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The Case for Valuation Studies in the Water Framework Directive

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EXECUTIVE SUMMARY

WFD55: The Case for Valuation Studies in the Water Framework Directive (May 2005)

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Background to research

The EU Water Framework Directive (WFD) introduces several innovations into water management and policy in Europe. Central to these is integrated water management at the scale of the river basin. The incorporation of economic approaches throughout the implementation of the WFD constitutes also a clear innovation. The most prominent economic aspects of the WFD concern the selection of cost-effective sets of measures for achieving good ecological status/potential in all water bodies, the implementation of the principle of cost recovery for water services in line with the *polluter-pays-principle*, and the decision on derogations, if achieving good status should prove to be disproportionately costly.

Objectives of research

This study sets out from the draft methodological framework for cost-effectiveness analysis in the WFD developed by RPA for Defra. This framework makes suggestions on the procedure for the selection of measures, and on the cost and benefit information to support an assessment of cost disproportionality in decisions on derogation. Against this background, the present study was set up to examine **how valuation studies inform decision making processes**, and which role they can play for economic assessment tools. The present study identifies alternative approaches to support WFD-related decision making especially for decisions on straightforward cases, taking account of the specific situation in Scotland and Northern Ireland in terms of complexity of hydro-situations and availability of information., Finally, it discusses the degree to which valuation of costs and benefits is required in order to make good regulatory decisions in the implementation of the WFD in Scotland and Northern Ireland.

Key findings and recommendations

For those decisions in the WFD implementation where economic considerations will play a role, a number of assessment tools are available, ranging from expert judgement on simple cases to different types of cost-benefit analysis or multi-criteria analysis for the most complex decisions. Only few of these assessment methods require input from monetary valuation studies in the form of monetised costs or benefits. In general, the most complex decisions requiring input from valuation studies will relate to

(i) the assessment of disproportional costs in the context of derogations and

(ii) the selection of measures to be implemented nationally which will require a full cost-benefit analysis (including the monetisation of all relevant effects). For the selection of local measures, valuation studies are not expected to play a major role, except in cases of significant non-water-related externalities that may be assessed through benefits transfer.

The challenge is to develop a robust screening method for sorting decision situations by order of complexity, targeting the use of elaborate economic assessment tools to a limited percentage of (complex and policy-relevant) cases. An initial proposal for such a screening method is developed in this study, which needs to be further tested and refined.

Key words: Water Framework Directive, cost-effectiveness, programme of measures, disproportionate cost, monetary valuation, economic assessment

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1 BACKGROUND

The EU Water Framework Directive (WFD) marks a significant step in the development of water management in Europe, as it introduces several policy innovations, many of which have not been applied on the European level before. The most important of these is the integrated approach to water management that the Water Framework Directive establishes, which allows solutions to water management issues to be found at the river basin level.

Among the novelties introduced by the Water Framework Directive is also the consistent incorporation of economic approaches throughout the implementation process of the Water Framework Directive. For the first time in a major environmental directive, it is proposed that economic approaches are used more systematically to support decision making, ensuring that (financial) resources are spent efficiently, that targets are achieved at the lowest cost and that the polluter-pays-principle is made operational. This approach will also prevent undesirable economic consequences for particular water uses.

In the implementation process of the Water Framework Directive, economic aspects surface on different occasions in more detail, most notably in the selection of cost-effective sets of measures for achieving good ecological status or potential in all water bodies, in implementing the principle of cost recovery for water services, and in the decision on derogations, if achieving good status should prove to be disproportionately costly.

Addressing these economic concerns in the Water Framework Directive might include the use of economic valuation studies. Such studies can be used to determine the economic value of environmental goods and services (including water resources) in monetary terms. This allows making trade-offs between environmental protection and economic development more explicit. For example, placing a monetary value on the benefits from improving water quality in a water body can support the assessment of whether the costs of measures necessary to deliver these benefits are justified and whether a derogation (i.e. reaching environmental objectives within a longer time frame or proposing lower environmental objectives) might be justified.

To assess the value of an environmental good or service in monetary terms is a difficult task, as most of these goods and services are not traded on a market (in contrast to other goods and services, whose value is reflected in their market price). This means that the value of environmental goods and services has to be derived by using results from surrogate markets, either by inferring values from existing and related markets, or by simulating a virtual market for the environmental good, in order to solicit information on people's willingness to pay.

Although there is considerable theoretic background about the valuation methods and a growing literature of valuation studies, the practical use of these in environmental policy making is still limited. This is due, among other things, to a lack of empirical data and limited time and resources, as valuation studies can be expensive and time-intensive endeavours. It is also due to a lack of experience with the use of economics in decision making, a fairly recent phenomenon in many European countries that is still often greeted with scepticism, both by stakeholders and by administrative staff. This underlines even more heavily the need for practical, transparent, inexpensive, robust and reliable approaches to economic valuation, ensuring their use in cases where they effectively improve decision making.

Additionally, there are alternative approaches/methodologies to the use of valuation studies (e.g. using more "ad-hoc" methods like satisficing, scorecard approach or expert judgements, see Chapter 3) that might be adopted for the more “straight-forward” cases in the WFD implementation. Their advantages would be lower costs, simpler implementation as well as more familiarity of policy maker and stakeholder with these techniques, possibly leading to greater acceptance of results. The setback of such techniques is that they may leave policy makers and the public with numerous diverse bits of information that need to be weighed and integrated, which makes these methods unsuitable for analysing complex trade-offs, and which increases the element of subjectivity in decision making.

In the implementation of the Water Framework Directive, the first step has now been taken with the 2004 reporting to the European Commission, which also sets the scene for the economic analysis. This is therefore a good time to take stock of what lies between today and 2009, to determine the decisions that need to be taken and the information on which these decisions can be based, including the potential use of valuation studies.

2 OBJECTIVES OF THIS STUDY

Based on the terms of reference, the project is set in the context of the draft methodological framework for cost-effectiveness analysis that was developed for Defra[1] as one of the scoping studies for setting up the Collaborative research programme; the framework is also referred to as the “RPA-approach” from here on. In addition to the selection of measures, the scoping study also makes suggestions on the type of cost and benefit information that could support an assessment of disproportionality in the decision on derogations.
In this context, the present study should

- Examine how **valuation studies** inform decision making processes;
- Identify what **alternative approaches** could be adopted for straightforward cases in the context of the WFD and the requirements of the Treasury Green Book;
- **Road test decision making**, maximising the use of existing information that the agencies in Scotland and Northern Ireland already collect or that can be easily obtained; and
- Determine the **degree to which valuation of costs and benefits is required** in order to make good regulatory decisions in the context of the WFD.

The findings of this project are mainly related to project 3 of the Collaborative Research Programme (CRP) on assessing the cost and benefits of options in River Basin Management in order to support the implementation of the Water Framework Directive. The CRP has been established to promote the adoption of a coherent economic appraisal approach between the participating organisations, and to avoid the development of several separate methodologies. Project 3 of the CRP deals with the definition and analysis of disproportionate costs in the context of WFD derogations. At the same time, insights from this project may also support the work on Project 2 (a and b) of the CRP, dealing with the methodologies for assessing costs and impacts of measures as well as the selection of the most cost-effective sets of measures.

[1] Postle, M. et al. (2004): CEA and Developing a Methodology for Assessing Disproportionate Costs, Risks & Policy Analysis Limited (RPA), London.

In doing this, this project had an initial look at the first steps of the WFD implementation process starting with the IMPRESS analysis and leading up to the selection of measures. For these steps, increased use of screening as well as selection criteria based on available information could lead to efficient and realistic decision making, so that a full Cost-Benefit-Analysis (CBA) would only be required for the most complex decision situations. In addition, the project was also designed to recognise the **special conditions** in Scotland and Northern Ireland, and to describe the impact that these special conditions have on the WFD implementation. When applying the approach suggested in the RPA-study, it has to be considered that fewer valuation studies exist in Scotland and Northern Ireland as compared to England and Wales (see also chapter 5.2), and that less personnel and resources are available to conduct additional studies. At the same time, by and large, the decision situations in the water bodies in Scotland and Northern Ireland tend to be **more clear-cut** than in most cases in England and Wales.

Box 1: Focus of the study

The original focus of the current project was on the potential **role of valuation studies in the implementation of the Water Framework Directive,** including their role in supporting the choice of **cost-effectiveness combinations of measures,** thus linking the IMPRESS results to the selection of measures and the related economic information needs.

Based on the kick-off meeting for this project, as well as the exchanges with the steering group, the focus of work moved more towards another important aspect of potential use of valuation studies for WFD implementation, that is the **practical aspects of assessing disproportionate costs in the context of decisions on derogations** (pursuant to Article 4 WFD). In addition, it was pointed out that information on alternative approaches to support decision making without the use of valuation studies is of high interest at this point in the implementation process.

This issue of derogations pursuant to Article 4 WFD deals with setting lower environmental targets or extending the 2015 deadline in cases where all cost-effective options prove to be disproportionately expensive. The decision on whether the costs of achieving good water status are disproportionate should be weighed against the benefits of achieving the good status. To this end, valuation studies may be called for to quantify benefits in monetary terms, so as to allow a direct comparison of costs and benefits. At the same time, expressing all costs and all benefits in monetary terms might require substantial data, and therefore might be costly and time-consuming. A staged approach might be necessary using first simpler alternative approaches requiring less data to make best use of the resources available for WFD implementation. Given their high cost, the use of primary valuation studies should be limited to those cases where a "simpler" assessment of disproportionality is not feasible nor sufficient to support effective decision making.

It has to be noted that the use of valuation studies in the context of Article 9 WFD (e.g. considerations on the recovery of the costs of water services including environmental and resource costs) remains outside the scope of the current study.

3 ALTERNATIVE APPROACHES TO ASSESSMENT AND EVALUATION IN SUPPORT OF DECISION MAKING

Different approaches can be used to assess alternative policy options, to compare and rank them or to select the best option. As this study has focused on the use of valuation studies in WFD implementation, and as the monetary valuation is mainly relevant for CBA, different valuation methods (including benefits transfer) are discussed in the chapter on cost-benefit analysis. For this reason, the discussion of CBA is more elaborate than that of other assessment methods.

There is not one single, clear-cut typology of the different approaches that can be followed. Several guidance documents for policy appraisal and evaluation have been produced in the UK and elsewhere, most of which distinguish between a limited number of tools and approaches only. For example, HM Treasury's Green Book only lists cost-effectiveness analysis and cost-benefit analysis as explicit assessment methods. Table 1 below presents an overview of selected UK and EU guidance documents and manuals and the approaches and tools covered in these documents. In addition, specific guidance has been published by the Environment Agency and other bodies on individual assessment methods (such as the benefits assessment guidance or the DETR guidance on mutli-criteria analysis.

It should be noted that the approaches covered in the table are not complete alternatives, as they do not have the same objective, scope, and level of detail. As discussed in the following chapter, there is a hierarchical relation between some of the different assessment methods, where one can serve as input to another one.

Table 1: Existing guidance material and assessment approaches covered

Title	Assessment approaches covered
HM Treasury: The Green Book	CEA, CBA
European Commission, DG Region: Evaluation of Socio-Economic Development: The Guide	CBA, CEA, MCA, Benchmarking, Economic Impact Assessment, Environmental Impact Assessment, Strategic Environmental Assessment, Gender impact assessment, expert panels
DETR: Review of Technical Guidance on Environmental Appraisal	CBA, CEA, MCA, Environmental Impact Assessment, Life Cycle Analysis, Strategic Environmental Assessment, Risk Assessment
Environment Agency Toolkit	CBA, MCA, expert judgement, cumulative effects assessment, Best Available Technique (BAT) and Best Practicable Environmental Option (BPEO), constraints and opportunities mapping, consultation and participation tools, ecological footprint, horizon scanning, Sustainability Appraisal and Integrated Appraisal, modelling, network analysis, quality of life capital, risk assessment, scenario testing, sustainability Threshold Assessment (STA)

It is important to realise that in the actual practice of assessing and evaluating policies, the applied approaches do not always follow the steps suggested by academic textbooks.

In practice, evaluators may skip parts of the analysis (e.g. using the status quo instead of constructing an elaborate baseline scenarios, or conducting a sensitivity analysis) if there is no sufficient data available, or if it is felt that certain aspects are irrelevant to the outcome of the analysis.

In the following, some selected methodologies will be discussed in greater depth and compared with a view to the inputs required in terms of data, time and manpower, the type and reliability of results thus obtained, and potential sources of error. In presenting the different assessment methods, this section will move from the simple to the more complex tools, with assessments using monetary valuation (CBA, MCA) as the most complex methods.

It should be kept in mind that all of the assessment methods presented in the following can be implemented in different ways: for each of the methods, practical usage will differ in terms of the level of detail, the thoroughness and the reliability of the analysis. While it is possible to rank the methods in terms of complexity, it is difficult to assign them specific criteria such as expertise or manpower input required to conduct the analysis.

3.1 Expert Judgement

Expert judgement is not an assessment tool in the proper sense, but it was included on the grounds that many decisions are taken in this way. Basing decisions on expert judgements – either own experience or involving external experts – can be an expedient method for decision making, especially in cases where none of the methods described above are applicable. At the same time, expert judgement is necessary for all the methods discussed here: this includes e.g. the identification and screening of possible options, the identification of relevant effects, the identification of the baseline scenario or the choice of the appropriate discount rate.

While expert judgement is a necessary input for other methods, it can also serve as the basis for a decision without using other methods. This applies in situations where a lack of data prevents the use of any of the assessment tools described above, and where neither time, manpower nor resources are available to gather the necessary information. Decisions based on expert judgement may also be an expedient procedure in cases where only very few options are available, where an initial screening suggests that one option is superior to all others in all respects, and where stakeholders agree on the desirability of an option.

Expert judgement can be further structured e.g. through the use of the Delphi Technique. This method of expert judgement is applicable in cases where adequate hard data is not available. It is normally conducted in two stages: in the first stage, a group of experts are interviewed separately and anonymously. The results of this poll are then consolidated and fed back to the experts. In the second stage, the same individuals are interviewed based on the same question, but now with the knowledge of the peer group's opinion. In theory, this process could be continued until consensus has been reached.

3.2 Scorecard Approach

The scorecard represents an alternative method to avoid some of the problems associated with Cost-Benefit Analysis and Multi-Criteria Analysis (e.g. Ministerie van Financien 1992). Originally a management tool, it has also been applied to support political decision making, in the case of the Netherlands since the 1970s. The output of a scorecard is a matrix that summarises the different impacts of various alternative policy measures.

