) the operation (mostly where deficient) and, where existing plants were thought inadequate, (ii) suggested expansion or upgrade. Some suggestions focused on specific areas that were considered priorities – for example, Osbertstown and Kells. Others argued for including other WWTPs (e.g. Arklow) in the plan. The Environmental Protection Agency (EPA) asked that a prioritised list be produced. The umbrella organisation SWAN (Sustainable Water Network) recommended that no new developments be permitted unless adequate wastewater treatment facilities were in place and that isolated developments should not be allowed to discharge directly into watercourses. The need for WWTP sludge management plans was identified and there was a suggestion that land application be banned. A specific concern was the cleaning-up of the Avoca river. There was a suggestion that discharge licensing should be informed by fisheries issues, and that emission limit values (ELVs) should be reduced.

Some comments requested: (i) clarifying the reasoning behind specific decisions; and (ii) giving more detail in the report (e.g. in relation to Boyne exemption). Others – from local authorities, for instance – identified work in progress, listed areas where cooperation with other local authorities was needed and suggested extensions of time for the implementation of specific measures.

3.3.2 Quarries, mines and landfills

Twelve of the fifteen comments related to the Avoca river: most of these objected to its proposed derogation. These comments came from the general public, from special interest organisations and from Arklow Town Council, demonstrating the strength of opinion and concern regarding the issue. Both An Taisce and SWAN suggest that the Avoca river water-quality problems were due not only to the mines, but also to a local landfill, industry and WWTP.

An exemption from the requirement to achieve good status by 2015 was sought for peatlands in Co. Offaly because of naturally occurring high concentrations of ammonia.

3.3.3 Agriculture

The 57 comments showed a considerable amount of disagreement with the supplementary measures relating to agriculture. For example, one organisation argued against the use of buffer strips; set-aside; reduced stocking density; reduced amount of land reclaimation; nutrient management planning; stricter slurry storage or closed spreading periods; the relocation using digesters in areas of nutrient surplus; and the prevention of using watercourses for livestock under the Rural Environment Protection Scheme (REPS).

Other negative factors raised were the effect of riparian buffers on stocking levels and the consequent loss of farm income. On the other hand, a positive impact on habitats was expected. One comment suggested that incentives for the proper management of water quality should be included in REPS and in Rural Development Plans. Offaly County Council mentioned that results of a research project carried out by four local authorities in the Upper Boyne had indicated that a 3-m planted riparian buffer would be effective at preventing fertilisers spreading into streams. Farm inspections (to monitor compliance) were proposed by the EPA and rejected by the Irish Farmers Association (IFA).

There was a mixture of outright opposition to many supplementary measures (claiming they were premature and excessive) and suggestions (e.g. by the Irish Creamery Milk Suppliers Association [ICMSA]) that the Nitrate regulations are sufficient and no further supplementary measures are necessary for the agricultural sector. Sludge and slurry management plans were suggested as mandatory requirements for WWTPs and for dealing with animal wastes.

It was also suggested that the results of the EPA's good agricultural practice study and Teagasc's agricultural

mini-catchments project should be obtained before the implementation of supplementary measures.

There was opposition to over-grazing remediation. Nose pumps were suggested instead of giving cattle access to watercourses. Concern was expressed that slurry storage periods will not be sufficient to protect salmonids. Siltation due to ploughing close to river banks was also raised as an issue and it was suggested that it should be addressed by buffer strips.

However, digesters of biosolids are supported by An Taisce. A soils expert, commenting in a personal capacity, suggested that the results of field-scale experiments may not scale up linearly to actual catchments and that, because of this, the contribution of agricultural runoff may be overestimated. In relation to groundwater fluxes, experiments that do not extend to below-rooting depth may not assess nutrient fluxes to aquifers. Insufficient farm storage is suggested as the cause of most farm-based pollution of watercourses. It was suggested that intensive pig farming in particular will require aid to achieve WFD goals.

There was concern over the time lag between the implementation of measures and an observable improvement in water quality. Presumably, the longer the lag, the more difficult it would be to sustain controversial measures.

3.3.4 Wastewater from unsewered properties

There were 17 comments concerning wastewater from unsewered properties. It was noted tht problems arise in poorly drained soils and that the onus is on planning authorities to ensure sufficient assimulative capacity. It was suggested that planning authorities should commission their own percolation tests to ensure an independent assessment. Regular inspections of septic tank systems were recommended. There was a specific mention of the problems of 'fats, oil and grease' (FOG), and the FOGS programme of Fingal County Council was mentioned as an example.

It was recommended that methodologies to assess cumulative impacts are required, and that financial support is required for new systems or for the improvement of existing systems. Suitable alternative (proprietary) systems are required where septic tanks are not appropriate, for example, because of insufficient percolation or assimilative capacity. Laws requiring certified annual desludging were suggested. Specific areas mentioned as being under particular pressure from, inter alia, septic tanks were the Broadmeadow estuary and the Nanny river.

3.3.5 Forestry

In all, 20 comments were submitted concerning forestry. End users of plant-protection products (e.g. pesticides) should be required to keep records of use, and biological methods of pest control should be developed and encouraged to replace pesticides. High-risk or sensitive sites should be identified and targeted instead of imposing blanket measures and only after cost-effectiveness studies. Changes in acidification protocol should occur only on the basis of scientific justification. Problems of replanting in acid sensitive areas were not addressed, and problems of acidification had been over-simplified and misunderstood. There were some suggestions that forestry codes of best practice are sufficient and no additional measures should be introduced unless effects can be justified scientifically. It was also suggested that there is a need to challenge existing requirements to replant felled forests, and that enforcement of best-practice guidelines is required.

3.3.6 Dangerous substances

There were 15 comments regarding dangerous substances. One comment noted that the remit should include surface waters as well as groundwater, another that measures should be discussed with Pesticides Control Service (PCS) (in relation to EU strategy on sustainable use of pesticides) and mentioned in any related National Action Plan, and that pesticide use should be monitored. Concern was expressed that sheep-dip is not within the remit of the PCS. It was also recommended that pesticide use in the forestry should be reduced and recorded, and pesticide and herbicide use in Special Areas of Conservation, Special Protection Areas, and Natural Areas of Conservation prohibited. There was concern about the impact of road runoff and a suggestion that oil interceptors for roads should be regulated and maintained. A public awareness campaign was suggested to inform the public about the impacts of household chemicals (e.g. oils, detergents, paints, solvents) and to change their behaviour when disposing of these.

3.3.7 Abstractions

There were many revisions of the maps in the draft RBMP (there were 43 comments in all) – particularly corrections of the locations of existing water abstractions and additions of further known water abstraction points and adding additional vulnerable rivers. There were requests for some abstractions (e.g. Vartry) to be subject to planning permission and for a full Environmental Impact Assessment (EIA) so that water levels would be unaffected and riparian owners' rights respected. Abstractions should not exceed 'rate of flow'.

There was concern about climate change increasing the pressure due to unregulated abstractions, mainly for irrigated agriculture. There was a suggestion that the dewatering of a quarry should be considered as a water transfer rather than an abstraction.

There were also recommendations that rainwater harvesting and water reuse as a means of reducing pressure on water supplies should be considered. In general, it was judged that conservation measures, including public awareness, were being addressed adequately.

There were objections to ending groundwater abstractions on farms. One comment suggested that increased water abstractions for newer urban areas were putting pressure on existing water resources. Another suggested a licensing system for significant surface water abstractions analogous to that for groundwater. This should be determined, administered and regulated by an independent body. The term 'significant' should be defined. For groundwater bodies, recharge should be assessed and taken into account. Farm families should have parity with other domestic water users (regarding payment for water). There was specific concern regarding further abstractions from the Avonmore/Avonbeg damaging the situation at Avoca.

3.3.8 Morphology

Among the 36 comments dealing with morphology, a maintenance drainage programme was suggested for the River Barrow to alleviate flooding of farmland. It was also suggested that gravel/sediment mobilisation downstream of dams should be considered in the plan. (Note this comments was from the ERBD AC itself.) It was also recommended that the plan should take account of the Liffey Reservoir Act (1936), echoing similar concerns mentioned above. All activities at Dublin port and the development of Bremore port should also be considered in the RBMP as they may have impacts on coastal waters. Coastal defences, both 'soft' and structural, should be considered in the plan, with the latter being physical modifications.

3.3.9 Summary

Reading the comments, a number of broad conclusions can be made:

- The vast majority of comments related to the supplementary measures and very few to the basic measures. Most of the latter concerned enforcement and regulation.
- Although some topics received more comments than others, all topics received a significant number of comments.
- A very broad range of organisations responded – from local authorities themselves through government organisations to private special interest groups. Even the ERBD AC had an effective input.
- Only a small number of comments were from individual members of the public (for a discussion of possible reasons for this, see Section 5 below).
- A very broad range of issues was covered: scientific, regulatory, even looking ahead to the impacts of climate change.
- It was clear that a considerable number of comments were carefully and deeply researched, and this is indicated in the influence these had on the final plan.

3.4 Effect on Final Plan

The public consultation phase has had a significant influence on the final plan in a number of ways:

- Typographical or mapping errors were corrected. In addition, each local authority was able to correct minor errors relating to its own area, for example, locations of abstractions and outfalls, condition of sewerage treatment works, etc. and was also able to raise special concerns local to its area (e.g. the Delvin river and the Avoca river).
- Issues were raised that were considered by the ERBD team for possible inclusion in the plan.
- New issues were raised that were included in the final plan, or issues were identified that had not received sufficient attention.

Table 3.1 lists the major issues that arose (most of which resulted in a modification to or addition to the plan) and the organisation that proposed them. It is clear that suggestions from all categories of responder influenced the final plan and that it was clearly responsive to the stakeholder responses.

Interestingly, many of the responses did not influence the final plan, because they were considered outside the remit of the plan, because they were either (i) outside the scope of the WFD or (ii) the topics were considered the responsibility of another (governmental) organisation. These demonstrated that public concern about the environment extended beyond the remit of the WFD and that there are people and organisations willing to raise these issues in any forum.

Table 3.1. Effect of comments on plan.