These impacts can be expressed in quantitative form (as physical impacts), they can be monetised, but they can also be presented in qualitative form (i.e. effects classified as positive, negative or neutral, or as low-medium-high). In this sense, the scorecard bears some resemblance with the performance matrix that is drawn up as part of Multi-Criteria Analysis. The assessment of the impacts that are entered into the scorecard can be based on the analysts own expertise, it can involve expert opinions or the views of affected stakeholders. In this way, a scorecard approach can also be combined with participatory methods.

The scorecard itself does not provide a weighting of these effects across the various alternatives, but only shows the expected effects in a structured format. The weighting and summation of the expected effects is left to the decision maker. In this way, while the scorecard approach has the advantage of being a simple and flexible tool, it is also clearly limited as a support for decision making. Its main merit is to present the available options and their performance against the evaluation criteria in a structured form. However it does not provide a mechanism of aggregating impacts measured in diverse units, or choosing the most preferable of a set of options. Therefore a decision based on the scorecard alone will usually be possible only in clear-cut cases, where one option definitely recommends itself as the most suitable one. In other cases, a scorecard will often be used as an input to other assessment methods, including Cost-Benefit Analysis and Multi-Criteria Analysis.

3.3 Satisficing

A Satisficing approach can be described as an assessment procedure to obtain an outcome that is good enough, rather than seeking the best solution. A Satisficing approach can thus be contrasted with an optimising approach that seeks to identify the best solution, as is the case e.g. for Cost-Benefit Analysis, Cost-Effectiveness Analysis or Multi-Criteria Analysis.

For the implementation of a satisficing approach, one or more criteria need to be identified that the measure is expected to fulfil. The subsequent analysis can then either investigate all possible measures to achieve this objective(s), and list the successful options without ranking them. Alternatively, the analysis may also be terminated once the first option has been identified that fulfils the requirement(s).

In decision theory, the term satisficing is also used to refer to an optimisation process where *all* costs, including the cost of the optimisation calculations and the cost of getting information for use in those calculations, are considered. This takes account of the fact that, in some cases, the costs of gathering and processing information may not be justified by the subsequent improvements in decision making that can be achieved through the improved information. This is likely to be the case in decision situations with a low level of complexity, where only few well-defined options are available, where the targets are clearly specified and where little or no trade-offs between targets are necessary.

One difficulty associated with such an approach is that the added value of better information for the decision making process may only be apparent if this information is available: if it is not available, it may be hard to assess in what way better information might have changed the results of the decision, and what impact this would have had.

3.4 Cost-Effectiveness Analysis

A **cost-effectiveness analysis (CEA)** seeks to find the best alternative activity, process, or intervention that minimises resource use to achieve a given result.

Effectiveness is in this context defined in relation to achieving a predetermined or desirable change in water status reduction in polluting discharge. The effectiveness analysis is usually highly site-specific. CEAs are performed when the objectives of the public policy have been identified and the only remaining question is to find the least-cost option of achieving these objectives. In a CEA, the cost-effectiveness of a policy option is calculated by dividing the annualised costs of the option by physical benefit measures, such as animal or plant species recovered, tons of pollutant emissions reduced, kilometres of river length restored, etc. Different options are then compared and prioritised based on their cost-effectiveness-ratio. CEA, therefore, does not ask nor attempt to answer the question whether the goal of the policy is justified, in the sense that the social benefits expected from this goal exceed the costs necessary to reaching this goal. CEA is sometimes used as a second-best option when a full-blown CBA would be desirable, but many benefits cannot easily be monetised. The different steps in a CEA are presented in the box below.

Step 1: Identify the environmental objective(s) involved
Step 2: Determine the extent to which the environmental objective(s) is (are) met
Step 3: Identify sources of pollution, pressures and impacts now and in the future over the appropriate time horizon
Step 4: Identify measures to bridge the gap between the reference (current/baseline) situation and target situation (environmental objective(s))
Step 5: Assess the effectiveness of these measures in reaching the environmental objective(s)
Step 6: Assess the costs of these measures
Step 7: Rank measures in terms of increasing unit costs
Step 8: Assess the least cost way to reach the environmental objective(s)

Like a Cost-Benefit Analysis, a CEA not only requires economic input, but also relies heavily on the skills of engineers and environmental expertise. As economists often have little knowledge of the technical specifications of the different measures available, substantial input from technical and environmental experts is required to estimate the effectiveness of measures.

Since the policy objective is considered a given in a CEA, there is no need to consider the benefits of achieving this objective. Indeed, in practice, one often sees that once an objective has been agreed, a second policy or decision criterion is that it be achieved at the least costs, hence making a comparison of costs and benefits irrelevant. This also means that in a CEA, monetary valuation of environmental goods and services is not required.

This is different if the CEA is extended to include also the (positive or negative) side-effects of policies. A pure CEA is single-dimensional: policy measures are only compared in view of their potential contribution to achieving one single objective. Obviously, some policy measures may have side-effects that extend beyond their main purpose: for example, a constructed wetland that is targeted at nitrate retention from a water body may also have a positive effect on biodiversity, or may increase the amenity value of a landscape. In recognition of this fact, RPA (2004), referring to the WATECO guidance, recommend that “non-water environmental and resource costs” be taken into account. One way of doing this would be by valuing the side effects in monetary terms, to subtract them from the costs (in the case of positive side effects) or add them to the costs (in the case of negative side effects). However, accounting for side effects does not necessarily involve monetary valuation as they can also be assessed in physical or qualitative terms.

In this case, the judgement on whether side effects are significant enough to affect the ranking of options would need to involve expert judgement, possibly also using a scorecard approach.

A number of approaches are used in practice at varying levels of complexity, scale, comprehensiveness and completeness for carrying out a cost-effectiveness analysis. These are discussed, for example, in Zhang and Folmer (1995). A distinction is made between bottom-up and top-down approaches. The bottom-up approach focuses on technological details of measures and their impact on individual enterprises (micro level), whereas top-down approaches usually consider the wider economic impacts of pollution abatement and reduction measures or strategies, often without detailed technical specification of the proposed measures (macro level).

Bottom-up approaches can also be characterised as being more technical engineering approaches, including often detailed information about the technical characteristics of production processes and only limited information about the financial engineering costs of emission abatement technologies. Top-down approaches on the other hand focus much more on the economic relationships and consequences involved and much less on the technical specification of measures. Examples of bottom-up approaches are simple approaches comparing a limited number of abatement technologies usually on a very local scale based on their engineering costs and emission reduction capacity and the use of dynamic optimisation models (usually through linear programming (LP) models to automatically prioritise between various abatement measures and technologies at enterprise and sometimes also at sector level). Examples of top-down approaches are input-output and computable general equilibrium models.

As for the inclusion of non-priced side-effects, the inclusion of indirect effects depends upon the extent to which these indirect effects are considered more or less relevant for the final decision-making procedure.

3.5 Cost-Benefit Analysis (CBA)

Cost-benefit analysis (CBA) is carried out in order to compare the economic efficiency implications of alternative actions. The benefits from an action are contrasted with the associated costs (including the opportunity costs) within a common analytical framework. To allow comparison of these costs and benefits related to a wide range of scarce productive resources, including different types of water use, measured in widely differing units, a common numeraire is employed: money. This is where most problems usually start for economic policy or project appraisal since some resources, especially environmental resources such as water, are not priced in monetary terms. For many goods and services provided by water resources, there is no market on which they are traded, and therefore no market price is available which reflects their economic value. There are, however, several economic valuation methods which allow placing a value on non-marketed goods and services. The economic valuation of water [use] compares the willingness to pay and opportunity costs of the goods and services supplied by water resources and the water environment. This means that a wider range of goods and services can be explicitly recognised in the CBA process

In general, the following steps can be identified for a Cost-Benefit Analysis:

1. Set the objective of the policy measure (unless this is given)
2. Set the baseline (what would happen if no action is taken / business-as-usual)
3. Define the alternative options to achieve the objective

4. Identify and measure the investment costs of each option compared to the baseline option (in monetary units)
5. Identify and quantify the positive welfare effects of each alternative option compared to the baseline option
6. Value the positive welfare effects in money terms, using market prices or economic valuation methods for non-priced (effects)
7. Compare costs and benefits through time (using appropriate discount rate)
8. Perform sensitivity analysis
9. Present recommendations

Carrying out a CBA often is an iterative and multi-disciplinary process, involving not only expertise from different fields, but also policy and decision-makers. While economists are involved (to varying degrees) in all steps, environmental expertise of many kinds is also needed, especially for steps 4 and 5. Knowledge of engineers and environmental scientists is required for step 2 and 3 etc. Policy and decision-maker input is essential when defining the objective which the policy measure is supposed to achieve, and when identifying the baseline and policy scenarios, including current policy. One key role of an economist in the process is to frame the issue and to set the CBA framework at the beginning so that the multitude of environmental studies that need to be undertaken are working towards answering the same two questions: 'is the action worthwhile?' and 'if so, what is the best option to achieve this objective?'

A cost-benefit analysis compares the costs and benefits of different policy options in monetary terms. The results of this analysis can be interpreted as a benefit-cost ratio (i.e. total benefits divided by total costs, where a ratio larger than one would indicate a desirable option), or as a net present value (net benefits minus net costs, where a net present value larger than zero would indicate a desirable option). This means that, strictly speaking, only those costs and benefits are included in a CBA that can be quantified in monetary terms. In a CBA, however, it will hardly ever be possible to monetise all impacts: those impacts that cannot be monetised are left out of the analysis, in the sense that they do not figure in a benefit-cost ratio or in the calculation of the net present benefits of a proposed action. Non-monetised impacts, if relevant, can nonetheless be included in a qualitative discussion.[2]
Depending on the extent of factors covered in the analysis, different types of CBAs can be distinguished. Brouwer et al. (2004) makes a fundamental distinction between financial and economic CBA:

- A **financial CBA**, also referred to as a cash-flow or a financial analysis, evaluates advantages and disadvantages of a policy measure in terms of the expenditures and earnings directly associated with its implementation. Originally devised for investment decisions, the tool can also be used to assess budgetary impacts of policies.
- An **economic CBA** evaluates the costs and benefits of a policy measure in a broader sense, taking into account the effects on the national economy as a whole.

[2] While a textbook CBA would require all impacts to be monetised, in practice different approaches exist on how non-monetised impacts can still be connected to the CBA in one way or another. Thus, in the approach put forward by the Dutch Ministry of Economics, such effects would be listed as „Pro Memoriam" items on the balance sheet, expressed in qualitative or quantitative form (Brouwer and van Ek 2004). Pearce (1998) argues that in earlier CBAs conducted in the UK, such impacts would have been either ignored entirely, left for a subsequent environmental impact analysis, or monetised only partly. This approach of monetising impacts where possible, and including them in other form where monetisation is not possible marks a deviation from the textbook ideal of a CBA, but does not discredit the tool as such.

- The costs and benefits addressed in an economic CBA may include indirect (second-order) effects and non-priced external effects (e.g. environmental effects). If such externalities are included in the analysis in monetary terms, it is also referred to as an **extended CBA**.

Table 2 provides an overview of the impacts covered in the different CBA types.

Table 2: Impacts covered by different types of Cost-Benefit Analysis

	Financial / budgetary impacts	Economic impacts	Non-priced external effects
Financial CBA	✓		
Economic CBA	✓	✓	
Extended CBA	✓	✓	✓

In practice, government policies are often evaluated primarily on the basis of their financial (budgetary) costs, as these can be assessed relatively easily. The calculation of economic costs and benefits, and especially of non-priced external effects, is a more difficult task. However, the economic / extended CBA is the more appropriate method for evaluating public policies, since government interventions are often related to the provision of public goods, which have an impact on society as a whole. Such impacts should consequently be valued and evaluated from a societal perspective, not the perspective of the principal investor only (Government). In the case of environmental policy measures, an extended CBA will often be called for, as the main benefits of such policy measures usually consist of so-called external environmental effects (improvements) for which no market prices exist.

In a CBA, both the costs and the benefits need to be quantified in monetary terms. Finding monetary information on the costs is fairly straightforward in most cases, as there is considerable experience with (at least the direct) financial costs caused by policy measures, and as market prices will often be available for the cost of measures.

The valuation of benefits is usually more demanding in terms of time, skills and resources: this requires that a monetary value be placed on the outcome of a policy decision. In cases where the outcomes of a policy measure are traded on a market, this valuation can be done using market values (e.g. square metres of housing supplied times average house prices, or cubic metres of drinking water delivered times the drinking water price paid by consumers). In cases where the outcome of a policy measure falls outside existing economic market systems– as is often the case with environmental policy measures – the outcomes can be valued through the concept of individuals' willingness to pay (for an improvement) or their willingness to accept compensation (for a deterioration).

In order to value individuals' willingness to pay (WTP), different methods are available. These can be broadly divided into revealed preference and stated preference approaches. Revealed preference approaches approximate an individual's WTP through their behaviour in other complementary markets such as housing or transport. They include hedonic pricing and the travel cost method, which are described in more detail in Box 2. Stated preference approaches assess an individual's willingness to pay by asking them how much they would be prepared to pay if a specific policy measure was implemented. This is done through questionnaire surveys (e.g. face-to-face, telephone or mail surveys); methodologies include contingent valuation and contingent ranking. These methods are well founded in economic welfare theory and have been applied for decades, nonetheless they continue to be the subject of much debate (see Box 3).

Box 2: Hedonic pricing and the travel cost method – Practical use

The hedonic pricing method infers the value of environmental features from the prices of traded goods or goods that have a market price. It is applicable in those cases where the prices of other goods are directly influenced by environmental factors.[3] The most frequently used example is the housing market, where the value of two otherwise comparable properties or apartments will differ depending on the environmental amenities in the vicinity of each site. Thus, if the proximity to a hazardous waste site leads to a measurable drop in the property price (compared to equivalent houses in other locations), this difference in prices gives an indication of the external cost of the waste site. Hedonic pricing can also be applied to the valuation of external benefits, e.g. if properties in the vicinity of an undisturbed river or lake result in a higher price than comparable properties elsewhere. In the context of water policy, this method can be used to find out how individuals value a clean vs. a contaminated river or lake. In the UK, three different studies were identified that have used the hedonic pricing method in the context of water. One of the studies values the benefits of recovery in water quality for fisheries through hedonic pricing. The other studies value the amenity value of water as well as benefits that people gain from a waterside location (see also Appendix I).