Action re. plan	Proposer
Correct operation and upgrades where necessary of urban WWTP	EPA
Arklow WWTP included in plan	Irish Doctors Environmental Association
Permits of WWTP and industrial discharges to take account of objectives of plan	EPA
Extra capacity in treatment works to deal with septic tank desludging	SWAN
Exemption for peatlands due to high naturally occurring ammonia	Offaly County Council
Farm inspections to control wastes	EPA
Examine statutory requirement for replanting following felling	SWAN
Maintain register of pesticide use.	Department of Agriculture, Forestry and Food (DAFF)
Plan to take account of updated pesticide legislation	DAFF
Conduct public awareness campaign on dangerous household chemicals	SWAN
Regulations to ensure abstractions from surface or groundwater do not cause waterbody to fail WFD requirements	Eastern Regional Fisheries Board (ERFB)
Rainwater harvesting to be considered for plan together with other methods	Shay Murtagh Ltd/SWAN
Situation re. Matt river (Bog of the Ring) to be reviewed in plan	Fingal County Council
Additional water conservation strategies included in plan	An Taisce
Ban on phosphates in detergents to be considered	SWAN
Identify and publicise status of water bodies locally	SWAN
Plan to take account of Liffey Reservoir Act	ERBD AC
ESB to be included in POMS (due to sediment mobilisation downstream of dams)	ERBD AC
Plan to clarify if structural flood defences are morphological changes	Heritage Council
Generic measure to be included to cover suggestions for River Delvin	Fingal County Council
Health impacts of flooding etc. due to climate change to be accounted for	Irish Doctors Environmental Association
Issues of climate change to be expanded	Central Fisheries Board (CFB) (now Inland Fisheries Ireland)/SWAN/IFA
More measures re. invasive species	CFB
Biosecurity plans for lakes to be included	CFB
Coordinate with Floods Directive	Office of Public Works (OPW)
Chapter on Strategic Environmental Assessments (SEAs) on supplementary measures to be included in plan. Also Habitats Directive to be considered	An Taisce /EPA
Cost-benefit assessment of water conservation as a supplementary measure	An Taisce
Sustainable development to be considered priority in plan	Dublin City Council
Addition report on economics to be produced	IFA
Greater consideration of groundwater as both a pathway and receptor	Geological Survey of Ireland (GSI)
Public participation to be addressed	SWAN
Plan to clarify responsibilities for monitoring delivery of basic measures	SWAN
Measured data on risk of septic tanks to be made public (to be considered)	SWAN
Consider establishing a water pollution hotline (incl. outside-office hours)	SWAN

4 Decision Support Systems

The number and complexity of issues arising in the drafting of an RBMP, as seen above, and in particular the need to encourage meaningful public participation in decisions related to the RBMP was the motivation for the WINCOMS project (Bruen 2008). WINCOMS sought to identify suitable existing computer-based decision support systems (DSSs) and identified those most appropriate for use by stakeholders in WFD decision-making. The result is a list of 48 DSSs that address a range of issues of water-management and protection. The full list is given in the main report available at: http://erc.epa.ie/safer/reports. WINCOMS organised workshops to introduce participants to some of these systems. In the first of these (19–20 October 2006) a number of European DSSs, covering a range of approaches, were tried and compared. A subsequent study identified 48 DSSs to be examined. This list was shortened to 36 with direct relevance to the WFD. A more detailed examination of these reduced the list to 15 (or 12 as Decisionarium has 4 separate components) promising candidates, and the second workshop (13 March 2008) was used to test 2 of these which were then used by the ERBD AC in the third workshop (13 May 2008). The results are of wide applicability in environmental decision support. However, their principle targets are stakeholders and decision-makers involved in WFD activities.

4.1 Brief Literature Review

There are many definitions of computer DSSs, starting from the very general such as software 'intended to support the human judgment involved in making decisions' (Fazlollahi, Parikh et al. 1995), to very specific, complex, software able to organise data, implement models and present the results in a formal manner (Forgionne and Frager 1998). Despite their importance for some decision-making processes, the latter process-oriented DSSs can be properly used only by experts and experienced practitioners, due to their complex architecture, data requirements and interfaces. However, recently one can observe the rapid development of other software supporting decision-making in a more user-friendly way, for example, simpler multicriteria DSSs (e.g. Mustajoki, Hamalainen et al. 2004; Znidarsic, Bohanec et al. 2006). These DSSs may not contain complex simulation models, but the emphasis is put on multicriteria algorithms and ease of use in order to attract a broader range of potential uses and users. This study covers both the model-oriented and multicriteria DSSs.

It goes without saying that out of 48 DSSs surveyed to date, only a few can be eventually adopted to facilitate stakeholders' participation in the WFD. The process of identifying the most appropriate decision support software adopted here consists of two major steps (viz. Le Blanc and Tawfik Jelassi 1989): (i) screening of the software available and selection of those DSSs that are suitable for use by a general, non-technical, user group of stakeholders and (ii) within this group selecting 2 or 3 systems particularly directed at facilitating public participation in the WFD-related decision-making policy.

The first step involved a literature review, to identify the range of available systems and to document their capabilities. As noted above, this identified 48 environmentally oriented DSSs (described in detail in the main report). Of these, those systems not specifically designed to facilitate stakeholder participation in water management and policy formulation and those too specialised and therefore too difficult to be used by non-expert stakeholders were excluded. This left 15 systems (see Table 4.1) (note that each of the 4 programs in the Decisionarium group of DSSs was evaluated separately, making a total of 15) that suited the WINCOMS criteria and were shortlisted for further, more detailed, evaluation. This involved using them with specific case studies to thoroughly examine all their features and such factors as the architecture of the software, user-friendliness, efficiency, ability to work with the Internet, accuracy of the outcomes it produces, etc.

Table 4.1. Shortlist of DSSs selected for further detailed analysis.

No.	Name	Description
1	Decision Analyst	Implements analytical hierarchy process (AHP), SMARTER and direct weighting methods, i.e. methodologies for multicriteria analysis and decision-making. A tool designed to support decisions on an individual basis.
2	Decision Facilitator	A multicriteria decision support tool that can be used for group decision-making.
3	Decisionarium (4 separate pieces of software)	A public Internet site for interactive multicriteria decision support with tools for individual decision-making: (i) Web-HIPRE supports value tree and AHP analysis including group models, (ii) RICH allows the decision-mdecision-maker to provide incomplete ordinal preference statements of the relative importance of attributes in a value tree, (iii) Opinions-Online – a platform for surveys voting and group collaboration, and (iv) Smart Swaps offering an implementation of the even swaps procedure.
4	DEXi	A software tool supporting conceptual decision-modelling. It uses an expert system shell to deal with qualitative multicriteria decision-modelling methodology and allows the user to evaluate and analyse options (alternatives). It supports problems that may be expressed by means of deterministic utility functions.
5	Excel-AIM	Provides a multiple attribute decision-making approach to identify the best alternative in a decision-matrix. Developed as an MS Excel application.
6	Groove	A popular peer-to-peer network program for rapid exchange of information between people connected to the Internet. With it, group decision-making and negotiation can be undertaken in the virtual web, which helps to establish collaboration between stakeholders by facilitating the communication, of information, as well as execution and recording of various aspects of the decision analysis.
7	HERMES	A system that improves classical decision-making approaches by supporting communication among decision-makers. Fully web-based system and therefore provides easy access to broader public.
8	INCA	A process-based model to calculate the cycle of nitrogen in the plant, soil and in-stream systems. Although primarily a model-based system, it is included here because it is already used in some catchments in Ireland.
9	mDSS	An integrated tool to assist water authorities in decision activities related to the management of water resources. The objective of the tool is to contribute to the quality and transparency of decision-making by achieving a truly integrated approach suitable for the development of RBMPs.
10	MIKE-BASIN and MIKE-SHE	MIKE-BASIN is the water resources model for RBM supported by GIS techniques. MIKE-SHE can simulate the entire land phase of the hydrologic cycle. Although both are complex modelling tools they are already used in several catchments in Ireland.
11	proDEX	A software tool supporting the conceptual decision-modelling of environmental problem issues. It uses an expert system shell that can deal with qualitative multicriteria decision-modelling methodology to model the economical and ecological implications of human impact on various components of environment. DOS operating system.
12	TeamSpirit	A web-based group problem-solving system to integrate creative problem solving approach and techniques to support the decision-making process of distributed teams. The approach proposed aims at facilitation of the group decision-making analysis performed by different decision-makers spread throughout the different places.

4.2 Selection of Decision Support Systems Shortlist

4.2.1 Attitudes and preferences of the ERBD AC

To fulfill their primary responsibility to provide advice relevant for producing a management plan for WFD implementation, the AC needed to respond to a large amount of complex and diverse data in addition to facilitating a wide range of interests and concerns. In order to assist the AC in meeting this challenge, the WINCOMS project was proposed to facilitate public participation through the investigation of DSSs for use in the ERBD.

One important aim of the study was to investigate the attitudes, preferences and skills of AC members in order to contribute to the development of criteria for a DSS that can be tailored to their needs in the implementation of the WFD. To evaluate the DSSs for WINCOMS, a questionnaire survey was conducted and its results analysed using the analytic hierarchy process (AHP). The results of the survey, where respondents provided details on their values and opinions, are also more widely applicable in the field of sociology – particularly in relation to the environment and public consultation in an Irish context. The survey included questions about the participants' preferences for the criteria used to select

a DSS. The results of the study revealed that potential AC users of the DSS are concerned mainly with the simplicity and efficiency of the decision-supporting tools.

Based on the objective of selecting an appropriate multicriteria model, the following major research questions were formed and drawn on in the design of a questionnaire that was sent to all members of the AC. The full text of the questionnaire is in the main project report (available at http://erc.epa.ie/safer/reports). First, WINCOMS was interested in gaining information on the relevant attitudes, knowledge, experiences and interests that members of the AC would bring to the WFD implementation process. This included their ideas on the environment, policy-making and consultative processes. More specifically, WINCOMS was concerned with what members see as the main issues involved in meeting WFD targets and the types of measures that could be introduced in response to these issues. On a more practical level, the project required data on the familiarity of members with technical information and the formats in which it could be presented. There was also a research question on the core computer skills and any decision support experience of potential DSS users included in the research.

The study was based on the analysis of the questionnaire, which was forwarded to the AC and returned by 42% of its members. Half of those came from specific sectoral groups: environment NGOs and fishing-related organisations each had three members return a questionnaire. Member of the business sector and the IFA also responded. Although half of those received were from local authorities, only 7 of the 25 elected representatives completed the questionnaire, so this group was under-represented in the findings given here.