Although hedonic pricing seems to be a useful method for economic valuation, its practical usage is quite restricted. On the one hand, the method is based on several assumptions. For example, hedonic pricing assumes that environmental characteristics can be picked up in market prices of houses, that house owners, when buying the house, take into account the assumed relationship between these environmental characteristics and the market price of a house and that house markets behave perfect, i.e. are transparent and characterised by perfect information to both buyers and sellers. When analysing a hedonic pricing model statistically, many factors may influence the price of properties, and it is often difficult to account for all these factors, let alone isolate the quality of the environment as one single factor, especially if different factors are interdependent.

The travel cost method can be used for the valuation of natural resources, which are intensively used for recreation. Surface water resources often meet that criterion and have therefore been subject to many travel cost studies. The underlying assumption here is that the expenses that visitors incur (and are apparently willing to pay) in order to visit for example a lake or estuary gives an indication of the value of the resource in question. In addition to the direct financial expenditures to travel to a specific site, the amount of time needed to travel there and the corresponding opportunity costs of time have to be considered as well as entry fees and other on-site expenses. Three main types of travel cost models can be distinguished: the individual model, the zonal model and the random utility travel cost model. The travel cost method has been used in several water-related studies in the UK. In two cases it has been used to estimate user benefits of lakes/reservoirs as well as benefits of marginal changes in river quality. The travel cost method has also been used to obtain the value of salmon angling for anglers (for further information see Appendix I).

Like the hedonic price method, the travel cost method is data intensive. Furthermore, many assumptions are needed in order to be able to estimate the travel cost model, including assumptions about the opportunity costs of travel time. These assumptions usually have significant impact on the estimated economic value. Individual and zonal travel cost models are fairly simple and straightforward approaches, but lack the ability to differentiate between public good provision levels (including quality). Like the increasing use of choice experiments, random utility travel cost models are more sophisticated in this sense and the only models which are able to model different quantity and/or quality levels (attribute levels) of the natural resource involved.[4]

[3] Pearce and Horwath (2000): Technical Report on Methodology: Cost Benefit Analysis and Policy Responses.

[4] Cansier (1996): Umweltökonomie (Environmental Economics).

Box 3: The discussion on monetary valuation in environmental policies

Monetary valuation of environmental benefits has been both supported and heavily criticised in the social science literature and by policy practitioners. While proponents underline the strength of monetary valuation in bringing all different types of impacts down to one common denominator, opponents criticise this very property as oversimplistic.

The use of CBA and of monetary valuation in environmental policy-making and especially contingent valuation (CV) as an extension of traditional CBA has stimulated an extensive debate (e.g. Sagoff, 1988; Foster, 1997). For most critics, the neo-classical economic theory underlying CBA and CV is overly restrictive and too simplistic. The assumptions underlying the theory are considered too narrow to properly describe the environmental values people hold, the process of preference construction, or the way individual values are aggregated into a total economic value. Another criticism originates from fears that the economic efficiency criterion is being promoted as a meta decision-making criterion, overriding criteria such as equity or long-term sustainability (Brouwer et al. 1999).

Irrespective of these criticisms, it is clear that valuation studies have a role to play in contemporary environmental policies, as they provide additional knowledge to support better decision-making. It is important to apply and interpret economic valuation results in their appropriate context and to be aware of the pitfalls involved. However, this applies to most methods and techniques, whether in economics or in any other field. Many of the criticisms of monetary valuation may be relieved when best practice is followed while conducting valuation studies – for example, a contingent valuation study can well be integrated with public participation. The main question is rather – given their high costs and the expertise required – how their use can be targeted at those cases where valuation studies actually provide an added value in terms of improved decision making. This in itself is an economic problem.

Apart from methodological and theoretical concerns, valuation studies are often greeted with scepticism by policy makers and by stakeholders, who doubt the practical usefulness of such studies. There are different motivations for this:

- **Capacity constraints**: Conducting primary valuation studies is time-consuming and costly. Given the limited budget and manpower in an administration, they can pose a strain on the available resources. In addition, the economic knowledge of desk officers is often limited – in many instances, economic studies will be overseen by officials without an economic background. This is further enhanced in cases where valuation studies do not produce an added value for the quality of decision-making: if officials have the feeling that valuation studies can only tell them what they already know, the resources that flow into the studies are even harder to justify.
- **Acceptance of the results**: Both administrative staff and the wider public may be reluctant to accept valuation studies themselves, or the results they produce. This may be due to the ethical concerns discussed above, but also because economic valuation is embedded in an overly restrictive framework of assumptions and axioma and especially contingent valuation is hypothetical in nature and hence open to a number of strategic biases. In stakeholder consultations, the use of valuation studies is also criticised as overriding public debate by referring to "scientifically proven" results.

In recent years, attempts have been made to produce more acceptable results, i.e. ‘authorised’ valuation results in informing public decision-making in different environmental contexts. For this purpose, some preliminary guidance has been drafted, involving stakeholders right from the start to avoid at least some of the standard problems or issues that economic valuation exercises seem to run into (e.g. Brouwer, 2000, 2003).

Three general approaches can be followed to place a monetary value on non-priced public goods or services as a result of any policy measure:

- They can either be assessed through a primary economic valuation study, which elicits the willingness to pay / to accept compensation of the affected population by applying one of the valuation methods described above. From a methodological perspective, this is the preferred option: especially contingent valuation methods, if applied correctly, will provide the theoretically correct measure of the expected welfare changes and at the same time can be part of a public participation exercise. One problem is that such measures can represent a strain on time and resources, depending on how they are specified and implemented. For an extensive contingent valuation study, the costs of conducting a primary valuation study may run into the tens of thousands of £, and the analysis may take several months. For a less detailed or a less comprehensive study, costs and time requirements will be lower.
- Alternatively, the benefits can be assessed through a transfer of values obtained in different studies conducted in other locations (benefit transfer). Specific methods for benefit transfer are explained in Box 4 below. However, the use of benefits transfer is not without problems: it will only deliver reliable results if conditions at the study site (where the original values were obtained) are comparable to conditions at the policy site (to which the original values are transferred). However, it has not yet been assessed conclusively in which cases conditions can be considered as "comparable". Also, Pearce (1998) points out that there is a real possibility that an incorrect application of benefit transfer will deliver wrong results and discredit the instrument of CBA altogether.
- Thirdly, existing cost estimates (damage avoidance costs) can be used as proxies for non-priced welfare effects as long as these proxies do not also enter the cost-benefit equation on the cost side. This method assumes that the costs of the avoided damage itself are at least as high as the costs of avoiding it, an assumption that may be justified in many, but certainly not in all cases.

Box 4: Benefits transfer as a way to increase the applicability of monetary valuation[5]

Environmental benefits transfer is a technique in which the results of previous environmental valuation studies are applied to new policy or decision-making contexts. In the literature, benefits transfer is commonly defined as the transposition of monetary environmental values estimated at one site (study site) to another site (policy site). The study site refers to the site where the original study took place, while the policy site is a new site where information is needed about the monetary value of similar benefits.

In the field of environmental valuation, benefits transfer has been applied extensively in various contexts, ranging from water quality management (e.g. Luken et al., 1992) and associated health risks (e.g. Kask and Shogren, 1994) to waste (e.g. Brisson and Pearce, 1995) and forest management (e.g. Bateman et al., 1995). Costanza et al. (1997) have extrapolated the monetary values of existing valuation studies to the flow of global ecosystem services and natural capital, and have thereby raised a number of questions as well as heavy criticism about the validity and reliability of benefits transfer.
A number of criteria have been identified in the literature for benefits transfer to result in reliable estimates (e.g. Desvousges et al., 1992; Loomis et al., 1995). These are summarised by Brouwer (2000):

- sufficient good quality data
- similar populations of beneficiaries
- similar environmental goods and services
- similar sites where these goods and services are found
- similar market constructs
- similar market size (number of beneficiaries)
- similar number and quality of substitute sites where the environmental goods and services are found.

Study quality is an important criterion which can be assessed in a number of ways. Above all, one can look at the internal validity of the study results, that is the extent to which findings correspond to what is theoretically expected. This internal validity has been extensively researched over the past three decades in valuation studies. Studies should contain sufficient information to assess the validity and reliability of their results. This refers, among others, to the adequate reporting of the estimated WTP function. The reporting of the estimation of the WTP function should also include an extensive reporting of statistical techniques used, definition of variables and manipulation of data.

The most important reason for using previous research results in new policy contexts is that it saves a lot of time and money. Applying previous research findings to similar decision situations is a very attractive alternative to expensive and time consuming original research to inform decision making. In practice, several approaches to benefits transfer can be distinguished, which differ in the degree of complexity, the data requirements and the reliability of the results. In practice, the first two approaches are most frequently applied, as they require relatively little data or expertise, and are not very time consuming.

- First, the unadjusted mean point (WTP) from another study can be used to predict the economic value of the benefits involved at the policy site. Ideally, this study focuses on the same environmental goods or services, but was carried out at a different location or at a different point in time.

[5] This box is based on: Brouwer, R. (forthcoming). Environmental benefits transfer: Testing the Empirical Evidence. Kluwer Academic Publishers.

Box 4: continued

- A second approach is to use and average the unadjusted mean point estimates from more than one study, if available.
- A third approach is to use one or more mean unit (WTP) values adjusted for one or more factors which are expected to influence the value estimates at the policy site. For instance, mean WTP is sometimes adjusted for differences in income levels between the different sites.
- Fourth, the entire WTP function from an original study can be used to predict mean WTP at the policy site. The estimated coefficients in the WTP function are multiplied by the average values of the explanatory factors in the new policy context to predict an adjusted average WTP value. This approach would appear to be more robust than the transfer of unadjusted average unit values, since more information is transferred (Pearce et al., 1994). However, it is also more data intensive as information about all relevant factors has to be collected.
- A fifth approach is to use a WTP function which has been estimated based on the results of various similar valuation studies. The WTP function is in this case estimated on the basis of either the summary statistics or the individual data of different studies. This approach is usually referred to as meta-analysis.
- A sixth approach is the use of a value function - either based on a single or on multiple previous studies - in which the coefficient estimates are adjusted when transferring the estimated value function to a new policy context based on prior knowledge.

Thus, while benefit transfer provides a quick and cheap alternative to original valuation research, some conditions must be met if it should provide reliable results. Above all, the local circumstances and conditions in the new decision-making context need to be close enough to the ones prevailing in the original research. The risk of obtaining misleading results may be controlled and reduced by integrating more explaining variables into the transfer, however this also increases the data requirements and the complexity of the analysis. Also, the possibilities of conducting a sound and reliable benefits transfer hinge on the number, quality and diversity of valuation studies available – the larger, the better and the more diverse the existing set of studies is, the more likely will there be a primary study that is “close enough” to the policy site for results to be transferable.

3.6 Multi-Criteria Analysis (MCA)

A Multi-Criteria Analyis (MCA) is a structured approach used to determine overall preferences among alternative policy measures, where each policy measure may pursue several objectives. It is used to structure a policy problem in terms of possible policy alternatives and to assess each alternative under various criteria.

Multi-Criteria analysis is mainly applicable to cases where a single-criterion approach is insufficient (e.g. a cost-benefit analysis, which compares options based on their economic efficiency only). Instead, an MCA may accommodate a range of social, environmental, technical, economic, and financial criteria. MCA is therefore applicable especially where significant environmental and social impacts are present, which cannot (easily) be expressed in monetary terms. MCA are often integrated with participatory approaches and tend to facilitate such input to a larger degree than the classical monetary assessment tools CBA and CEA (see also Nichols et al. 2000 for a discussion).

One setback of MCAs is that they are often difficult to use for lay people. Most of them require an expert to explain how the method works, and to help users to define options, criteria and weights, as well as to choose the appropriate aggregation procedure. The question often is which approach one feels most comfortable with when making effects comparable and commensurable, that is through economic valuation of effects or standardisation and weighting procedures of impacts based on a statistical standardisation of impacts and criteria weights.

The steps taken to carry out an MCA can be described as follows:

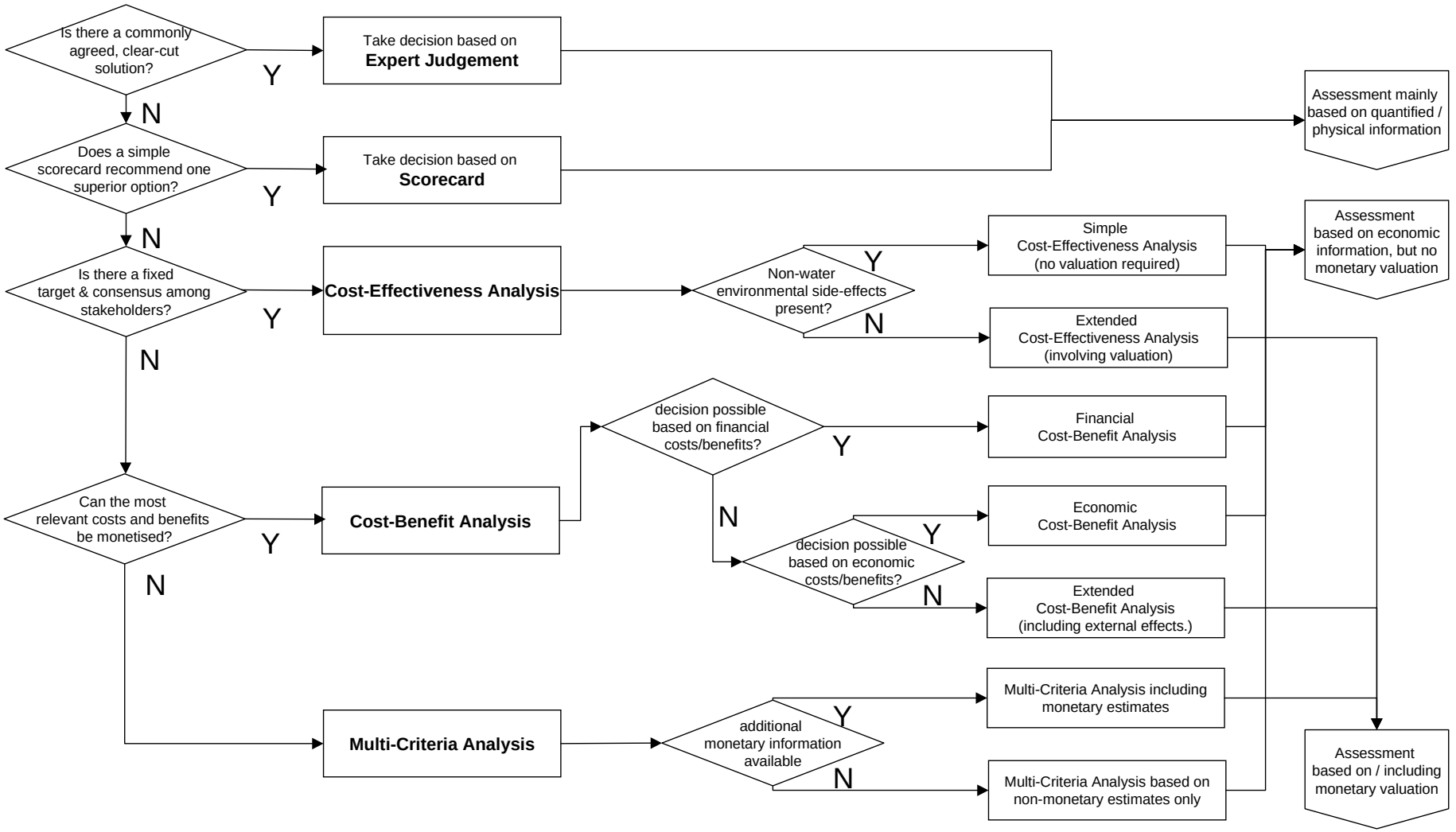
1. As for a CBA, an MCA sets out by identifying and framing the problem that is to be assessed, and formulating the objectives that are to be reached through the policy intervention. Such objectives may include environmental targets as well as social cohesion, employment generation or income distribution.
2. As in CBA, this is followed by the identification of different options to achieve the objectives, a step that may also involve participation of stakeholders and the wider public. If too many potential measures are identified, an initial screening may be helpful to pre-select the available options. Also this screening can take place based on a qualitative multi-criteria analysis.
3. A third step is to identify the criteria against which the different options should be evaluated, along with their suggested indicators and measurement units. The identification of the criteria will be closely related to the objectives identified in the first step. The criteria can be measured in monetary or in quantitative (physical) terms, but they may also be qualitative / descriptive in nature. An important difference of MCA in comparison to CBA is that an MCA is able to relate information in different forms to multiple objectives measured through multiple criteria. In this way, MCA incorporates environmental, economic and social effects just like a CBA does, but trades them off against each other in a different way, namely based upon multiple criteria measured in different units. While the weighing and trading off of different criteria is therefore more complex for an MCA than it is for a CBA, it means that an MCA does not require the use of monetary valuation studies in the same way that a CBA does.
4. In the following, the policy options identified in step 2 are assessed in terms of the criteria defined in step 3. To do this, the policy options are assessed compared to a common predefined baseline scenario, usually a ‘business as usual’ scenario and sometimes a ‘do nothing’ scenario. The performance of the different options against the baseline scenario are then presented in a score card or effects table . A score is provided for each option against each criterion.
5. A fifth step is to standardise the effect scores.

6. A sixth step is to prioritise the different criteria by attaching weights to them. These weights can be assigned by the analyst, by the decision maker, or they can be elicited from stakeholders through some form of participatory consultation process. Another option is to involve a panel of experts (Delphi method). The determination of weights is crucial, at the same time it also introduces an element of subjectivity into the decision making process. The weighting procedure basically corresponds with the valuation step in a CBA. A sensitivity analysis is therefore essential to assess the effect of different weights on the outcome of the analysis.
7. In a seventh step, the different options are compared and evaluated. For this evaluation, the weighted scores have to be aggregated. For this aggregation a number of approaches have been developed. On the one hand, compensatory aggregation techniques sum up the weighted scores across the different criteria, so that low scores on one criterion may be compensated by high scores on another. On the other hand, non-compensatory approaches only use a partial aggregation. Examples of these would be dominance approaches (assessing whether one option dominates all others), lexicographic elimination (comparing options in terms of the criterion deemed most important to see whether a unique best performing option in terms of this criterion can be selected), or outranking (where one option outranks another if it outperforms the other on enough criteria of sufficient importance (as reflected by the sum of the criteria weights) and is itself not outperformed on any one criterion). Additionally, the DETR multi-criteria analysis manual (DETR 2000) identifies some methods that can not be ranked as compensatory or non-compensatory approaches. A direct analysis of the performance matrix includes a "screening" of alternative options, falling short of a quantitative analysis. Another approach which focuses on qualitative aspects would be to perform a MCA using qualitative data inputs only.
8. The final step of an MCA is to prioritise, compare or order the alternative policy measures based on the evaluation results. Different methods can be used to this end. Depending on the method chosen, an MCA can be used to identify a single most preferred option, to rank options, to short-list a limited number of options for subsequent detailed appraisal, or to distinguish acceptable from unacceptable options. The prioritisation of different options should also involve a sensitivity analysis, investigating how the ranking order of the options would change if key parameters (e.g. weighting of criteria) were changed.

3.7 Combination of the different assessment methods

Figure 1 below presents a simplified, general overview of how the different assessment methods are related to each other, based on the assumption that only one assessment method is carried out. The flowchart below is formulated in a general way, and is not specifically geared towards WFD-related decision making. For an application to the selection of cost-effective combinations of measures and the decision on derogations, see chapters 6.3.2 and 6.4.2 below.

Figure 1: Decision flowchart for the choice of an assessment method



In many cases, the different assessment methods will not be full alternatives, as suggested in the flow chart above. Rather, different methods will be applied sequentally or will be combined, with one method providing input to another. Figure 2 gives a schematic overview of how the different assessment methods can be usefully combined (this information was not included in the flowchart to avoid overcomplexity.

Figure 2: Order and possible combinations of different methods

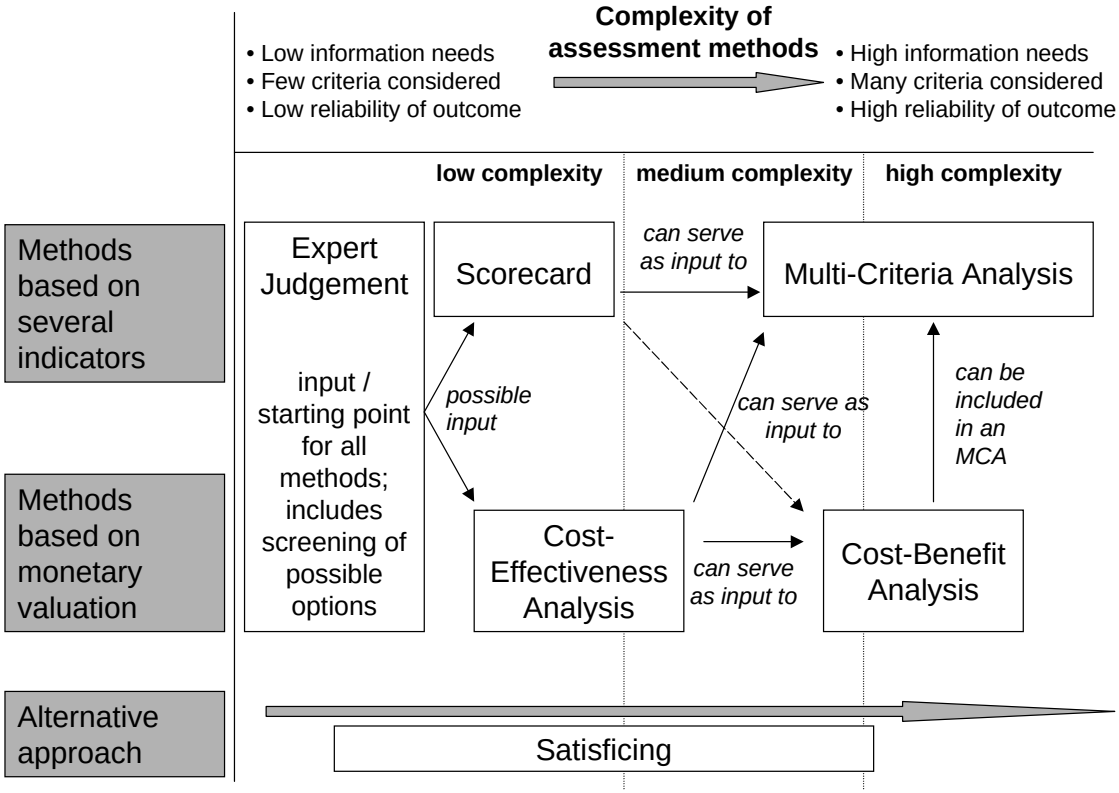


Figure 2 shows that it is effective to use methods in a sequential order if several methods are used. This consideration is especially important if decision makers prefer a low-cost and low-time strategy. They can first use a method which is relatively easy to handle (e.g. a limited CEA). If this method does not deliver the desired output in terms of unambiguously recommending a particular option, most of the information gathered for the CEA can be integrated into a more complex approach (e.g. a full blown CBA). To avoid unnecessary work and costs, decision makers should be aware of these possibilities to combine the different measures. For example, a scorecard approach can be useful input to an MCA as it is similar to a performance matrix that forms the basis of an MCA.

When looking at the complexity level of the different methods one also has to keep in mind the comparability of results obtained through different methods. As the methods which are based on several indicators (e.g. scorecard approach and MCA) often obtain more qualitative results, these are difficult to compare to quantitative results of a CEA or CBA.

3.8 Comparing the different assessment methods

The assessment methods described above present a non-conclusive selection of some of the most widely used assessment methods. Each of these methods have their strengths and weaknesses, they are applicable to different stages of the policy making process.

They furthermore differ in the format, precision and reliability of the results they deliver, and they require different amounts of data, manpower, skill and money to be implemented.

However, it is difficult to rank or to value the different approaches in a clear cut way along these indicators. A variety of approaches can be followed within each of the methods. It is therefore difficult to precisely determine the data, skills or time required for a given method. So, for example, a CBA using the travel cost, hedonic pricing or contingent valuation method will be far more demanding in all respects than a CBA that employs benefits transfer. However, while a benefits transfer is less time and cost intensive, it does not involve the stakeholders in the same way as other methods; which is why decisions may be more difficult to communicate and to implement. Further trade-offs exist in terms of the reliability of results, which is expected to be higher if original valuation studies are carried out.

Still, while the complexity of different tools may differ, it is possible to express them in a certain range, and based on this to rank the valuation methods. A schematic overview of the applicability to different policy questions and the requirements of the tools is given in Table 3 below. The ratings in this table may change depending on approaches used within the methods.

Table 3: Assessment methods, suitability in the policy process and requirements

Criteria \ **Options**	**CBA**	**CEA**	**MCA**	**Satisficing**	**Scorecard**	**Expert Judgement**
Suitability for steps of the policy process:[a]						
Structuring / framing the problem	+	+	++	O	+	+
Identification of options	+	+	+	+	+	+
Ranking of options	++	++	++	-	O	O
Selecting an option	++	++	++	--	-	O
Communicating decision results	+	++	+	-	-	-
Involvement of stakeholders	O	O	++	-	+	--
Requirements in terms of:						
Information needs[b]	High	Mod	High	Low	Low	Low
Economic valuation required[c]	Yes	Poss.	Poss.	No	No	No
Time (months) to conduct analysis[d]	> 6	> 3	> 6	< 3	< 3	< 1
Skills / manpower requirements[b]	High	Mod	High	Mod	Mod	High
Cost of the analysis[b,d]	High	Mod	High	Low	Low	Low
Robustness of results	High	High	High	Low	Mod	Low

a) ++ very high, + high, O undetermined, - low, - - very low.
b) Mod = moderate,
c) Poss. = possible.
d) Please note that the information provided in this table is merely a rough indication of the average time and costs required for the different methods. Depending on the specification, time and costs can be both higher and lower. Simpler forms of CBA and MCA can also be conducted in a month, and at lower cost, especially if benefit transfer is applied.

When comparing the different assessment methods, one observation is the considerable diversity of approaches that exists within the methods themselves.

- For example, a "minimal" version of MCA may consist in a direct, non-quantitative analysis of the performance matrix, which involves little more analytical effort than a scorecard. At the other extreme, a "maximal" version of an MCA may integrate the results of a CBA as a sub-assessment, involving the use of valuation studies to monetise impacts (see e.g. Strijker et al. 2000).
- Likewise, whereas the information required for a financial CBA may be readily available, the information needs for an extended CBA can be much more substantial. This is mainly due to the efforts required for the estimation of benefits, including the use of valuation studies. How extensive and costly this exercise turns out to be depends on the valuation methods used. Through the use of benefits transfer, the cost of information gathering can be reduced considerably, to the extent that the marginal cost of conducting a CBA (rather than a CEA) may become relatively small.
- While the general assumption is that a CEA is less data and time-intensive (and therefore less costly) than a CBA, this may change if indirect economic impacts and non-water related environment costs/benefits are considered as well, especially if these are quantified and valued in monetary terms. Also, it clearly depends on the efforts required to assess the effectiveness of measures (in particular when dealing with the functioning of the ecosystem and the ecology) relevant to both cost-effectiveness and cost-benefit[6] analyses.

Therefore an analyst not only has to choose between different assessment tools, but also decide on the level of detail within the analysis. The guiding principle for this analysis should be whether the extra cost of a more detailed assessment is worth the greater precision of the results thus obtained; the ultimate yardstick in this respect being whether the results improve the quality of decisions taken.

Despite the fact that the assessment methods themselves offer some flexibility regarding the level of detail and the data and time requirements, it can be noted that the three "classical" analysis methods – CBA, CEA and MCA – tend to require far more input than the "ad hoc" approaches (satisficing, scorecards and expert judgement). This corresponds to a greater reliability of the results they produce, and a more detail way of presenting the results. For CBA, CEA and MCA, the reliability of results is further enhanced through the use of sensitivity analysis, which should be (but is not always) part of the analysis. A sensitivity analysis makes sure that the ranking of the different options is robust and does not change when key assumptions are changed, such as the discount rate applied. A sensitivity analysis would also assess in how far the results are affected by incomplete or imprecise information, respectively by the assumptions made in order to overcome such information limitations.