Core findings on the experiences of respondents in accessing technical information suggested that respondents most frequently sought data on environmental issues from a variety of sources. At work, this was most commonly done in order to keep up to date or informed, whereas it tended to be for general interest or educational reasons during leisure time. The Internet was used in both situations by a large number of members. At work, journals were drawn on regularly, while newspapers tended to be a popular source for technical information for leisure purposes. When asked about their preferred delivery medium when dealing with new information, written texts and videos were seen as most useful by respondents.

Only 2 respondents never used computers. Only one computer-user saw their level of skill as lower than medium and 70% of respondents used computers five or more times each week. Most people stated that they used the Internet regularly and often used word processing, spreadsheet and email programs. A quarter of members had used a geographical information system (GIS) and found it useful. The highest level of familiarity here was with systems that are commonly used by local authorities.

In terms of consultative group experience, 40% of members had previously taken part in deliberative groups similar to the AC. The majority of those were in the area of environmental planning. Three-quarters of respondents were actively involved in some form of voluntary organisation. When asked about actions that could improve ERBD decision-making, members pointed to the importance both of clarity in the information disseminated to them and of the availability of adequate data relevant to AC work. Finally, respondents most frequently stated that the possible difficulties to be overcome were the level of power afforded to them and a perceived potentially low level of active participation among AC members.

4.2.2 Stakeholders' requirements for a DSS

The ideal DSS for use by stakeholders would have the components shown in Figure 4.1, that is, knowledge of how the environment behaves, data on its current state, knowledge of the measures that can be undertaken to improve water quality (and the ability to predict their impacts) and a multicriteria decision analysis tool to use all of the above in supporting the decision-making process. Many of the DSSs examined by the WINCOMS team had some or all of these components to varying degrees. However, most tended to emphasise one or other of the aspects – for example, some were strong on modelling while others were strong on multicriterion methods. Some put a lot of effort into usability by developing a simple graphical user interface, others did not. WINCOMS used workshops to introduce candidate DSSs to stakeholders and to observe their interaction with the systems. The observations and feedback from the three workshops (Table 4.2) helped in the selection/ evaluation of DSSs. The timing and sequence of these

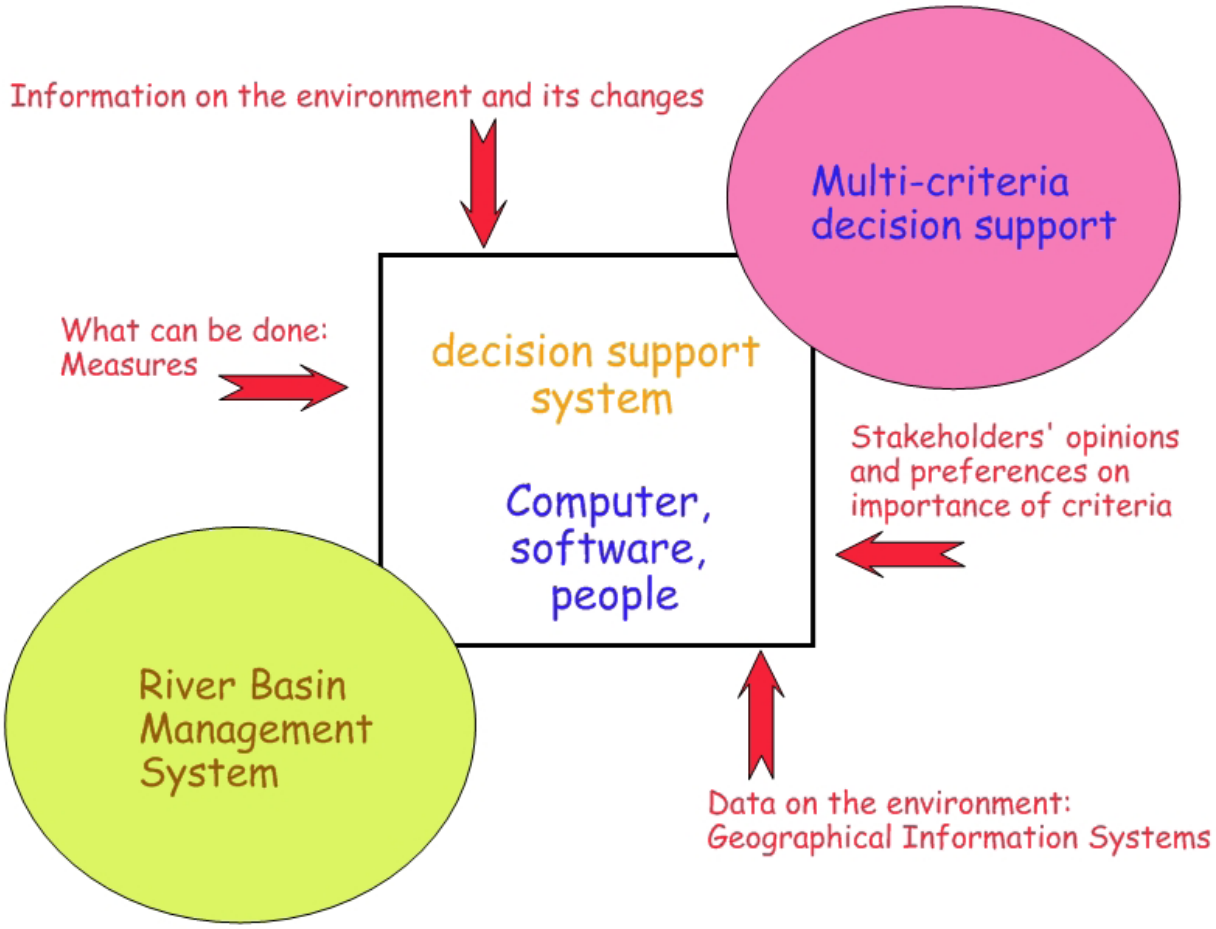

Figure 4.1 Idealised components of a decision support system for use by stakeholders.

workshops was intended to progress from a broad view of widely different approaches (Workshop 1) through the selection of specific DSSs (Workshop 2) to practical hands-on experience of the chosen DSS with the AC (Workshop 3).

4.2.3 Stakeholders' attitudes and opinions as seen through the workshops

This section reports on these workshops and on the assessment of measures and tools as communicated by workshop participants. The original WINCOMS project proposal envisaged two workshops, but in fact three workshops were held (see Table 4.2). An additional workshop (No. 2), for technical experts, was organised to gather additional data and feedback to inform the planning of the final workshop with AC members, which was considered a very important component of the project. The first two workshops were open to participants from outside, as well as inside, the ERBD, but the third workshop was exclusively for the ERBD AC.

Three workshops were organised by the WINCOMS project: Workshop 1 explored general DSS issues; Workshop 2 tested in detail two selected systems and

Table 4.2. WINCOMS workshops.

Workshop no.	Dates	External experts	Invited attendance
1	19–20 November 2006	Prof. Carlo Giupponi (University of Milan)	Day 1: Project personnel
		Dr Angela Pereira (EU Joint Research Centre [JRC] Ispra)	Day 2: Project personnel, EPA, all RBDs
2	13 March 2008	Dr Martin Znidarsic, Jozef Stefan Institute, Department of Knowledge Technologies Ljubljana	All interested RBD technical personnel invited
3	13 May 2008		ERBD AC members and observers

Workshop 3 allowed ERBD AC members to test the selected DSS (DEXi) for a prepared case study. All participants in the third workshop were able to learn how to use DEXi, and they completed the case study within a single afternoon. All three workshops produced constructive suggestions that fed into the processes of reviewing and selecting DSSs for use with the WFD. (More information on the structure and contents of WINCOMS workshops can be found in Appendix 2.)

4.3 Detailed Examination of Shortlisted Decision Support Systems

A shortlist of 15 (or 12, as Decisionarium consists of 4 separated programs) DSSs was produced from an earlier, wide-ranging, survey of DSSs and simulation models. These systems were ranked by combining the scores given for each DSS with the appropriate criteria and importance weights determined from a survey of stakeholders. As noted above, the weights were calculated using the multicriteria AHP method. The results are shown in 4.3, which shows the evaluation for each DSS under each of the stakeholders' criteria and, in the final column, the overall score for the DSS system.

Due to the variety of different purposes of the DSSs, the shortlisted DSSs were divided into three basic categories: (i) single-interface systems (blue), (ii) multiple interface systems (green) and (iii) modelling systems (yellow). The AHP comparisons were carried out only among the systems belonging to the same category. The names of the DSSs categories adopted in this study require a short explanation. Single-interface systems are often called 'individual decision' DSSs, whilst multiple-interface systems are called 'group decision' DSSs. However, such taxonomy can be misleading for non-technical experts, because in both the first and second categories decisions may be made by a group, as well as by a single decision-maker. Rather, the difference between these two categories stems from the way the data are input to a system: either by one decision-maker to one computer or independently by a number of stakeholders by means of a number of terminals connected to some (internal or external) network.

The first category consists of 9 DSSs mostly based on various modifications of multicriteria decision analysis models involving decision tree type methods, which are simple and yet reliable. For this category, single interfacing does not require the ability to work in the Internet and some DSSs received a score of zero for this particular criterion. Nevertheless, they generally scored well overall, with final scores ranging from 3.11 to 6.66. The DSS that achieved the highest mark (DEXi) represents a slightly different theoretical approach from most of its counterparts, since it is based on the utility function technique. Because of its simple calculation method and its extremely user-friendly interface, DEXi surpassed other DSS and was selected as a suitable system for demonstrating single interface systems in the WINCOMS project and for WFD applications.

Multiple-interface DSSs were the second software category considered in this study. They are usually web based, because the Internet facilitates convenient and fast exchange of ideas among the members of the decision-making team. Therefore, all systems that were advertised as a group decision-making DSS but did not provide any technical ability to work in the Internet, were excluded from this category and moved to the class of single interface DSSs. As a result, there were only 5 systems qualified in this group decision-making class. However, even within these selected systems, some did not meet the requirements of the definition of the DSS (e.g. Groove, or CoPe_it!). Opinions-Online was the only DSSs belonging to this category that performed relatively well in almost every criterion (overall score: 7.26). It also can meet most of the requirements of WINCOM project. Hence, it is recommended to as a tool for supporting negotiations and group-decision analysis when implementing WFD.

The third category contained two systems representing simulation modelling tools, namely INCA and MIKE BASIN/MIKE SHE. Both are system modelling-oriented DSSs and as such are very useful and can support water-quality decisions concerning WFD implementation. Numerical modelling is often the only reliable way to predict future catchment behaviour and the technical performance of new measures. By simulating scenarios of possible alternatives, decision-makers can explore the potential consequences of their choices. Therefore, models remain the basic tools of decision-makers. However, both system-oriented DSSs received relatively low marks in relation to WINCOMS purposes, mostly because of their complexity. Moreover, the two models considered in this study focused on selected aspects of water quantity and quality, but in

Table 4.3. Results of evaluation of selected decision support systems (scores range from 0 [lowest] to 10 [highest])

DSS	Class, other important features	Suitability for WFD	Ease of use	Internet-based	Group/team access and working	Cost	Clarity	Overall score
DEXi	Single interface system	9	9	0	0	10	8	6.66
Web-HIPRE	Single interface system	9	6	8	0	10	6	6.41
Smart-Swaps	Single interface system	2	8	8	0	10	5	5.32
Decision Analyst	Single interface system	8	6	0	0	10	5	4.98
RICH	Single interface system, incomplete data decision-making	8	2	8	0	10	3	4.54
MDSS	Single interface system	9	2	0	5	10	1	3.70
Excel – AIM	Single interface system	7	3	0	0	10	3	3.62
ProDEX	Single interface system, probabilistic utility functions	7	2	0	0	10	2	3.11
Opinions-Online	Multiple interface system, web-based	6	8	10	9	10	5	7.26
TeamSpirit	Multiple interface system, web-based	6	9	0	9	10	7	6.91
Groove	Multiple interface system, web-based, negotiations	2	4	10	8	2	4	4.66
HERMES and CoPe_it	Multiple interface system, web-based	2	4	10	9	10	1	4.58
Decision Facilitator	Multiple interface system, web-based	2	5	0	2	10	5	4.05
INCA	Simulation modelling tool, process oriented DSS	5	2	0	0	10	2	2.79
MIKE-BASIN and MIKE-SHE	Simulation modelling tool, process oriented DSS	7	2	0	0	0	1	1.83

order to provide the complete image of all hydrological, hydrogeological, chemical and biological phenomena in catchments, additional models and DSSs are necessary. Consequently, due to the effort and significant expense in constructing and using such models, it is suggested that stakeholders should employ the final conclusions generated by modelling experts using these tools rather then the tools themselves. It is likely that this is the mode of use envisaged by the developers of both packages.

Thus, one system from the first category and one from the second were selected to be tested in Workshop 2. No system from the third category was selected.

Two DSSs were recommended for further implementation and demonstration to stakeholders in Workshop 2 of the WINCOMS project: (i) DEXi as a tool for multi criteria, single-interface decision-making; and (ii) Opinions-Online for multiple interface systems using the Internet to exchange data.

4.4 Results

In a survey about the desirable characteristics of DSSs, the AC members rated the criteria relating to *clarity of the decision process* conducted with the use of a DSS very highly. This may be because they are reluctant to trust computer decision support tools blindly. The second most important criterion was *ease of use* – a natural consequence of people's desire to minimise the effort required to install and use the software. The third important characteristic of the selected DSS was its *ability to satisfy the requirements of the WFD and WINCOMS objectives*. Lower down on the list were two features (*group working* and *Internet access*) with much in common. Because group and team working often require web-based DSSs, the two criteria are linked. Access through the Internet enables easy frequent contact and fast interchange of ideas among the members of the team. Provided that the previous

criteria are satisfied, the stakeholders consider that the cost of software is of lower importance. However, it is worth noting that in WFD applications they would normally not be expected to pay for the software out of their own pockets.

Using this information, two DSSs – DEXi and Opinions-Online – were considered particularly suitable for use with stakeholders and selected from the shortlist. Both DEXi and Opinions-Online were accepted by the participants of Workshop 2.

5 Assessment of Communication and Participation

5.1 Introduction

5.1.1 The Water Framework Directive: innovations, opportunities and challenges

The WFD requires a transdisciplinary, holistic, and integrated approach to 'efficient' water management (Ker Rault and Jeffrey 2008). While innovate and forward thinking, this more ambitious and wide-ranging approach makes it extremely complex to implement on the ground. A central and innovative aspect of the directive is the requirement that member states consult the public and encourage the active participation of stakeholders. The WFD recognises the need for three types of participation in river basin planning: (i) 'information supply' (provision of clear and adequate information), (ii) 'consultation' (making plans and options available for comment) and (iii) 'active participation' (a term that remains largely open to interpretation). It is interesting to note that the former two are to be 'ensured' while active participation merely 'encouraged' (Ker Rault and Jeffrey 2008).

This report examines the activities of one RBD in relation to engaging and communicating with stakeholders and the public. It looks in particular at the effectiveness of communication with stakeholders within the ERBD. Its findings are based on ethnographic observation at stakeholder council meetings in the ERBD, reading of minutes of same, plus interviews with key informants. The WINCOMS researcher also observed proceedings at public information and consultation events, attended three AC National Conferences, an International Conference on the Water Framework Directive, and a series of meetings between ERBD engineering consultants and the WINCOMS project. The research also draws on documentary analysis of state and EU legislative papers, policy reports and guidance documents. The resultant dataset was input into Nudist software and coded for qualitative analysis.

Before moving on to explore the findings of this research, it is important to explore 'participation' as a concept and introduce the ERBD and its constituent organisational structures.

5.1.2 From 'participation' to 'social learning'

In recent times there is a growing recognition that effective environmental management requires collaborative approaches. Natural resource management, planning and nature conservation literatures are all littered with references to the need for 'consultation', 'participation', stakeholder 'engagement' and 'deliberative and inclusive practices' (Daniels and Walker 1996; Owens 2000; O'Riordan 2002; Kelsey 2003; Berkes 2004). Numerous case studies outline best (and worst) practices drawing on a wealth of sociological theorising on what constitutes 'genuine' participation, how this can be achieved, and importantly, for what *purpose* it is envisaged. Participation is often valued instrumentally, that is as a tool to legitimise policy prescriptions and/or to facilitate their implementation on-the-ground, while others have considered its intrinsic worth (i.e. as a legitimate end in itself) based on the principles of equity and fairness in decision-making (Renn, Webler et al. 1995; Fischer 2003).

For many practitioners, Sherry Arnstein's (1969) 'Ladder of Citizen Participation' is the 'bench-mark' for describing and evaluating participatory activities. Arnstein differentiates between participation and non-participation by use of a ladder metaphor based on a graded movement upwards from 'manipulation' of the citizen at the bottom rung to 'citizen control' at the top. The utility of Arnstein's model, however, is increasingly questioned. The power to effect change, many sociologists argue, is not 'held and projected' by particular groups or structures (whether state or otherwise) but is 'diffuse' and 'de-centred' within networked systems (Castree and MacMillan 2001). The complexities, uncertainties and interdependencies of our 'network society' make 'collaborative governance' essential to the achievement of particular goals (Hajer and Wagenaar 2003) but these cannot be achieved through the relocation of 'power' from one source to another. As Levin argues: 'there is an emerging understanding that many of our resource and environmental problems are complex system problems' (Levin 1999 cited in Berkes, Colding et al. 2002). These are problems where the

inherent complexity of (interacting and ever-changing) natural *and* social systems (or social-ecological systems) makes their management extremely complex. This challenges traditional notions of participation because no single group can completely understand the entire nature of the problem or put forward a wholly objective and definitive solution. While some sectors of society undoubtedly wield more power than others, none has the power to manage the problem independently of others.

The concept of social learning is an emerging term in the lexicon of participatory discourse – particularly in the area of natural resource management (Social Learning for Integrated Water Management [SLIM] 2004; Tippet, Searle et al. 2005; Ison, Röling et al. 2007; Mostert, Pahl-Wostl et al. 2007; Pahl-Wostl, Craps et al. 2007). Drawing heavily on new thinking in sociology (as well as ecology and natural-resource management), the concept is underpinned by two interrelated lines of argument. The first concerns the aforementioned complexities (and hence uncertainties) of social-ecological systems, which as Ison, Röling et al. (2007) argue, are 'unknowable' in absolute terms. The second concerns the context dependence of environmental knowledge: how the 'facts' of nature cannot be understood independently of the socio-cultural contexts (scientific, institutional, cultural, economic) within which they are constructed. A key concept in social learning is 'frames'. Frames influence how people 'see' reality. For example, fishermen, farmers and state officials employ different frames when faced with water-management issues, so each group perceives that different issues are at stake and each proposes alternative solutions. Equally, environmental experts employ different frames. Botanists, biologists, chemists and engineers, for example, may all consider a particular riverbank with vastly different interpretations of its form, value and purpose. All knowledge of 'nature' is thus to some degree 'partial' (Irwin 2001). Taken together, these insights suggest the redundancy of traditional 'command and control' methods of natural resource management based on 'linear cause-effect thinking' and 'mechanistic views of nature as "productive, predictable and controllable"' (Berkes 2004). Instead, they suggest the need for *new ways of learning* about social-ecological systems, such as water catchments.

Based on 10 case studies of participatory RBM conducted as part of European HarmoniCOP project, Mostert, Pahl-Wostl et al. (2007) discuss social learning as an ideal form of integrated water management. Social learning is reliant on two fundamental conditions: first, the absence of an overarching objective 'frame' from within which to assess the 'problem' means that *all stakeholders* should be included in its definition and proposed solutions. Second, for effective learning to occur, stakeholders must have sufficient opportunities to grapple with multiple (often conflicting) frames, acknowledge interdependencies and gain an appreciation of the complexities of the issues. This can only happen if stakeholders are *locked into a long-term working relationship*. In Ireland, the ACs and Technical Councils offered the potential for this to happen.

Social learning occurs when stakeholders produce new knowledge, skills, attitudes and behaviours 'to deal with differences constructively' and 'to cope with uncertainty'. The learning process entails compromise on all sides. While achieving 'consensus' is unlikely and conflicting frames is an inevitable part of the process, the experience should build greater levels of trust and goodwill among otherwise competing interests. It should result in collectively devised, workable solutions acceptable to all parties.