In terms of the required economic information, and especially regarding the use of valuation studies, the economic assessment methods CBA and CEA clearly require most information. However, while the use of economic information is necessary or at least advisable in most assessment methods, the use of valuation studies (or benefits transfer) is necessary only in the case of an extended CBA, which covers the non-priced environmental impacts of a policy measure. For a CEA including side effects (e.g. the non-water related environmental and resource costs referred to by RPA 2004), the use of valuation studies is advisable; in an MCA, their use is possible, but not necessary, since the impacts can also be expressed in qualitative or quantitative (physical) terms.

[6] Indeed, the information for assessing effectiveness and impacts (thus benefits) of measures is similar.

Table 4: Information requirements for the different assessment methods

Assessment method	Economic information	Use of valuation studies for non-market impacts
Cost-Benefit Analysis		
Financial CBA	Possible, but not necessary	Not required
Economic CBA	Necessary	Not required
Extended CBA	Necessary	Necessary
Cost-Effectiveness Analysis		
Pure CEA	Necessary (costs)	Not necessary
CEA + side-effects	Necessary (costs, wider indirect economic impacts)	Advisable (for non-water-related environmental costs and benefits), not necessary
Multi-Criteria Analysis	Advisable (usually included in MCA)	Possible, but not necessary
Satisficing	Possible, but not necessary	Not required
Scorecard approach	Possible, but not necessary	Not required
Expert Judgement	Not required	Not required

4 THE WATER FRAMEWORK DIRECTIVE AND ECONOMIC VALUATION

In order to establish the potential use of valuation studies in the WFD implementation, it is useful to set the scene by looking at the potential uses of valuation studies in the implementation of the Water Framework Directive. There are four different places in the Water Framework Directive where valuation studies could come into play: [7]

1. Article 9: Member States shall take account of the cost recovery of water services, including environmental and resource costs.
2. Article 9: Member States shall ensure by 2010 that water pricing policies provide adequate incentives for water users to use water resources efficiently, and thereby contribute to the environmental objectives of this Directive.
3. Annex III and Article 11: Member States shall make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures.
4. Article 4: possible economic justification for derogation (including designation of water body status):
   - Objectives derogation if the achievement of these objectives is disproportionately expensive (i.e. allowing for less strict environmental objectives, or reaching a given objective in a longer time period).
   - Derogation for new modification or sustainable economic activity, if benefits of this activity outweigh benefits from good water status.

[7] The following Chapter is based on: Brouwer et al. 2004a: Assessment of environmental and resource costs in the Water Framework Directive. Information sheet prepared by Drafting Group ECO2, Common Implementation Strategy, Working Group 2B. [RIZA working document 2004.203X.]

According to Paragraph 1 in Article 9 of the WFD, "*Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle*". In fact, Art. 9 is the only Article in the Water Framework Directive that explicitly mentions environmental and resource costs. In the context of the WFD, environmental costs are defined as the economic damage costs to the water environment and other water use(r)s caused by alternative competing water use (e.g. water abstraction or wastewater discharge). Resource costs are defined as the opportunity costs of using water as a scarce resource in a particular way (e.g. through abstraction or wastewater discharge) in time and space (Brouwer et al., 2004a).

In order to assess the level of cost recovery, one has to know the total costs, which include environmental and resource costs, as well as the contributions to these costs from the different users of the water service through existing price and finance mechanisms. An analysis of the level of compensation received by different water users for any damage caused by a specific water use gives an idea of the internalisation of environmental and resource costs through existing pricing mechanisms. This also gives a clear indication of the extent to which the Polluter Pays Principle applies. Economic valuation will therefore play a role when dealing with environmental and resource costs in the context of Article 9. However, while this is the most clear-cut case for the use of valuation studies, it was not a main focus of this study. Therefore, the potential use of valuation studies for the implementation of Art. 9 is not discussed further.

While Article 9 is the only article in the Water Framework Directive that explicitly mentions environmental and resource costs, the underlying concept is also relevant for the issues raised in Article 4 (economic justification for derogations) and Article 11 (selection of cost-effective combinations of measures). In these two Articles, the potential use of valuation studies does not primarily aim at investigating the environmental and resource costs, but rather might serve as supporting information for decisions on the selection of measures and the disproportionality of costs.

The selection of cost-effective combinations of measures (Art. 11) will resemble a cost-effectiveness-analysis (CEA), which identifies the least costly way of achieving a given target (See also chapter 3.4 for a more detailed description). With few exceptions, tt is unlikely that valuation studies will play an important role in this process. By contrast, the decision to derogate because of disproportionate costs (Art. 4) might be assessed through a cost-benefit analysis (CBA). This method weighs the costs of an option against the corresponding benefits, and which requires a monetisation of benefits. [8] Alternatively, methodologies that are not based on monetary valuation might be used for this assessment as well, thus reducing the need for valuation studies. As these areas are the main focus of this study, the possible use of economic valuation for the implementation of Art. 11 and Art. 4 is described in greater detail below.

[8] It should be noted that not all methodologies that will be used to address these questions have been clearly defined. Although the questions raised in Article 4 suggest that CBA would be a feasible tool, the practical implementation need not take the form of a textbook-type CBA, but could also include weighing of qualitative elements, e.g. through a multi-criteria analysis. Likewise, RPA (2004) recommends a staged approach to the CEA carried out under Article 11, ranging from a pure CEA (no quantification of benefits) to a CBA-type assessment (full quantification of benefits). A more detailed discussion of those issues can be found in chapter 6 of this report.

Generally, it becomes clear that valuation studies may play different roles and may have different importance in different parts of WFD implementation: depending on where in the WFD they are addressed, the potential use of valuation studies has to be judged differently.

4.1 The selection of cost-effective measures and the Water Framework Directive

Article 11 of the EC Water Framework Directive requires Member States to establish programmes of measures which ensure that all river basins attain the environmental objectives established by the Directive by the year 2015. These programmes are drafted on the basis of the status reports that had to be prepared for all river basin districts by the end of 2004. As mandated by Article 5 WFD, these status reports will include an analysis of the characteristics of each river basin, a review of anthropogenic stresses and an economic analysis of water uses. Annex III of the Directive furthermore specifies that the economic analysis should contain sufficient information to allow judgements about the most cost-effective combination of measures for inclusion in the programme of measures and thus emphasises the economic dimension of this selection process.

In principle, the selection of the **most cost effective sets of measures** under Article 11 and Annex III of the WFD will be done through a cost-effectiveness analysis, which does not require economic valuation as a general rule (see 3.6 above). But in some cases, valuation studies might be relevant to support and influence the selection of measures.

If one or more of the possible measures are expected to have significant (positive or negative) side effects one option is to value these side effects in monetary terms and include them in the analysis as “non-water environmental and resource costs”, as suggested by RPA (2004) and by the WATECO guidance. For example, this could be the case if a measure restricts the use of hydropower and thus leads to more fossil fuel burning, or if a constructed wetland intended for nitrate retention also creates positive effects in terms of biodiversity, flood retention and landscape amenity values),. If the side effects are valued in monetary terms, they could be added to or subtracted from the cost of measures (in the case of negative or positive side-effects, respectively).

However, it is also possible to describe the side effects in physical terms. Including them into the selection process would then be done by effectively expanding the Cost-Effectiveness Analysis to a Multi-Criteria Analysis, with the cost-effectiveness of measures as the main decision criterion and their (positive or negative) side-effects as a supplementary criterion.

4.2 Economic valuation and the decision on derogations

According to Article 4 WFD, derogations from the environmental objective of good surface water status by 2015 can be sought on different grounds. These derogations are discussed in greater detail below. They include:

- Time derogation (Article 4.4 WFD) involving an extension of the timeframe in which the objectives have to be reached (beyond 2015);
- Less stringent environmental objectives (Article 4.5 WFD) due to unfeasibility or disproportionate costs of the measures that would be required for reaching good water status;
- Derogation obtained for new (hydromorphological) modifications and new sustainable economic activities that lead to a deterioration in water body status (Article 4.7 WFD).

In addition, the designation of Heavily Modified Water Bodies (HMWB) & Artificial Water Bodies (AWB) (according to Article 4.3 WFD) can also be mentioned in this context. Strictly speaking, HMWB & AWB are not equivalent to a derogation, since their status is equivalent to that of the natural surface water categories. In this way HMWB & AWB can be granted time and less stringent objective derogations in the same way as other water bodies (once designated). However the process of designating HMWB and AWB bears some resemblance to the derogations and may involve economic considerations. Once a water body (WB) is designated as HMWB or AWB, the associated environmental objectives are the "good ecological potential" and "good chemical status", as opposed to the general WFD objective of good ecological status.

For each of these derogations, a number of "derogation tests" have to be applied as input into decision making. These derogation tests require information, expertise and knowledge on a wide range of issues such as biophysical, economic and social elements.

Up to now, discussions on the European level have focussed on two types of derogations (and related decisions): the designation of HMWB & AWB, as well as derogations due to new modifications and new sustainable economic activities. In addition, Annex IV of the WATECO guidance deals with the issue of disproportionality of costs for all derogation tests, but does not go into much detail.

A crucial input for the decision on derogations is the judgement whether the costs of reaching good ecological status are considered as disproportionate. For this assessment, the central question is obviously "in proportion to what" the costs are considered as (dis-) proportionate. One possible interpretation is that the costs of achieving good ecological status should be regarded in proportion to the benefits. Such a comparison can (but need not) take the form of a cost-benefit-analysis.[9] This means that the costs of pollution control measures (including water services such as wastewater collection and wastewater treatment) are compared to the damage costs avoided through such measures.

Valuation studies might play a role in this process, depending on the interpretation of disproportionality applied and on the extent that economics will be used for taking decisions on derogations.

The following chapters describe the different economic criteria to be found in the WFD derogation tests. The specific roles valuation studies have to play are mentioned below but not discussed in detail as the importance of valuation studies for different (economic) methods has already been described in Chapter 3.

4.2.1 Designation of HMWB & AWB

The process for the provisional identification and designation of HMWB & AWB (Art. 4.3 WFD) has been developed in detail in the EU guidance document on HMWB & AWB.[10] The WATECO guidance Annex IV.II(b) also discusses the use of economics as part of the appraisal techniques in this designation process. Economic aspects are relevant in several parts of the HMWB designation tests:

[9] Apart from the case of new modifications and economic activities where the WFD specifically refers to the comparison between the potential benefits obtained from new economic activities and the benefits arising from achieving good water status (see Article 4.7 of the WFD).

[10] Guidance Document on identification and designation of Artificial and Heavily Modified Water Bodies, Final, CIS Working Group 2.2 on Heavily Modified Water Bodies, 14 January 2003.

- In assessing "adverse effects" (on the "specified uses" or on the "wider environment"), economic elements will play an important role. However, according to the HMWB guidance, the ability of the user (or use) to pay any disproportionate costs should not be used as an additional consideration.
- In considering "other means", cost disproportionality is taken into account by comparing the costs of the existing morphological modification versus the costs of "other means" aimed at delivering the same beneficial objective.
- In considering measures to reach the environmental objective (good ecological potential and good chemical status), cost-effectiveness and cost disproportionality considerations will be relevant in a similar way to the selection of measures for natural water bodies.

Valuation studies of water-related environmental costs are relevant to the last issue of disproportionate costs and derogation (see below). The comparison of “other means” will include both water-related and non-water related environmental impacts as part of the test on *significantly better environmental options*. This test could build on monetary values for different environmental costs that would facilitate a ranking of means by aggregating impacts on different environmental media (soil, water, air, etc).

4.2.2 Time derogation

The **time derogation** (Article 4.4 WFD) involves an extension of the timeframe in which the objectives have to be reached (beyond 2015). Based on the total costs of the measures relating to a specific water body, an assessment has to take place whether these costs are "disproportionate". In case they are disproportionate, but a change in time scale would make them proportionate, a time derogation may apply on the water body scale (Art. 4.4a WFD).

Time derogation is limited up to a maximum of two further updates of the river basin management plans except where the natural conditions are such that the objectives cannot be achieved. Therefore, when an environmental objective cannot be achieved by 2015 and a time derogation applies, the objective should be achieved by 2021 or 2027. The time constraint may often influence the decision as to whether the proposed measures are technically feasible or disproportionately expensive.

Today, the role of valuation in justifying time derogation is unclear. If the justification for time derogation is primarily driven by financial issues and the need to plan investments over time in line with the availability of financial resources, valuation will have a small role. However, if time derogation is based on more complete cost-benefit analysis, valuation of environmental costs (including water-related environmental costs) could be relevant.

4.2.3 Less stringent environmental objectives

This type of derogation allows for less stringent environmental objectives (Article 4.5 WFD) if reaching good water status is either not feasible, or would require measures that are disproportionately expensive. When the programme of measures is formulated, an assessment has to take place "for specific bodies of water" to investigate whether reaching the (appropriate) WFD environmental objective is "disproportionately expensive". In case the human impact is so extensive or the natural condition is such that the achievement of the environmental objective would be disproportionately costly, a less stringent (lower) environmental objective may be set.

At the same time, it has to be assessed whether “the environmental and socio-economic needs cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs".

The justification for less stringent environmental objectives can clearly build on the monetary valuation of environmental impacts – thus comparing the costs of reaching good water status with the environmental benefits obtained. Also, and similarly to the designation of heavily modified water bodies, the comparison of different means and their environmental impact could build on values for different environmental costs that would facilitate a ranking of means by allowing aggregation of impacts on different environmental media (soil, water, air, etc).

4.2.4 Derogation for new modifications and activities

Derogations for new modifications and new sustainable human development activities (Art. 4.7 WFD) that lead to a deterioration in water body status are discussed in Annex IV.II(a) of the WATECO guidance. According to this annex, economic aspects are most relevant in the following aspects:

- When identifying a new activity, it should be determined whether new economic activity is sustainable. Among other things, this will involve an assessment of the economic implications of the activity in terms of turnover, income and production patterns;
- When identifying all practical steps (measures) to mitigate the adverse impact on the water body, the choice of measures may depend partly on their financial feasibility. The total costs of these mitigation measures would then need to be assessed (Art. 4.7a);
- When comparing the benefits of the new modification with the benefits of meeting the quality objectives of the Water Framework Directive, the assessment will include different types of water-related benefits, including economic, environmental and social water-related benefits. To ensure comparability, the benefits foregone by failing to achieve the objectives should be quantified in monetary terms. Where this is not possible, alternative techniques should be employed, e.g. qualitative or semi-quantitative judgements. Thus, the different benefits and impacts should be presented in a multi-dimensional table (Art. 4.7c);
- When comparing the new modification with alternatives (other means) that serve the same beneficial objectives, the environmental impact and the costs of the new modifications should be compared to those of the alternative options. It may be possible to transform environmental impacts into monetary (thus comparable) values (Art. 4.7d).