Social learning requires what Innes and Booher (2003), drawing on Habermas (1984) describe as 'authentic dialogue'. This relies on certain speech conditions: 'each speaker must represent the interest for which he or she claims to speak, each must speak sincerely, each must make statements that are comprehensible to others, and each statement must be accurate' (idem: 38). These ideal conditions rarely occur in everyday life, especially in the political realm where stakeholders are accustomed to concealing their interests and where 'positional bargaining' is more common than deliberative, open-ended dialogue. However, drawing on a considerable platform of research into collaborative policy-making, Innes and Booher (2003) show how skilled facilitators can 'help a group to approximate these conditions'. Various techniques can be employed to build trust and ensure comprehensibility. In the Sacramento Water Forum, for example Innes and Booher (2003) report that:

> ... the method for getting information that all could believe in was to select a consultant all could agree on, who would conduct analyses, allow members to ask challenging questions about parameters, assumptions and methodology, then get revised analyses until the data were meaningful and acceptable to all.

The group was also facilitated in a manner that allowed stakeholders to follow discussions where they led, 'rather than being artificially constrained by rules about what can be discussed or what cannot be changed'. This led to the development of innovate, workable solutions.

On the basis of their research findings, Innes and Booher (2003) develop a model of 'DIAD network dynamics'. Authentic dialogue (AD) they argue, requires two characteristics of participants, first *diversity of interests* (D) and second, *interdependence of interests* (I). Under certain conditions and with appropriate facilitation, D and I can lead to AD, which is characterised by 'reciprocity, relationships, learning and creativity'. This can lead to 'adaptations of the system' where new meanings, new identities and innovate solutions can emerge. It is important to note that the system depends heavily on the *diversity* and *interdependence* of participants. The inclusiveness of a sufficient diversity of interests allows assumptions to be challenged. This guards against 'entrenched thinking' and allows discussions to move 'beyond the acceptance of a status quo' (Innes et al. 2003). Stakeholders must also become fully aware of their interdependence, in this case their reliance on an interconnected water supply.

5.1.3 Opportunities for interaction

A central theme in the success or failure of a social learning initiative is the provision of adequate *time* for the learning process (Mostert, Pahl-Wostl et al. 2007). In the case of the WFD, not enough time was given for stakeholders to build trust, to construct common frames, to acknowledge interdependencies and to develop collaborative and authentic forms of dialogue. It is important to note that the setting-up of the ERBD councils was delayed due to controversy regarding the Nitrates Directive (see below). From the outset, therefore, project leaders were 'working against the clock' and under intense pressure to provide 'deliverables' in line with EU requirements and in conjunction with national templates.

The entire process was dictated by deadlines from the EU. A member of the ERBD team commented

> … the Directive set deadlines and there's a certain amount of, if you like, lack of clarity, generality about the obligation, 'Member States shall encourage the active participation'. There was no lack of clarity about a deadline. The Directive said by such a date you shall have done X, that was 100% and if we hadn't done X by the date, even if we got it done a month later, you were in breach of the Directive and you were technically open to prosecution by the Commission.

Dublin City Council and CDM, as project managers and service providers respectively, were thus driven by the need for *efficiency* (not only in terms of water management but in terms of management of the ERBD project). 'Deadlines are often tight and the ambitious goals and timescales of the WFD may push managers to rush participatory processes' (Tippet, Searle et al. 2005).

5.1.4 Politics and institutions

'Political and institutional factors' are important factors in the achievement of social learning (Mostert, Pahl-Wostl et al. 2007). Controversy surrounding the implementation in Ireland of the Nitrates Directive partly determined the political landscape. The competent authorities, moreover, had little or no tradition or experience of collaborative decision-making to draw on. This is similar to the 'torturous' implementation of the Habitats Directive (Laffan and O'Mahoney 2004), where state authorities adopted a 'top-down' approach and relied heavily on scientific experts. The Department of the Environment, Heritage and Local Government (DoEHLG) in both cases, appeared fearful of losing control of the process. The social learning model, in other words, is far from the 'norm' in Irish policy implementation. This possibly explains the low expectations of many AC members. Cultural factors are important co-determinants of participation in the drafting of RBMPs (Enserink, Patel et al. 2007).

Finally, it is worth noting that EU guidance with respect to public participation is unclear and at times confusing and self-contradictory. Because of the complexity and scope of the WFD, the Commission established

a Common Implementation Strategy (CIS) aimed at allowing 'a coherent and harmonious implementation' of the Directive (CIS: 4). The WFD and its CIS are open to interpretation regarding Article 14 on public participation and how there is a lack of clarity regarding the *meaning* and *value* of particular forms of participation (i.e 'informative, consultative and decisional participation', Ker Rault and Jeffrey 2008).

A senior member of the DoEHLG explains how the CIS was helpful *not* so much in terms of clarifying a *common understanding* but more in terms of identifying where member states had *divergent understandings* of issues:

> … in other respects they just couldn't achieve unanimity so therefore that process helped to identify those areas where Member States already had divergent interpretations of things.

The lack of clarity with the WFD and its Common Implementation Strategy is not surprising given that both documents emerged from an intense process of negotiation at EU level – a process wherein divergent cultural attitudes and political factors were all jostling for position (see Kallis and Butler 2001; Aubin and Varone 2002). Trying to standardise this *complexity* across such a vast, ecologically and culturally heterogeneous area was an onerous, if not impossible, task. As Irwin argues: 'while standardization offers the promise of a common set of operating principles, implicit cultural and institutional factors may work in the opposite direction' (Irwin 2001).

5.2 Communication with the Public

As stated previously, 'information supply' (the provision of clear and adequate information) and 'consultation' (making plans and options available for comment) are obligatory requirements within the WFD. Consultation often appears as 'an exercise where the *public* (a more vague term than stakeholders) is informed and then react to plans proposed by an authority' (emphasis added) (Ker Rault and Jeffrey 2008). Mostert, Pahl-Wostl et al. (2007) distinguish stakeholders from the public by noting that the latter are 'unorganised' compared to stakeholders who organise themselves (via unions and associations) to defend specific interests. This differentiation, however, is not clear-cut because 'the fact that some people are organised to defend their interests while others are not, changes with time' (Ker Rault and Jeffrey 2008). The point remains that consultation, nonetheless, should be focused to include both organised and disorganised sectors of society: by aiming primarily at *the public* at large, it should attempt to be all inclusive.

Public consultation on the *Water Matters* report took place from 22 June to 22 December 2007. The *Water Matters* booklet was published in English and Irish on 22 June 2007, in accordance with Article 14. Public notices were published in national and ERBD local print media including the *Irish Independent* and *The Irish Times*. An editorial, plus an invitation for comment was also published in the Local Authority News (CDM & DEHLG, 2007). The report and its background documents were also available for free download from the ERBD website (www.erbd.ie) with the additional facility of sending in comments by email.

Five hundred and fifty copies of the booklet were printed in English and 100 in Irish. Hard copies were circulated to various governmental and NGOs including: the ERBD AC, the ERBD Technical Council, local authorities, the DoEHLG, the EPA, the OPW, SWAN, and Waterways Ireland. Supplementary copies were made available at the ERBD office, Dublin City Council and CDM offices.

Despite this extensive degree of *information provision*, by November 2007, only a small number of comments and queries had been received (CDM & DEHLG, 2007). In response to this, the ERBD decided to conduct a series of roadshows at various locations in the district.

Because of budgetary and time constraints, the *Water Matters* roadshows were limited to three locations (not all 12 local authorities could be visited). During October and November 2007, the ERBD project hosted the following meetings (see Table 5.1), two of which were attended by a WINCOMS researcher who observed proceedings for the purpose of this research.

Table 5.1. Public consultation meeting

Venue	Date
Wicklow – Grand Hotel	30 October 2007
Kildare – Lawlor's Hotel	31 October 2007
Meath – Ardboyne Hotel	1 November 2007

The ERBD project employed several methods to publicise the roadshows. They sent direct invitations to groups and communities. They also produced a leaflet (containing a questionnaire designed to be used for the entire period of consultation). Invitations and leaflets were sent to county and town councillors, environmental NGOs, secretaries of angling clubs and the local president of the IFA.

Finally, they employed three channels to access the general public: through (i) public notices in local newspapers, (ii) local radio advertisements, and (iii) public notices in county council buildings. Each county council received a package containing public event notices, 10 copies of the *Water Matters* report and 25 copies of the roadshow leaflet. PR officers were asked to ensure that the notices were displayed around county building entrance areas, libraries, etc.

The roadshows were conducted as 'open drop-in' evening meetings, between 4 and 8 p.m. Each was held in a medium-sized conference room containing four round tables and three 'stations'. The 'stations' were set up to provide background information about WFD, the ERBD and *Water Matters* report. They comprised:

- A *Water Matters* display unit: a 10-panel illustrative display summarising each chapter of the *Water Matters* report;
- A DVD (*Flowing into the Future*) playing in a loop on a computer screen;
- A description of CDM's RBM system (the process used to develop and implement the plan) (CDM, 2007) projected onto a screen.

Upon arrival, visitors were introduced to the concept of the event. They were invited to sit at tables, explore the stations, review the report and comment either via notes or by filling in the questionnaire. They were also 'interviewed' by the project team.

The first roadshow in Wicklow was attended by 25 people. Visitors included representation from: Ireland Waste Water; the Green Party; Wicklow County Council; Coast Care; Arklow Fly Fishers; Teagasc: IFA; WPA; Wicklow Coastline Business Alliance; Brittas Bay and Barndarring Resource Group. The Navan roadshow also attracted 25 visitors, including representation from Meath County Council; Moynalty Tidy Towns; Trim and Athboy Anglers; Kells Anglers: Longwood Anglers; Friends of the Aquifer; Tom Brody and Son Ltd; Meath Green Party. The Kells roadshow, however, had a low turn out with only four visitors during the four-hour period (CDM & DoEHLG, 2007).