As stressed above, Article 4.7 explicitly refers to a comparison of costs (foregone environmental benefits resulting from deterioration in water status) and benefits (economic benefits resulting from the new economic activity). Thus, it makes a cost-benefit analysis compulsory – with potential for using valuation studies for expressing foregone environmental benefits in monetary terms.

5 CURRENT USE OF VALUATION IN SCOTLAND, NORTHERN IRELAND & BEYOND

In order to assess the current state of play for the integration of economics into water management decision making, this Chapter gives an overview on how economic valuation studies are used in selected EU States that are well advanced in this regard and may serve as a reference for what is done elsewhere.

Special focus is given to the situation in England and Wales, since there is a need for a co-ordinated approach within the UK. The current use of valuation studies are described, with a special focus on the current thinking in England and Wales regarding the future use of economic valuation in the WFD implementation process.

Finally and most importantly, the current use of economics and valuation studies in Scotland and Northern Ireland is described, in order to clarify the starting point for the use of valuation studies or alternative approaches in the WFD implementation process.

5.1 The use of economic valuation studies in water policy in selected EU Countries

5.1.1 Netherlands

The practical estimation and application of environmental costs in the context of the implementation of the WFD in the Netherlands is based on the principle of "different costs for different purposes", and guided by existing official guidelines for environmental cost calculation from the Environment Ministry. Two other important considerations are (1) data availability and (2) the reliability and accuracy of the available data. In the latter case, policy and decision-maker demand for reliable and accurate estimates in different phases of the implementation of the WFD plays an essential role.

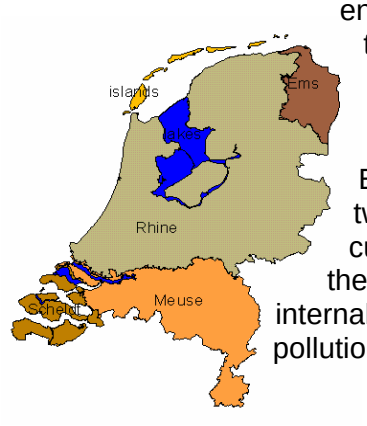
For the purpose of cost recovery (Article 9) and the 2004 reporting requirements (Article 5), environmental costs are approximated by looking at the costs of measures whose primary aim is to protect the water environment based on existing legal (environmental) standards. This approach is used to assess the level of cost recovery and design possible future pricing policies to tackle water pollution problems at water body level in river basins as foreseen in Article 9 based on the cost-effectiveness analysis in Annex III. This cost-based approach is used as long as the basis for economic valuation of environmental damage costs (e.g. cause-effect relationships between pressures and impacts) and economic valuation procedures based on expressed or stated preference methods (which would allow a valid and reliable break-down of economic values to damage categories and damage units) remain surrounded by too many uncertainties. Cost data are readily available (for water projects and related water management activities data bases exist going back 10-20 years) and guidelines for standard cost calculations for water projects developed more than ten years ago and have been applied ever since, including guidelines related to the assessment of uncertainties in these cost calculations.

Table 5: Cost of environmental protection related to water in 2000 in the Netherlands

Title	**Total costs of environmental protection**
Sector	**(million €)**
Agriculture	30
Industry	373
Water boards	911
Total	1,314

Source: Statistics Netherlands

The calculation of costs of environmental protection as a proxy for environmental costs for the 2004 reporting requirements is based on the available data about environmental costs related to water from Statistics Netherlands. Statistics Netherlands calculates these costs annually based on the existing guidelines from the Environment Ministry. These national guidelines correspond to the international environmental cost accounting guidelines provided by the OECD and Eurostat for environmental protection measures. The environmental costs related to water mainly include wastewater treatment costs. The costs are calculated separately for industry, agriculture and the regional water boards. The latter are in charge of public wastewater treatment in the Netherlands.



Environmental costs have been elaborated more specifically for two water services, wastewater collection and treatment. The current costs of these water services are recovered directly from the sources of pollution (households, agriculture and industry) and internalised through existing price mechanisms (sewerage levy and pollution levy).

Table 6: Cost recovery rates of environmental protection activities per basin

	Water service	
	Wastewater collection	**Wastewater treatment**
River basin	(cost recovery %)	(cost recovery %)
Rhine	79	98
Meuse	77	95
Scheldt	73	92
Ems	76	100
Netherlands	78	97

Source: Statistics Netherlands

Available information about the total revenues from existing price and financing mechanisms is used to assess the extent to which the current costs of these measures to prevent, avoid, mitigate or restore environmental damage related to water are recovered within the institutional setting in river basins.

At the same time, on-going work also focuses on the translation of environmental damages into valid and reliable economic values with the help of economic valuation methods, such as contingent valuation and travel cost studies. For instance, a national contingent valuation study was conducted recently, which investigated public willingness to pay for improved water quality as a result of the implementation of the WFD and in which economic values were broken down by river basin (Brouwer, 2004a).

Large scale national valuation studies have furthermore been carried out looking at ecological restoration of lakes and lakeshores (Brouwer et al., 2004b), bathing water quality improvement in the context of the revision of the European Bathing Water Quality Directive (Brouwer, 2003) and biodiversity and health risks related to the clean-up of contaminated sediments (Brouwer, 2004b).

In view of the experiences with these valuation methods in the Netherlands so far in the domain of water, the results are at present only considered suitable for pre-feasibility cost-benefit studies in the explorative phase of the decision-making cycle in the WFD, for example to support the setting of environmental standards. They are still considered unsuitable to target specific economic sectors, for internalising environmental costs, and fix price levels for specific water uses and services in possible future pricing policies as foreseen in Article 9. They are expected to play a more important role in the context of Article 4 (disproportionate costs). As more knowledge, data and information become available over time, the accuracy and reliability of the estimates are expected to increase, resulting in a fine tuning of the analysis to support actual decision-making regarding the selection of a cost-effective programme of measures in the river basin management plan by 2009.

5.1.2 France

In France, the valuation of environmental costs and benefits in the field of water has been limited to the research sphere. Examples of effective use of valuation studies for supporting decisions are very rare.

- A cost-benefit analysis including environmental costs and benefits has been carried out for the proposed (and highly controversial) Charlas dam in the South of France. Many criticisms have been raised on the use of the values in this report. [11]

- Values for environmental costs and benefits have been assessed for supporting and justifying the first Schéma Directeur d'Aménagement et de Gestion des Eaux (SDAGE) developed by the water agencies for each of the 6 river basins in France in the 1990s. As analysed in Laurans et al. (2001), these valuation studies were not part of an overall assessment of the costs and benefits of the SDAGE: they were aiming at illustrating and emphasising specific costs and benefits relevant to different spatial scales or issues (e.g. agriculture and water pollution). The studies remained marginal in the overall analyses and discussions on economic issues, most of the attention being placed on financial issues and on the balance between costs of programmes and financial resources available to support investments and programmes.

Overall, and although values for environmental costs and benefits exist in the literature, there is no legal obligation to use them and they are rarely used and applied for supporting decisions. Along similar lines, the levels of environmental charges linked to water (pollution and abstraction charges) are never related to possible values of environmental costs but directly defined by the investment needs of proposed investments.

It is interesting to note that the limited use of existing values in policy decisions might be embedded in the limited culture in applying cost-benefit analysis frameworks for the evaluation of policies and measures in the field of water.

[11] Patrick Deronzier, Ministry of Ecology and Sustainable Development – personal communication.

In this context, water policy is very different from transport policy where reference (monetary) values for various environmental impacts (e.g. the value of emission of a ton of CO_2) are available (see Boitieu and Baumstark (2001)) and are systematically applied to transport infrastructure projects.

Clearly, the Water Framework Directive will boost the development of valuation studies. For example, existing valuation studies have already been referred to in the characterisation report of the different river basin districts. The development of reference values for environmental costs and benefits is foreseen to support the justification of derogation and less stringent environmental objectives. Whether these values will play a significant role in justifying derogation as compared to other issues (such as capacity to pay or affordability) remains uncertain - apart probably from a small number of cases where environmental benefits are already known to be significant.

5.1.3 Germany

In general, the economic valuation of environmental goods and services does not have a long tradition in Germany, though it has been growing in the last years. The following table provides a non-exhaustive overview of recent water-related valuation studies that have been conducted in Germany.

Table 7: Valuation studies in Germany

Study	Object	Methodology	Result (examples)
Holm-Müller (1991)	Environmental quality (e.g. drinking water, surface water)	Contingent valuation	Improvement of 1 quality class (€/household*a): • 48 (surface water) • 24 (drinking water)
Hampicke, Schäfer (1994)	Isar estuary floodplains	Market prices (timber), contingent valuation	500 to 650 €/ha*a
Jung (1996)	Environmental quality (e.g. drinking water)	Contingent valuation	
Schönbäck (1997)	Danube floodplains, national park	Travel costs, Contingent valuation	Value of national park (11.500 ha): • 8,3 billion €
Waibel, Fleischer (1999)	Costs and benefits of agricultural pesticides	Market prices (drinking water), Contingent valuation (biodiversity)	Drinking water supply: 65,9 Mio € p.a. for Germany (51% of total external cost)
Muthke (2001)	Quality of water bodies for recreation	Contingent valuation	Improvement of 1 class: 30 – 43 €, 2 classes: 34 – 53 € / household*a
Wronka (to be published)	Biodiversity, drinking water	Contingent valuation	Improvement of drinking water quality: 22 - 75 €/household*a
Meyerhoff, Dehnhardt (2002)	Elbe floodplains (biodiversity, nutrient retention)	Contingent valuation, market prices (nutrients)	Area of 10.000 to 15.000 ha: net present value 850 - 1.080 Mio € (details see below)

One of the most comprehensive and influential works on the valuation of water resources in the recent past was written by Meyerhoff and Dehnhardt (2002), who estimated the value of the proposed restoration of 10,000 ha of floodplains along the river Elbe. Two distinct methodologies of analysis were used in the study. A contingent valuation study was conducted to evaluate the willingness to pay for the protection of biodiversity and endangered species in the Elbe floodplains through a set of measures. In addition, the ecosystem services of floodplains in improving water quality were assessed using the replacement cost method, whereby services provided by ecosystems are priced on the basis of technical substitutes. To this end, the floodplains' capacity for nutrient retention was valued based on the costs of otherwise needed investments for water treatment plants, as well as policy measures to reduce agricultural fertiliser input.

Although the study was not closely embedded into the WFD implementation, it does provide some examples of how to approach the economic aspects of the Water Framework Directive. Apart from demonstrating how environmental costs can be included in the selection and design of measures, it also provides evidence of the benefits (= environmental damage avoided) that users and non-users of the river would derive from a sustainable development of the river Elbe.

5.2 Use of economic valuation in the United Kingdom

This section reviews 40 economic valuation studies undertaken over approximately the last decade in the UK. The studies are selected according to:

- The robustness of the methodology: only those studies are included in the review that use valuation methodologies based on economic theory;
- The robustness of results: while not all studies can claim to have the best scores from statistical tests, studies are selected on the basis of an acceptable level of statistical reliability;
- The relevance of the environmental resource / change covered in the valuation studies: only those that are about fresh water bodies are included in the review. While groundwater would also have been relevant, there is no study in the UK that estimates the economic value of an aquifer; and
- Geographical location: only those studies that took place in the UK are included in the review. There are several other studies that are of topical relevance but took place in other European countries. These are not included in the review.

The studies are found in the academic literature as well as reports published or commissioned by public sector organisations. The literature sources include eftec's in-house database, EVRI database (The Environmental Valuation Reference Inventory – www.evri.ca) and the economic valuation database of the Environment Agency for England and Wales (EA) which eftec had prepared. The EA database has been used for assessing the Asset Management Plans submitted under the Periodic Review 2004.

Annex I presents the summary of the studies selected for review. The table provides reference information and methodological parameters including resource and economic value type, environmental change / valuation scenario and implementation in addition to results and commentary about the suitability of results for benefits transfer.

Studies are grouped according to the type of fresh water resource they cover, namely:

- Rivers;
- Wetlands, lakes, floodplains;
- Canals[12], and
- What is termed as 'demand side' (for want of a better term) which contains two studies about households' willingness to pay for drinking water and sewage connection.

The Annex also includes studies that are commissioned by some water companies in their effort to prepare Asset Management Plans for the Periodic Reviews and/or renew their abstraction licences.

5.2.1 Current use of valuation studies at the Environment Agency for England and Wales

This review is based on personal communication with Claire Johnstone of the Environment Agency and her draft report on the assessment of the current use of valuation studies by the Agency (pers. Comm., 14 December 2004).

There are two main ways valuation has been used in the EA: (i) as input to specific individual projects and (ii) more generally to show the benefits of broader environmental programmes or policies. The EA either commissioned original valuation studies or used the results from the existing literature by way of benefits transfer. The past use of valuation in the EA reflects the organisation's historic responsibility for water bodies. The environmental resources for which original valuation studies have been carried out have the most direct and visible links to human use, namely, abstraction of water and fisheries. Only one ongoing study was about water quality, while others were about water abstraction.

Original valuation studies: the EA has commissioned five original valuation studies, all for freshwaters (ERM Economics, 1992; House et al., 1994; ERM Economics/Willis, K. & Garrod, G., 1997; JacobsGibb, 2002; Spurgeon et al., 2001). Four of these studies valued low-flow alleviation in various rivers in England. They were conducted in response to the need to quantify the benefits to informal recreation, angling etc. resulting from specific schemes to alleviate low-flow problems. These schemes were part of the Periodic Review of the water company business plans which are approved by the EA in terms of their environmental performance. Through this review, the water supply and abstraction schemes are ranked in terms of their average incremental social cost (AISC), which is the sum of financial and environmental-social costs of the scheme.

In 1999-2000 the EA conducted a large-scale study estimating the economic value of inland fisheries. The information from this study fed into the Salmon & Freshwater Fisheries Legislative Review Group. As a result, the Government prioritised the need to enhance the contribution freshwater fisheries make to the economy. The economic values estimated in this study have also underpinned other Environment Agency policies such as the Urban Fisheries Policy, and schemes to promote angling. The original EA-commissioned studies mentioned above are reviewed in Annex I as far as they are relevant to the context of this report.

[12] While studies about canals may not be as relevant as studies about other water bodies in the context of the WFD, they are presented here for completeness.

Benefits transfer studies: The largest benefits transfer exercise carried out by the Environment Agency was for the Environment Programme in Periodic Review 2004. This work used existing economic value estimates to show the benefits of both individual projects and also, strategically, to show the overall value of the programme. (e.g. stating that improving xkm of rivers generates £y million of benefits). Thus, some 450 Cost-benefit-analyses have been taken for different schemes, of which 274 were proposed as their net benefits exceeded £1bn, and deferring the schemes where costs exceeded £1bn. As a result, those schemes that were proposed for implementation achieved 80% of the calculated total benefits at 40% of the calculated total cost.

One study (JacobsGibb Ltd 2002) used the values estimated in the original low-flow studies (noted above) in a benefits transfer exercise to compare different uses of the river water in the Yazor Brook. The results of this study were used to appraise different management options for the brook, and to see whether artificially maintaining high flows was justified.

An appraisal for a flood alleviation scheme in Knottingley used existing values for wetlands synthesised in a research paper by English Nature.[13] The creation of a new wetland to mitigate flood risk was found to provide additional environmental benefits (informal recreation, angling, non-use values) that outweighed the costs by 5:1.

Who uses the economic valuation information?: The information has been used by the Water Quality Directorate for the Periodic Review 2004. Other than that, Water Management is the only directorate to have used this information. Within this directorate, Water Resources division has carried out the highest number of original studies, and Economics division used benefits transfer extensively.

5.2.2 The "RPA-Approach": Assessing disproportionate costs for WFD implementation and the role of valuation studies

The report "CEA and Developing a Methodology for Assessing Disproportionate Costs" was one of three scoping studies in preparation of the Collaborative Research Programme (CRP) involving Defra, the Scottish Executive, the Environment Agency of England and Wales, SNIFFER, SEPA, English Nature, DTI and UKWIR. The Collaborative Research Programme was established to address the research needs for meeting the requirements of the Water Framework Directive. It is scheduled to run from April 2004 to March 2007 and consists of six sequential projects.

This early project on ‘CEA and Developing a Methodology for Assessing Disproportionate Costs’ was conducted to outline alternative methodologies for conducting the cost-effectiveness analysis and make recommendations on their implementation. The focus of the report is on the identification of the most cost-effective combinations of measures as stipulated by Article 11 WFD, but it also provided some ideas on the issue of disproportionate costs in the derogations of Art.4.

The study recommends a tiered approach, moving from a semi-quantitative assessment of cost-effectiveness through a simplified CEA, up to a full-blown cost-benefit-analysis to assess the (dis-)proportionality of costs, if necessary.

[13] ‘ Sustainable Flood Defence: The Case for Washlands’, English Nature, 2001.

The study thus argues that the level of detail of the analysis should be adapted, depending on

- whether there is general agreement among relevant stakeholders on the necessity of the measures;
- whether alternative measures have differential impact on the dimensions of the good status; or
- whether there are significant costs and benefits to third parties not accounted for in the cost-effectiveness framework above.

In general, the study establishes a close link between the selection of measures and the decision on derogations, based on the (dis-)proportionality of costs. Hence, the assessment whether the programme of measures should be regarded as disproportionately costly is presented as an additional step of the CEA carried out for the selection of measures.

In order to assess whether the programme of measures is disproportionately expensive, the RPA study suggests a range of potential criteria, including:[14]

- a comparison of social costs to social benefits, whereby disproportionality would be linked to some pre-established threshold ratio;
- a comparison of costs across different proposed measures, sectors and / or other river basins;
- calculation of the incremental benefit-cost ratio of adding further measures;
- distribution of the costs among sectors in line with the polluter-pays-principle and to eliminate cross-subsidisation;
- consideration of the expenditure incurred by a particular sector in the past;
- significance of costs to a firm / sector and economic knock-on effects;
- analysis of the distribution of costs and benefits across all sectors.

Based on these possible criteria, the RPA study recommends a mixed approach, combining benefit-cost ratios (expressed as net present values) as well as economic viability tests, a crude test whether the polluter-pays-principle applies on a sectoral basis, and an assessment of distributional impacts.

The results of this study are currently being developed further in project 2 (development of cost-effectiveness methodology) and in the near future in project 3 (disproportionate cost assessment) of the CRP.

5.2.3 Available economic information and use of valuation studies in Scotland & Northern Ireland

Annex I shows that only three of the 40 UK studies reviewed are from Scotland (two) and Northern Ireland (one). A partial assessment of the likely benefits of the Water Framework Directive in Scotland has been undertaken by Hanley (2001), which is described in greater length below.

[14] Regarding the second, fifth and seventh bullet above, it should be noted that a comparison based on the sectoral distribution of costs is not unproblematic as a basis for decision making. In order to achieve an economically efficient outcome, the main criterion for assessing the disproportionality of costs should be the benefits that measures deliver. Indeed, this argumentation is also expressed in the HMWB guidance which states that the ability of the user (or use) to pay should not be used as an additional consideration when designating HMWB (see chapter 4.2.1 above).

While this points to a gap in the Scottish and Northern Irish literature, there is extensive evidence in the rest of the UK to support the application of benefits transfer.

Box 5: Use of economic methodologies and valuation within SEPA

When is economic expertise used?
The current use of economic expertise by the Scottish Environment Protection Agency (SEPA) is less than what might be hoped or expected. In issuing consents under COPA? some consideration is given to economic concerns but this is a subjective assessment. There is no hard practice.

What (economic) methodology is used by SEPA?
04-DLM-COPA-MAN3 Guiding Principles (Technical Guidance Manual for Licensing Discharges to Doc Ref: DLM/COPA/MAN3)[15] is used as the main methodology and it covers the issue of BATNEEC. The principle of BATNEEC was introduced by Part 1 of the Environment Protection Act 1990, EPA 90, as an objective in authorising a prescribed process. Its application seeks to prevent, minimise and render harmless potentially polluting substances released to any environmental medium as a result of a prescribed process. Optimum control and the balance of economic costs against environmental benefits are achieved by observing the following hierarchy. The document also refers to UWWTD which refers specifically to the application of BATNEEC in the design, construction and maintenance of collecting systems. This guidance document also suggests that "SEPA should strive to ensure that BATNEEC is applied for new discharges and where capital investment is planned for an existing discharge. However, it must be kept in mind that BATNEEC is not a statutory driver under COPA".

What specific types of information are used?
Given that most decisions are taken locally and the 'quality' of decision making varies from case to case, it is difficult to give an overall list of types of information. Where an Environmental Impact Assessment is required the wider benefits and the socio-economic factors are considered. For example, details of any social, economic and environmental benefits arising from the proposed scheme that the developer may wish SEPA to consider are addressed. The relevant data may include information on:

- people employed and business output;
- reduced CO_2 emissions;
- potential amenity or tourism benefits;
- number of people and/or number properties served (potable use) and
- any other relevant socio-economic benefits to be obtained from the proposed development.

Currently this level of information provided still results in a fairly subjective decision.

Are there any specific economic studies/valuation studies used as a basis?
Staff are encouraged to ensure that anything undertaken is in line with HMT Green Book.

[15] see http://www.sepa.org.uk/pdf/guidance/water/wqmgmt/guiding_principles.pdf.

Box 6: Benefits Transfer exercise for Scotland

The likely benefits of the Water Framework Directive in Scotland have been partially assessed by Hanley in form of a benefits transfer exercise. Issues such as a limited evidence base relating to people's preferences for environmental improvements (especially in a Scottish context), a lack of detailed knowledge about the spatial distribution of benefits and possible interactions/overlaps, and also lack of sufficient prediction of impacts which may be valued by Scottish people limit the scope of the assessment. Monetary estimates are identified for rivers, estuaries, and coasts. However, for lochs, wetlands, groundwater, reduced urban run-off, low flow alleviation, agri-environmental improvements and acid mine damage, no benefit valuations are identified in the Scottish context.

The benefit analysis of rivers includes (i) benefits arising to local residents as a result of the improvements in river quality which may affect the benefits received through amenity appreciation and formal and informal recreation, and (ii) benefits falling to anglers from improvements in fishery status/establishment of fisheries where there were not possible previously. The benefits analysis for coasts and estuaries include improvements taking place in the aesthetic quality of a small area of estuaries due to the Water Framework Directive. However, the benefit assessments do not include benefits arising in terms of non-use value.

To summarise the use of benefits transfer:

- For rivers the approach adopted was to value the improvements (on a rough per km basis) on the basis of results of benefits assessment work undertaken in the River Clyde. These distinguish between improvements in the attributes of river quality in terms of river ecology, aesthetics and bankside vegetation. Total benefits of between £120 and £262 million per annum were estimated to arise. The range of results reflects uncertainty regarding the benefits associated with bankside restoration. There is a greater degree of uncertainty regarding these benefits and the range reflects whether they are included or not.
- For angling, the analysis uses the results of an examination of rental values by the District Salmon Fisheries Board for the River Tay (adjusted to include social as well as private benefits). On the basis of improvements in 4456 km of river, benefits of £10 to £58 million per annum were estimated.
- For estuaries the benefits are based on study which looked at the benefits of sewage related aesthetic improvements in the Tay Estuary. Benefits of around £11,384 per km^2 are estimated to arise for the 11.67 km^2 estuary downgraded for related reasons - giving rise to a total benefit in the region of £133,000 per annum.
- For coastal areas the analysis is based on a study which examined the benefits of local beach improvements in Ayr and Irvine in South West Scotland. This estimates a benefit of between £11,000 and £70,000 per km of coastline. Using a central estimate of £40,000 per km for the 71 km likely to be improved for sewage related reasons gives an overall estimate of around £2.9 million per annum.

The study concludes that the "best guess" range clearly excludes many benefits which might be very important. Annual benefits which can be quantified and valued are likely to be no smaller than £131 million per annum, and may be as high as £325 million per annum. The best-guess central estimate is £228 million per annum. However, many of the expected benefits could not be converted into monetary values. Thus the actual total economic benefits will be larger than £325 million/yr.[16]

[16] Hanley 2001.

5.3 Lessons learned from the current use of economic valuation

The review of the situation in other European Countries shows that up until now, economic valuation is used only in few instances. Even if we look at countries that would be considered as leaders in this respect, only few examples of detailed economic valuation studies can be found. Although the use of economic valuation has been under discussion for quite some time, and although the methods used for it are sufficiently developed, the application of economic valuation for water-related decision making is still in its early stages. In particular, there are not many cases where original valuation studies are used as input to CBA.

In comparison to the rest of the UK and to Europe, considerable progress has been made in England and Wales in the field of economic valuation, including the valuation of water resources and their uses. In addition to the considerable number of original valuation studies identified above, benefits transfer is used extensively in England and Wales, especially in water resources management. The main reason for this is that some decision-making structures explicitly call for an approach based on valuation and benefits transfer. For example, the entire Asset Management Plan (AMP) and Periodic Review process require calculating the 'economic cost of environmental impacts' and adding this to financial costs of each water scheme. To do this, they rely on using benefits transfer.

However, despite the considerable evidence and experience available in England and Wales, it is still difficult to apply these to the context of the Water Framework Directive. In particular, the use of existing valuation studies for benefits transfer is limited by the fact that most studies are either too site specific or address a specific policy question which is not relevant to WFD application. However, the approach to WFD implementation that has been put forward in the RPA scoping studyis very ambitious towards the use of economic valuation. It remains to be seen if strong focus on economic valuation is needed or if it will be more feasible to use a simpler, more "ad-hoc" approach which requires less time and skills.

Summarising, it can be said that the current use of economic valuation studies to support policy decisions is still fairly limited. Several reasons for this reluctance towards economic valuation studies and towards CBA can be identified:

- One of the main reasons is presumably the lack of a decision-making structure and strong legal requirement that calls for economic valuation (original work or benefits transfer) and for CBA. Where such requirements exists (e.g. in the case of the Periodic Review process), economic valuation is accepted and applied.
- Another reason for the limited use of economic is that decision-makers resort to CBA only when an easy decision cannot be made – with the decision on disproportional costs as the most obvious example of a difficult decision. Until recently, many of the EU or national environmental policies used to prescribe a technical or emissions standard regardless of its cost (with the exception of BATNEEC). When this is the casem disproportionality is not discussed in detail, and neither are costs and benefits.
- To some degree, the limited use of valuation studies and of CBA may also be due to reservations or outright rejection of economic approaches by decision makers and stakeholders, with decision makers preferring well-known and more established methods for decision making.

As the Water Framework Directive gives some emphasis to economic concepts such as the disproportionality of costs, cost-effectiveness or the principle of cost recovery for water services, it is possible that legal requirements for the use of valuation studies in water-related decision making will be established.

However, this is not self-evident, as the use of economic concepts is not equivalent to the use of monetary valuation. In implementing the economic aspects of the Water Framework Directive, different countries may also chose to adopt a more straightforward approach, e.g. by basing decisions on the financial costs and limiting the use of valuation to generic, national-level assessments. In conclusion, it may be said that there is an increasing demand for evidence-based decision making. This may take the form of an increased use of valuation studies, and has done so on some occasions, but it may also take the form of non-monetary physical data or qualitative assessments.

6 THE USE OF VALUATION STUDIES FOR WFD IMPLEMENTATION IN SCOTLAND AND NORTHERN IRELAND – A PRACTICAL APPROACH

This chapter combines the economic appraisal requirements of the Water Framework Directive with the available methods described in chapter 3. In doing so, particular focus is placed on the monetary valuation of environmental effects. On this basis, a practical approach for the use of valuation methods in WFD implementation is proposed for Scotland and Northern Ireland.

Overall, the guiding principle for identifying the “right” approach is to strike a good balance between reliability of the results and complexity of the analysis, in order to ensure that the available financial and human resources for the implementation of the Water Framework Directive are put to an optimal use.