The workshops were intended to allow the project team to gain a better understanding of local issues from people 'on-the-ground' and collect reactions and comments to the *Water Matters* report. The extent to which they were successful in this is doubtful for two main reasons. First, overall, the roadshows had a low turn-out (particularly the event in Kells). Second, visitors generally represented organised and to some extent 'targeted' stakeholder groups, as opposed to the public more generally. In spite of their best efforts to promote the events (via radio and newspaper adverts), public interest was extremely poor. Given the time and resources invested, this was a disappointing result.

Draft RBMPs were published for public consultation on 22 December 2008 for a six-month period, ending on 22 June 2009. Notices were publicised in major newspapers circulating in the region, and the ERBD coordinator was interviewed on radio. A copy of the draft plan, Strategic Environmental Assessment and Appropriate Assessment were made available for download on the ERBD and WFD Ireland websites. The draft plan contained a series of questions designed to prompt public reaction and encourage feedback, including: How would you like to see the monitoring data being provided to a wider group of stakeholders? Do you think that the classifications fairly reflect the status of waters in the Eastern River Basin District? Do you think that the proposed measures will achieve good ecological status? A Comments Form was provided along with information on where comments should be sent (namely by email or postal mail to the ERBD project).

Aside from these two legally required consultation initiatives (*Water Matters* and the draft plan, respectively), the ERBD also embarked on an *information provision* or *public awareness* project in the form of the Schools Programme conducted by the District's Mobile Monitoring Unit. The aim of the programme was to educate children as the next generation of water caretakers and to raise the visibility of the ERBD project in general. The initiative was targeted at Fourth to Sixth Class, and implemented in 25 primary schools across the ERBD. It is estimated that 1,000 children participated

(ERBD Draft Plan). The methodology employed was to increase the children's awareness of water quality by pointing to invertebrates existing in good- and poor-quality water. Several of these events – the Bray School Project and Castle Jordan National School events, for instance – were attended by a WINCOMS researcher.

The event at Bray School Project provides an example of how the programme operated. The day began with lively and 'child-friendly' presentations on water quality and the distribution of fact sheets to teachers. Children were taught how to recognise the main group of macroinvertebrates (such as mayflies and stoneflies) living in clean water and chironomids and asselus, indicative of polluted waters. Children thus learned how to biologically assess their own local rivers. This was followed by 'hands-on' examinations of invertebrates carried out in groups of ten, while other children drew pictures. The day ended with a quiz on what was covered. The children appeared to enjoy the experience and, for the most part, were genuinely engaged and interested in the topics.

Notwithstanding the success of Schools Programme, and in spite of considerable effort by the ERBD to provide clear and adequate information, public interest and feedback was poor. Communication, as a result, was again more *one-way* than two-way.

Although attempts *were* made to make water issues accessible and engaging to the *general public*, it appears extremely difficult to engage the general public on issues that appear highly technocratic and, to some extent, divorced from the day-to-day experiences of ordinary people. While water is used by everybody for a variety of purposes on a day-to-day basis, there is a sense in which it is 'taken for granted'. Unless some issue arises that threatens peoples' livelihoods, lifestyles or access to good quality water, not many people are likely to invest time investigating and commenting on water quality issues. Some participants in this research suggested that rural groups are more aware of water quality issues than urban groups (given the intimate relationship between agriculture and water quality). It was felt that while there is a greater onus of responsibility placed on the former to *protect* the watercourse, there needs to be an equivalent onus of responsibility placed on the latter (as well as the former) to ensure that water *conservation* is taken seriously.

Overall, the public consultation approach used by the ERBD reflects the 'Decide, Announce and Defend' (DAD) tradition of decision-making, one that Ker Rault et al. (2008) argue 'has been widely disparaged'. Sections of the CIS, in fact, were critical of this approach and suggested the need to change it (CIS 2003). This type of consultation can be understood as a 'postprocess used for commenting on a proposed solution', but 'what is the value of consultation when the public is considering a proposed solution instead of addressing what the public considers as being the problem?' (Ker Rault and Jeffrey 2008).

This raises questions regarding the *timing* of public involvement in WFD decision-making. At AC meetings, some environmental NGOs argued for *early involvement* of the public and stakeholder groups in line with a more 'holistic' approach. Project leaders, on the other hand, were wary of what they considered a 'blank sheet approach' and felt that the public would prefer 'to have something solid to knock down'. They cited 'uncertainties' and 'information gaps' as reasons against 'early involvement'. They also feared divulging politically sensitive (and at the time undecided) issues (such as water charges, designations and exemptions) in the public domain.

Irrespective of debates within the AC and the ERBD more generally, it is important to point out that most of the key decisions regarding public consultation and how it is conducted seem to be decided at national level by a Public Participation Working Group (PPWG). This group reports to the National Coordination Group (NCG) and is chaired by the DoEHLG. The ERBD roadshows, for example, were a response to PPWG requirements that RBDs should engage the general public through a series of meetings at local level. While the *raison d'être* of the group is to explore and consider ideas regarding public participation, it is perhaps ironic that membership of the group is limited to state officials:

> The Department set up a working group on public participation which, funnily enough, includes officials only … this has been an ongoing debate. (Interviewee)

One *central* reason why early public involvement and social learning are so *challenging* to implement at River Basin level relates to the substantive content of WFD and the ecological paradigm upon which it

is based. Qualitative analysis of the WFD reveals tensions and contradictions within the text (namely between substantive and procedural approaches to policy-making). Steyaert and Ollivier (2007) consider that the WFD is based on a particular (but contested) ecological school of thought, namely 'compositionalism' which conflicts with the alternative ecological paradigm of 'functionalism' (see Callicott, Crowder et al. 1999). Compositionalism focuses on ecosystem *status* and *stability,* while a functionalist paradigm perceives ecosystems as adaptive systems in *continual flux*. While compositionalism locates humans *outside* nature, functionalism perceives humanity and nature as part of one *dynamic, complex adaptive system*. As a result, compositionalism focuses more on protecting the *component parts* of ecosystems from human 'interference', while functionalism focuses on protecting the *processes or functions* of ecosystems of which humans are considered a part.

5.3 Concluding Comments

Communication in the ERBD AC was sufficient in terms of 'the letter of the law' but poor in terms of the 'spirit' of the law (although both remain to some extent 'open to interpretation'), (see Ker Rault and Jeffrey 2008). Crucially, the AC mechanism did *not* provide a forum where social learning could occur: its structure, remit and 'modus operandi' were wholly inimical to it. 'Active participation' of stakeholders was not distinguished from 'information provision' and 'consultation': the former was to some extent reduced to the latter. As well as being necessary to comply with legalities, participation was valued as a means to implement and legitimise the decision-making process – a convoluted process that stretched far beyond the boundaries of the ERBD.

Considerable effort (time and resources) was invested in providing information to the public who were consulted and given opportunities to comment. Overall, however, these initiatives were of limited success due to a variety of factors associated with engaging the public in complex, technocratic decision-making.

Public participation was to some extent constrained by factors *beyond the control* of the ERBD: the substantive content of the WFD, budgetary restrictions, time constraints, national templates and deadlines all curtailed options and limited choices. From EU to river basin level, the meaning and value of participation (and its various forms) were unclear or open to interpretation.

Some factors, on the other hand, especially with respect to the AC's performance, were *within the control* of the ERBD. These include issues regarding the composition of the AC; the role of stakeholder involvement (the status and remit of both stakeholder and Technical Councils and the relationship between them); the need for professionally trained and independent facilitation; the inclusion of multiple 'frames' and the need for greater openness and transparency.

6 Summary and Conclusions

6.1 Measures

While there is no shortage of measures available to address a variety of water-resource pressures, there is a very real shortage of data pertinent to Irish conditions on the cost and performance of most of these measures, with the exception of those for controlling point sources of pollution. Nevertheless, some broad indicators of what should be done to address water resource pressures in Ireland are evident from the scientific literature, based mostly on studies in the US:

- An educational/technology transfer element, dedicated to implementing measures in a particular river basin, is a fundamental requirement of any programme. Programme implementation should be the *only* responsibility of personnel involved in the education/technology transfer measure, and their activities should be guided by the need to effect changes in attitudes.
- As most point source measures must be approved and financed at a higher level of authority than the RBDs, the RBDs should focus their efforts on addressing diffuse pressures. While measures currently required by existing legislation/regulations are the obvious techniques to select (such as REPS or Nitrate Directive requirements), RBDs should not limit themselves to these. Inventive financing arrangements, such as revolving loans, should be investigated to help manage the economic demands that some measures may require for implementation. Likewise, RBDs should explore the establishment of special management authority areas to facilitate the implementation of measures.
- A targeted approach to implementing measures in a catchment will produce superior results to a 'blanket' application of a 'one-size-fits-all' strategy. Techniques exist that are tuned to Irish conditions that can assist managers in identifying areas in catchments that should be given high priority.
- Practical approaches to controlling sediment and other contaminant losses on construction sites are available for immediate application in the construction industry. Well-thought-out demonstration sites can help raise awareness of these measures.
- In the agricultural, forestry and construction sectors, measures that offer benefits for production as well as protection of water resources are easiest to implement due to acceptance by relevant stakeholders. Unfortunately, information with which to demonstrate production benefits is not always available.

6.2 Workshops

Three workshops were organised by the WINCOMS project, the first to explore DSS issues, the second to test two selected systems and the third to allow ERBD AC members to sample the selected DSS for a prepared case study. All participants in the third workshop were able to learn how to use DEXi and completed the case study within an afternoon. All three workshops produced constructive suggestions that fed into the processes of reviewing and selecting DSSs for use with WFD stakeholders, as described below.

6.3 Survey and Selection of Decision Support Systems

To evaluate DSSs for use in WINCOMS a combination of questionnaire survey and analysis using the AHP were employed. The representatives of AC and Technical Council were surveyed about their preferences for specific characteristics of DSSs and they indicated a strong preference for simplicity and efficiency of the decision-supporting tools.

Using the priority characteristics recommended by the survey, a three-stage process was applied to select a DSS for use in WINCOMS. First a comprehensive literature survey was conducted and a 'long-list' of potential DSSs was assembled. The project team did not

discover a single DSS that met all the requirements of the project. Each system was examined and assessed by the WINCOMS team and a 'shortlist' of potential DSS was produced. From the shortlist, two DSSs, (DEXi and Opinions-Online), particularly suitable for use with stakeholders were selected. Both DEXi and Opinions-Online were tested by the participants of Workshop 2. Based on the experience of that workshop, a special workshop (No. 3), exclusively for AC members, was conducted with DEXi. All participants were able to use the DSS within the first few hours of the workshop to explore options within the prepared case study scenarios.

6.4 Eastern River Basin District Advisory Council

Advisory Council members most frequently sought data on environmental issues. The Internet was used in both situations by a large number of members. At work, journals were regularly drawn on, while newspapers tended to be a popular source for technical information for leisure purposes.

Concern over pollution and possible poor participation or communication emerged at both ERBD and catchment levels. Law enforcement and public education were most often suggested to counteract these. A strengthening of political will or organisation tended to be the most frequently cited factor that would facilitate implementation of measures. The opposing factor of poor political will or organisation was seen as the most likely hindrance.

When asked about actions that could improve ERBD decision-making, members pointed to the importance both of clarity in the information disseminated to them and of the availability of adequate data relevant to AC work. Finally, respondents most frequently stated that the possible difficulties to be overcome were the level of power afforded to them and a perceived potentially low level of active participation among AC members.

The AC's comments on the draft SWMI (*Water Matters*) report showed an appreciation of the details of the WFD in terms of (i) the range of water bodies intended to be represented and (ii) the large number of measures of various types available.

While a wide range of scientific and geographical areas are represented in the comments on the draft management plan, the vast majority of submissions related to supplementary measures (both in favour and against). The basic measures were accepted for the most part as they mainly require enforcement of existing legislation and regulations.

Many responses were from organisations rather than individual members of the public and were carefully and deeply researched.

There were some suggestions that measures should not be implemented unless their effect can be proven scientifically and they are demonstrated to be cost effective. This argument is used to suggest that implementation await the results of current or future scientific studies, and it is the antithesis of the precautionary principle.

There was an acknowledgement of the value of public-awareness measures.

6.5 Advisory Council Communication

As noted above, in relation to the AC, communication was sufficient in terms of 'the letter of the law' but weak in term of the 'spirit' of the law. The AC mechanism did *not* provide a forum where social learning could occur: indeed, its structure, remit and modus operandi were unfavourable to it. For instance, stakeholders' 'active participation' was not distinguished from 'information provision' and 'consultation': the former was to some extent reduced to the latter. In addition to being necessary to comply with legislation, it seemed that participation was valued as step towards implementing and legitimising the decision-making process in formulating the RBMP.

Considerable effort was invested in providing information to the public who were consulted and given opportunities to comment. Overall, however, these initiatives were of limited success arising from a variety of factors associated with engaging the public in complex, technocratic decision-making.

Public participation was to some extent constrained by factors *beyond the control* of the ERBD: the substantive content of the WFD, budgetary restrictions,

time constraints, national templates and deadlines all curtailed options and limited choices. From EU to river basin level, the meaning and value of participation (and its various forms) was unclear or open to interpretation.

On the other hand, some factors – in particular with regard to the AC's performance – were *within the control* of the ERBD. These included issues outlined above – the make-up of the AC; the role of stakeholder involvement; the need for professionally trained and independent facilitation; the inclusion of multiple 'frames'; and the necessity for greater openness and transparency.

Participation, stakeholder engagement, social learning and authentic dialogue – none are a *panacea* for river basin planning, which is highly complex process bedevilled with uncertainties and subjectivities. Irrespective of the choice of measures established and the extent and quality of 'social learning' that occurs, questions of power and interest (including economic and political interests) remain. River basin management is thus inevitably characterised by *some* degree of conflict, whether at the planning or implementation stage. Nevertheless, other research has shown how the principles of social learning and authentic dialogue can minimise conflict while providing fair and effective ways of managing 'complex systems' problems.

6.6 Recommendations

1 There is a need for better Irish data on the costs and performance of most measures, especially those for controlling diffuse sources of pollution.

2 An educational/technology transfer element is a fundamental adjunct to any programme of measures.

3 While measures currently mentioned by existing legislation/regulations are choices, RBDs should not limit themselves to these.

4 A targeted approach to implementing measures in a catchment will produce superior results to a 'one-size-fits-all' strategy. 'Demonstration' sites can promote state of the art techniques.

5 Following a comprehensive review of existing DSSs, the project concluded that there was no single ideal decision support system suitable for use by all stakeholders in all circumstances. However, the DEXi system was found useful for stakeholders to explore the choice of measures for specific cases, but it required external supporting technical material. There is considerable scope for further efforts to develop DSS suitable for use with stakeholders.

6 Considerable effort was invested by the ERBD in providing information to the public who were consulted and given opportunities to comment. However, these initiatives were of limited success due to a variety of factors associated with engaging the public in complex, technocratic decision-making.

7 Public participation was to some extent constrained by factors *beyond the control* of the ERBD: the substantive content of the WFD, budgetary restrictions, time constraints, national templates and deadlines all curtailed options and limited choices. These should be addressed. From EU to river basin level, the meaning and value of participation (and its various forms) was unclear or open to interpretation.

8 The AC mechanism did *not* provide a forum where social learning could occur and 'Active participation' of stakeholders may not be clearly distinguished from 'information provision' and 'consultation'. The composition of ACs should be considered carefully as should the potential benefits of independent facilitation at its meetings.

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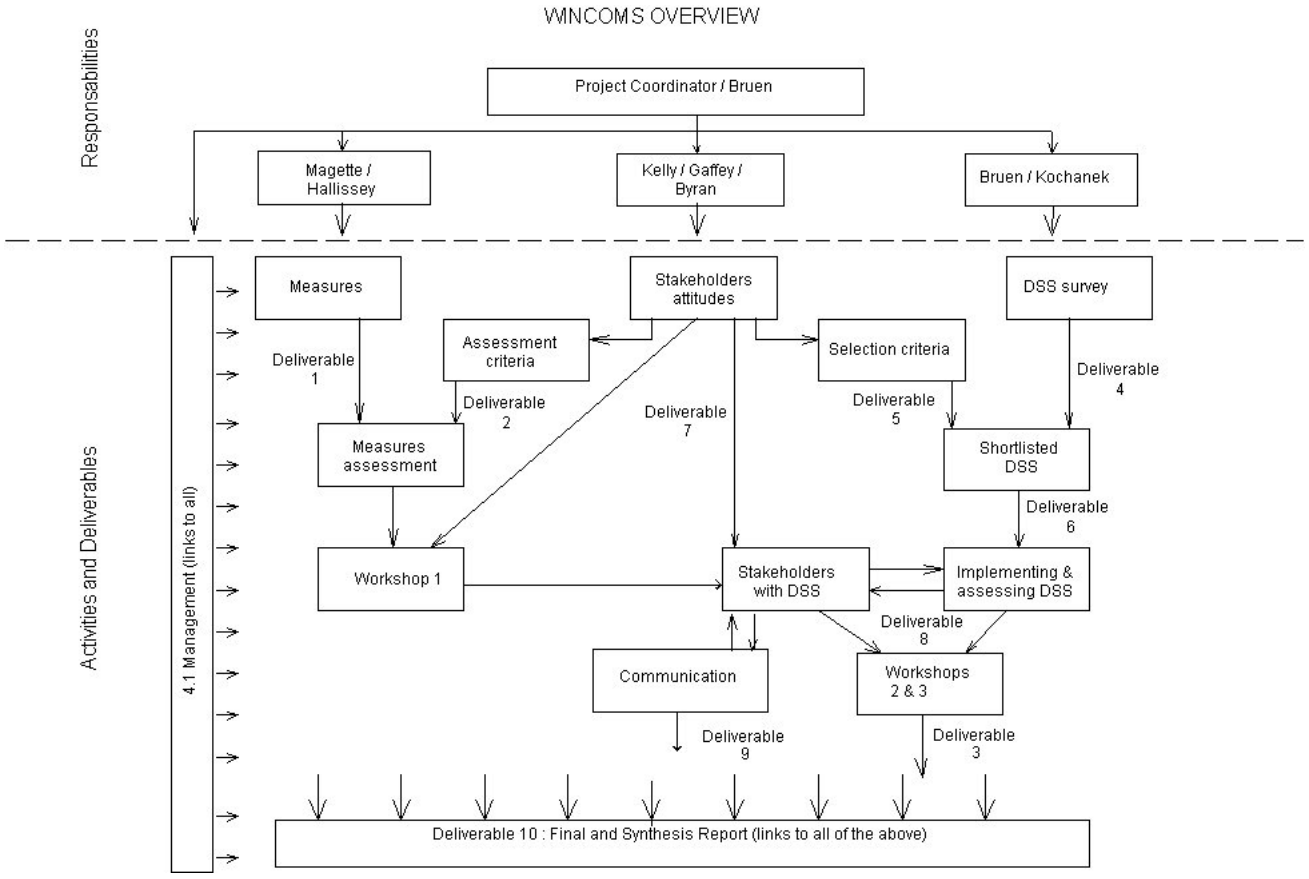
Acronyms and Annotations

AC	Advisory Council
AHP	Analytic Hierarchy Process
CDM	Camp Dresser McKee
DAFF	Department of Agriculture, Fisheries & Food
DoEHLG	Department of the Environment, Heritage and Local Government
DSS	Decision Support System
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency (Ireland)
ERBD	Eastern River Basin District (in Ireland)
ERFB	Eastern Regional Fisheries Board
EU	European Union
IFA	Irish Farmers' Association
NGO	Non-Governmental Organisation
OPW	Office of Public Works
RBD	River Basin District
RBMP	River Basin Management Plan
RBMS	River Basin Management System
SWAN	Sustainable Water Network
SWMI	Significant Water Management Issues
WFD	Water Framework Directive
WWTP	Waste Water Treatment Plant

Appendix 1: Outline of WINCOMS Activities



Appendix 2: WINCOMS Workshops

Workshop No. 1

External Expert 1: Prof. Carlo Giupponi

Dr Giupponi explained in detail the outcomes of Mulino, the EU-funded research project, which he coordinated, and the software tools, which it developed. He illustrated his talk with practical examples of the use of the tools. They included:

(i) Agna: Social network analysis (questionnaire);

(ii) Creative Thinker; (Brainstorming tool);

(iii) Decision Explorer (Cognitive mapping);

(iv) MDSS: The tool developed specifically by the Mulino team, which uses multicriteria methods;

(v) DSIRR: Economic analysis, farm scale;

(vi) Agcrop: Agri-environmental simulations, farm scale.

Professor Giupponi believed that it was impossible to have a single tool for the entire process and that separate tools should be used (but in an integrated way) and the best individuals tools chosen.

He described a case study relating to the WFD and Agricultural policy: deciding between conflicting long-term objectives in Italy:

(i) Local agricultural development;

(ii) Urban development expanding into rural areas;

(iii) Sustainable development, environmentally friendly, payments for water etc.

He illustrated the Somos techniques for elucidating stakeholder preferences; the snowball technique for constructing lists of stakeholders and discussed the topic of adaptive management.

External Expert 2: Dr Angela Pereira

Dr Angela Pereira is from the EU's Joint Research Centre at Ispra and is a founding member of its Knowledge Assessment Methodologies Group. Her work is at the interface between science and society. She described the Gouvern-e system developed by Ispra in a collaborative project. It is part of their 'Tools to inform debate and deliberations' project. It incorporates a scenario performance simulator. Here experience suggests that Quality Assurance schemes were often of interest/ concern to stakeholders. She thought that the key to the success of the RBD advisory bodies was the secretariate and the role that it performed.

Dr Pereira gave a practical demonstration of the Gouvern-e system.

After some discussion, the overall impression from the day was that, while some aspects of the Mulino mDSS system look promising for use in WINCOMS, the Gouvern-e system would be too difficult to adapt.

Workshop No. 2

The ultimate objective of the WINCOMS project was to introduce members of the ERBD AC to DSSs and to observe their interaction with these systems and obtain their opinions on their usefulness or otherwise. This was achieved in Workshop No. 3. However, the WINCOMS team decided that, to ensure the smooth running of Workshop No. 3 some prior experience with demonstrating DSSs should be obtained and so a further workshop, to take place before the AC workshop, was advisable. At this, the chosen DSSs could be demonstrated to technically knowledgeable participants so that any practical difficulties that might arise could be understood and addressed. Thus, Workshop No. 2 was held on Thursday 13 March, 2008 at UCD, Belfield, with technically knowledgeable participants, invited from all the RBDs, Technical Council members were invited (but not AC members) and from the EPA.

The purpose of Workshop number 2 was to demonstrate (with some prepared case studies) a shortlist of DSS to a selected group to (i) observe their interaction with the DSS systems and so determine how easy or difficult each is to learn and (ii) obtain feedback from the group on their opinions of the merits of each of the DSS's and (iii) to identify and resolve any practical difficulties with demonstrating DSSs. Invitations to the workshop were issued to all who attended the First WINCOMS

Workshop, members of the ERBD Technical Council, WINCOMS Steering Group and some academic researchers (who were not asked to complete the questionnaire surveys so the academic's options were not included in the analysis of participants' responses).

After the workshop, the participants were requested to complete and return an evaluation questionnaire. Eight questionnaires were completed in some detail and returned. Of the two DSSs demonstrated, the preferred system was DEXi. Respondents made a number of suggestions for improving the use of DEXi, relating to (i) ensuring the adequacy and clarity of the data, and (ii) ease of use.

(i) Adequacy of data input: Here the emphasis was placed on clearly defining the problem and providing quality data on which decisions can be made. One specific comment was 'Interesting day, all presentations clear and I have a much better understanding of DSS. I can see the strengths in that they allow for weightings and priorities. The key thing seems to be in defining the actual problem and providing quality data upon which decisions can be made.'

(ii) Ease of use: Only one respondent remarked that DEXi was found to be 'easy to use, transparent, gives robust answers, logical progression, widely applicable, tried and tested. Anyone with a reasonable familiarity with computers will have no problem finding their way around.' The remainder noted that 'non-technical, information technology-shy people might be put off by the IT session', that it would need some time to familiarise oneself with it, require some training, and / or a technical guide made available.

Other comments

Regarding the workshop as a whole, most found the introductory talks in the morning the most informative, and that they reassured prospective users that DSSs could be used to arrive at decisions in a logical way.

One respondent noted of DSSs as a whole (and apparently in terms of their ideal use as a negotiation and deliberation tool among stakeholders) that 'The quality of the findings depends very much upon how you phrase the questions and the "background" of the people who respond. If you don't know this it is difficult to see how you interpret the findings.'

Workshop No. 3

With the considerable experience gained from Workshop 2, particularly in terms of using DEXi with a group unfamiliar with DSSs and cognisant of the need for good facilitation of this processes, a third workshop was organised exclusively for members of the ERBD AC and the ERBD support team. This restriction on attendance was imposed to ensure familiar surroundings and a relaxed attitude on the part of the attendees. It was organised for the afternoon following a scheduled Advisory Group meeting (13 May 2008) and used the same venue (Gresham Hotel). AC members were notified verbally and by letter in advance of the workshop and Professor Bruen gave a presentation to the formal AC session in the morning to explain what would be covered in the workshop and to urge as many as possible to attend.

Eight people participated in the workshop which used DEXi (the system preferred by Workshop 2 participants) each was given the use of an individual computer on which the DEXi programme had been pre-installed. A helper/observer was assigned to each participant and two case studies were prepared (relating to Diffuse source P pollution and Urban runoff control). A CD with the DSS software and case study files was distributed to participants to allow them follow up the workshop at home or at work.

At the end of the workshop, participants were requested to fill in an evaluation questionnaire. Seven participants completed questionnaires. Participants included four AC members (two county councillors, including the chair of the AC, one member of Dublin City Council's Strategic Policy Committee (SPC) and one representative of the IFA). Three participants were members of the ERBD management group, including the ERBC coordinator. The final participant was an environmental movement representative and coordinator of SWAN.

In response to the first question: **What was your overall impression of the decision support system (DEXi) demonstrated today? How would you assess its strengths and weaknesses?** most participants noted strengths but also stated certain reservations.

In terms of its strengths, particularly noted were the transparency in how it works, its accessibility and the wide variety of choices it offers. The concerns

expressed included the need to ensure the quality of the data inputted, its openness 'to abuse in how decisions are made re weights of attributes of criteria', and judiciousness in interpreting the results. It was seen as potentially open to bias, and thus in interpreting the results one needed to know the context in which the information inputted was agreed, i.e. who decided what information to input and how this decision was reached. Thus its potential weakness was mainly a 'political/ human [one] in terms of weightings … affecting results'.

While there was recognition of its potential to give a 'defensible, democratic scientific decision', another respondent noted that DEXi should not be seen as actually making decision-making easier, but rather as a stimulus for discussion about the criteria, measures and weightings involved in the decision. Thus, DEXi should be seen as only 'a small tool used within a totally revamped public participation approach' and should not be used to replace properly facilitated workshops and discussion.

Positive responses to the question, '**How would you assess DEXi in terms of ease of use?'** confirmed this as one of its strengths, especially for those who were more familiar with the use of computers. For these respondents, it was 'really easy to use'. For those not so familiar, it appeared nonetheless, 'logical and therefore easy'. (It might be noted however that the one participant who left without completing the questionnaire did not appear to be clear as to the purpose and operation of such a DSS as DEXi).

Four of the seven respondents replied positively to the question, '**How would you assess DEXi in terms of facilitating WFD decision-making?'** and noted that it could save a considerable amount of time. One respondent noted, however, that in terms of facilitating the AC, this would depend on the extent to which the authorities allowed the AC to affect decision-making. A further AC member argued that DEXi was 'useful in modelling but should not be regarded as sacrosanct in final decision-making.'

Respondents were specifically asked, **Could you envisage using DEXi to facilitate WFD decision-making in a group setting such as the Advisory Council?** All replied positively, but four noted the conditions needed if it was to fulfil its full potential. These included the need for good and professional facilitation, adequate preparation, and ensuring it was used transparently with those less familiar with it.

One of the ERBD management group suggested that 'we should have a workshop [using DEXi], on a specific issue, say forestry [drawing on the discussion on this issue in SWMI, *Water Matters]* with a limit of 10 experts from the AC members about [this] water management issue'. This, he argued, would test its robustness, and offer AC 'members a real input to encourage agreement as it is an objective outcome' – i.e. encourage agreement with the optimal decision offered by DEXi.

Each of the participants was supplied with a CD to take away, which included the DEXi programme and some relevant case studies. Asked, **Are you likely to use the DEXi CD distributed after the workshop?** five replied positively, giving the reasons that they wanted to test out some of the measures already being thought about within the WFD, to explore further how DEXi worked, and because of personal interest.

A final question, **Can you suggest any improvements you would like to see regarding DEXi?** was responded to by two participants, some others stating that they did not know enough about DEXi as yet to make suggestions. One respondent reiterated her major point that DEXi ought not be used to replace properly facilitated workshops and discussion. A member of the ERBD management group suggested the possibility of providing 'guidance documents as to:

- How to go about weighting of attributes of criteria;
- How to run a workshop to get a real decision;
- A website with DEXi and case study data.

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil agus Rialtais Áitiúil a dhéanann urraíocht uirthi.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail.
- Scardadh dramhuisce

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

NDP
National Development Plan 2007 - 2013

Science, Technology, Research and Innovation for the Environment (STRIVE) 2007-2013

The Science, Technology, Research and Innovation for the Environment (STRIVE) programme covers the period 2007 to 2013.

The programme comprises three key measures: Sustainable Development, Cleaner Production and Environmental Technologies, and A Healthy Environment; together with two supporting measures: EPA Environmental Research Centre (ERC) and Capacity & Capability Building. The seven principal thematic areas for the programme are Climate Change; Waste, Resource Management and Chemicals; Water Quality and the Aquatic Environment; Air Quality, Atmospheric Deposition and Noise; Impacts on Biodiversity; Soils and Land-use; and Socio-economic Considerations. In addition, other emerging issues will be addressed as the need arises.

The funding for the programme (approximately €100 million) comes from the Environmental Research Sub-Programme of the National Development Plan (NDP), the Inter-Departmental Committee for the Strategy for Science, Technology and Innovation (IDC-SSTI); and EPA core funding and co-funding by economic sectors.

The EPA has a statutory role to co-ordinate environmental research in Ireland and is organising and administering the STRIVE programme on behalf of the Department of the Environment, Heritage and Local Government.

epa
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An Ghníomhaireacht um Chaomhnú Comhshaoil

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SSTI
Strategy for Science, Technology and Innovation

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government