Therefore, it is important:

- To further classify the specificities of water management problems in Scotland and Northern Ireland, as these will influence the choice of possible approaches for the selection of measures and for justifying derogations;
- To understand more fully the complexity of decision situations in Scotland and Northern Ireland as well as the possibility to ensure a proportionate and practical use of valuation responding to different levels of complexity, in particular as compared to England and Wales. In this context, elements of a possible pressures-and-impacts-based typology of water bodies in Scotland and Northern Ireland are discussed and presented in this section with a view to possible shortcuts in the methodology for selecting measures and using valuation techniques;
- To discuss the current understanding of the selection of measures and the assessment of disproportionate costs in the context of derogations in the UK, based on the methodology proposed in the RPA scoping study..

The present chapter investigates these different issues and offers first practical suggestions on how the selection of measures and the assessment of derogation can be approached in Scotland and Northern Ireland, focussing on the use of economic appraisal methods and the corresponding need for valuation studies.

Note: The elements of dealing with derogations and especially disproportionate costs are intended to feed into the strategic thinking in Scotland and Northern Ireland as well as into the upcoming project 3 of the CRP dealing with "Scoping and characterising the potentially disproportionately costly cases in RBMPs and the main gaps in information on valuation of environmental benefits".

6.1 Specific conditions for the use of economics in WFD implementation in Scotland and Northern Ireland

In order to assess the potential use of economic assessment methods, and especially the role of valuation studies in the WFD implementation in Scotland and Northern Ireland, there are some key differences with the situation in England and Wales that need to be taken into account:

1. There are several ongoing processes in the field of water management that are specific to the Scottish situation, e.g. the current re-definition and establishment of licensing regimes for abstractions or the “Quality & Standards” process specifying investments in the water industry sector. Indeed, these processes imply that some economic analyses required for the WFD implementation might be needed at an earlier stage than specified in the Water Framework Directive. This further emphasises the need for rapid and robust economic approaches applied after an initial screening, and also the need for regular update and review of results. Also, these processes put a further strain on available resources for the implementation of water legislation. In order to harmonise and, where possible, integrate WFD implementation with these processes, approaches proposed for all of the UK must be critically reviewed and re-evaluated in order to check for inconsistencies of approaches, objectives and deadlines;
2. Basically all Member States are facing problems of limited human resources for undertaking the different analyses required by the Water Framework Directive. This is particularly relevant to the field of economics, an area that is only slowly gaining some “respectability” in water management and policy as already mentioned above. It has not yet been translated into (internal) resource allocation decisions. Very practically, having one economist at SEPA for dealing with all relevant economic issues and none in Northern Ireland will be a limiting factor, especially in comparison to the available resources for water-related economic assessments in the Environment Agency of England and Wales, which is better equipped in terms of manpower and research budget, and can draw on a substantially larger pool of experience and data.
3. Finally, the decision situations encountered in water management in Scotland and Northern Ireland are expected to be simpler than in most of England and Wales (see below). As the complexity of the analysis should be guided by the complexity of the problem at hand, simpler methods for decision support might be relevant to Scotland and Northern Ireland.

6.2 The complexity of decision situations in Scotland and Northern Ireland

6.2.1 A complexity comparison of water management issues in Scotland and Northern Ireland

It is generally agreed that the situation of river basins in Scotland and Northern Ireland is on the whole is simpler than it is in England and Wales. One main reason is that river basins are smaller on average. In addition, there are more cases in Scotland where only a small number of users are located at a specific water body at risk of failing the environmental objectives of the Water Framework Directive. A few of the larger, more intensively used or more densely populated catchments (e.g. River Spey, River Forth or River Tay) will nonetheless present complex decision situations. The current results of the "Pressures and Impacts"-Analysis will provide further quantitative evidence to support the notion that complexity is by and large lower.

As a rough indication to support the notion that the complexity in Scotland is limited and concentrated to some specific areas, it can be noted that 54 catchments (35%) out of 155 in Scotland receive 4233 pressures according to the Water Framework Directive.

This accounts for 86% of all pressures (4902) to water bodies at risk in Scotland. By contrast, almost two thirds of the catchments receive the remaining 14% of all pressures. Furthermore, ten out of the 54 catchments referred to above (6% of all catchments) receive more than a third (36%) of all the pressures to the water environment in Scotland. Even this basic comparison may serve as an indication that pressures on the water environment in Scotland and water status problems are concentrated in very specific areas.

In the case of England and Wales, by contrast, 6,889 water bodies have been identified, of which 6,293 (or 91%) are at risk or probably at risk of failing to meet good ecological status. The water bodies at risk or probably at risk receive a total of 20,540 pressures, with 55% of all water bodies receiving 80% of the pressures, and 14% of the water bodies receiving about a third of all pressures.

This rough comparison would support the notion that decision situations in Scotland and Northern Ireland are more clear-cut, since there are less pressures in total, and since the pressures are concentrated on fewer water bodies / catchments in Scotland and Northern Ireland, while they are more evenly distributed in England and Wales. This lower complexity holds both for the selection of measures and for the assessment of derogations, and it also implies less need for valuation studies. This is mainly because decisions are more likely to be accepted, reducing the need for complex assessments. Therefore, in comparison to the more elaborated procedures required in the rest of the UK, some shortcuts could and should be integrated in the process, whereby less complex assessment methods are applied, and consequently the need for economic information can be reduced. The idea of introducing shortcuts corresponds to a satisficing approach as described in chapter 3, whereby the analysis can be terminated once a solution that is "good enough" is selected instead of conducting an elaborated analysis in search of some optimal solution.

6.2.2 Methodology for classification of water bodies into complexity categories

To better understand the level of complexity in water management decisions and to describe the consequences this may have for decision making, a "virtual classification" of water bodies was elaborated. This classification groups water bodies into categories with comparable levels of complexity. For the water bodies that are in the same category, the same analytical process and use of economic methods and tools would then be applied for selecting measures to improve water status.

In practice, using "the same analytical process" would imply:

- The same type of economic analysis, ranging from a rough, qualitative assessment based on expert judgement, to assessment methods that require information in quantified (physical) or monetary form (see chapter 3);
- The same scale of analysis (from an individual water body to an entire river basin, from an individual economic sector to the whole of Scotland or Northern Ireland);
- The same information and information processing tools (e.g. proforma for costs, economic modelling, etc.) are used for the analysis – be it site-specific or common to all water bodies and situations in Scotland or Northern Ireland.

Possible criteria for the classification of water bodies were discussed during the kick off meeting for the current project. These include the number of water bodies within a catchment, the types of environmental problems encountered, the number and types of impacts leading to water bodies to be classified "at risk", the number of pressures causing water bodies to fail reaching good water status, etc.).

Clearly, the size of the catchments is used only as a proxy to reflect the level of interconnectedness between water bodies, i.e. to account for the possibility that pressures from one water body may influence water status in another water body.

A more refined classification should account for specific aspects of measures. For instance, where national or regional measures are considered, these could make local measures at the water body level or the level of an individual pressure obsolete, or lead to a re-dimensioning of local measures. Also, the identification of measures may involve more than one local officer or a combination of local officers and SEPA head-office economist, thus requiring some form of co-ordination and joint approach.

To assess the complexity of a decision situation, the criteria described above can be used in different orders. The order in which they are considered will affect the speed at which complexity is reduced and coherent groups are identified. This however will depend on the specific situation of Scotland and Northern Ireland as captured in the first results of the pressures and impacts analysis and risk assessment. A first suggestion on the order in which the different criteria can be used is presented below. However, this would need to be further tested and refined.

Since no information has been made available on the (preliminary) IMPRESS results from Northern Ireland, the approach described below is based only on information regarding the situation in Scotland. This approach towards a classification of water bodies needs to be practically evaluated, esp. regarding:

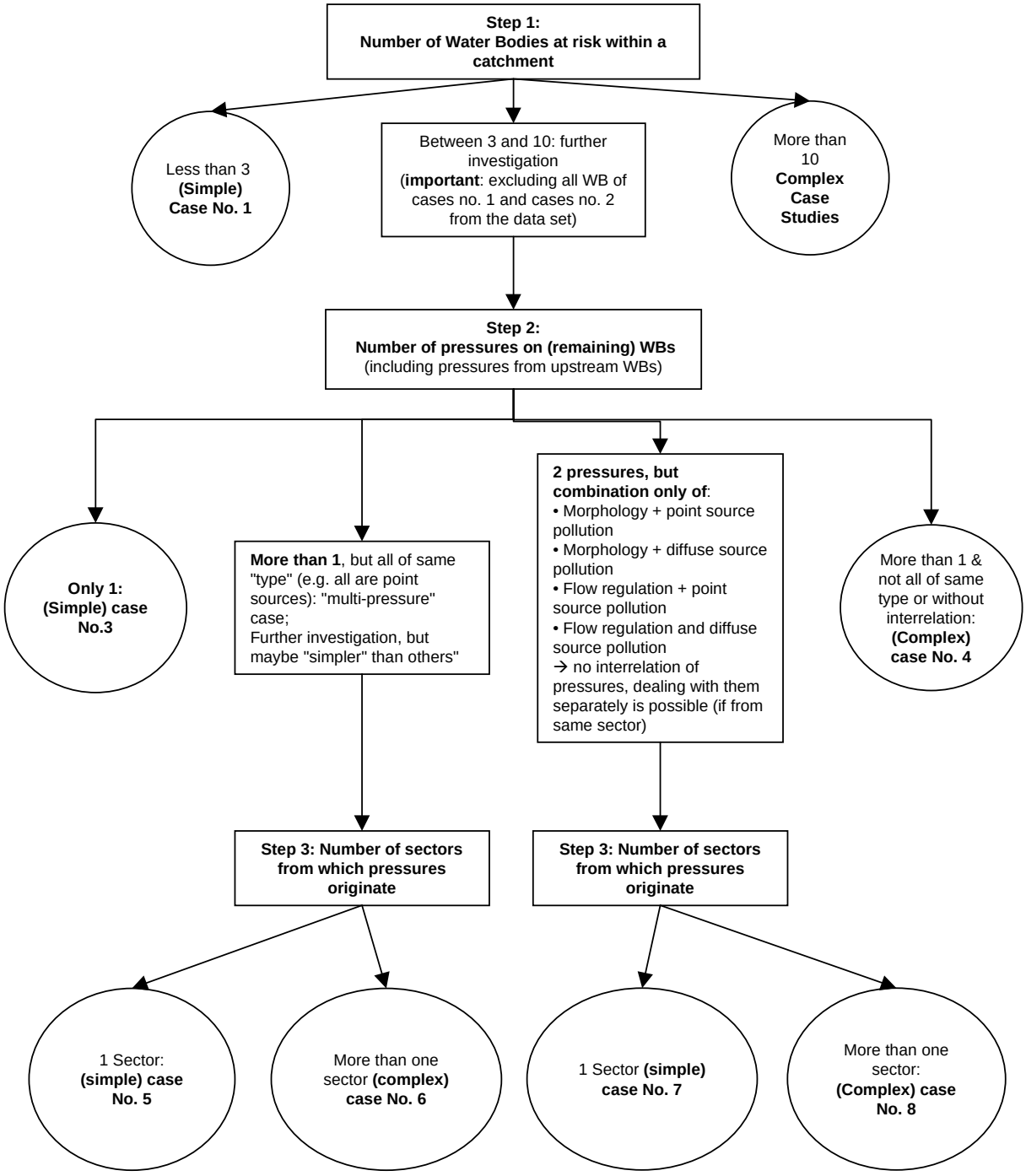
- the order in which the different classifications criteria are used and the usefulness of the chosen cut-off points;
- the exact "search" and classification potential of the SEPA-IMPRESS-database, cross-checking the practicalities of this approach;

A good timing for such a cross-check would be before the end of project 2 of the CRP in order to provide some (validated) input regarding the linkage of IMRESS analysis results, the selection of measures and the possibilities to simplify this selection by looking at groups of decision situations.

A general issue relates also to the population considered for assessing different levels of complexity. Indeed, many discussions have focused on water bodies at risk – assuming that other water bodies will not be considered. Uncertainty associated with the current assessment, however, might render the difference between water bodies at risk and not-at-risk less clear: indeed, eliminating water bodies with uncertainties today may have significant implications if those are considered at the same level for providing permits/licences for abstraction for example. Also, for larger river basins, the cost-effectiveness analysis might need to consider water bodies which are not at risk, but that could host measures that indeed are the most effective in reducing pollution in downstream water bodies for example. Thus, it is important that pressures affecting other water bodies are adequately considered and kept within the classification process.

One issue that is important to stress is that the **classification mainly focuses on cost-effectiveness analysis**. Indeed, it still needs to be assessed whether this classification will impact on the need to have simpler or more complex disproportionate costs/derogation assessments – depending on how cost-disproportionality will be defined (see more on this below).

Figure 3: Approach to classify the complexity of decision situations



The decision to integrate only WB would need to be checked, since there are interrelations between WB at risk and WB that might be of significance to the final outcomes.

6.2.3 The role of already planned measures changing water status

The classification above is based on the current water status and situation. Thus, it does not account for (basic) measures and projects that will be implemented between now and 2009 – and that may reduce or eliminate some of today's environmental problems.

Such measures include the Quality & Standards III projects (targeting Scottish Water and the protection of water resources for drinking water purpose) but also measures foreseen for the implementation of the Nitrates Directive, the IPPC Directive or any other environmental improvement measures with secured financial resources from various national, regional and EU sources.

How and at which scale such basic measures will be considered will need to be defined. Two alternatives can be envisaged:

- The implementation and likely impact of these basic measures is analysed first for Scotland as a whole with input from local SEPA staff – similar to what has been done for the pressures and impacts analysis and risk-assessment produced for the 2004 characterisation report;
- The assessment of the impact of these basic measures is left to local SEPA officers in charge of specific water bodies (at least for the simple cases where these local officers would deal with measures and simple economic analyses). These officers would then need to have a clear list of basic measures that will be implemented and that will affect their own water body.

There are several reasons to assume that the first alternative is likely to be more cost-effective, including the interconnection between water bodies, the possibility to build on the existing database of water bodies, and the value in combining local and more global expertise and knowledge. It implies that an additional analytical step is required for Scotland and for Northern Ireland as a whole prior to any further local analysis and decisions on consents or permits.

6.3 Suggestions for the use of economic valuation for the selection of measures in Scotland and Northern Ireland

In order to clarify the potential role of valuation studies for the selection of measures according to the Water Framework Directive, it is useful to look at what the current understanding for a roadmap on selecting measures is in the UK as a whole. To do this, the practicalities of the RPA-approach regarding the selection of measures and related needs for valuation studies is discussed. Based on this discussion, adaptations for elements of the approach are proposed to fit the actual needs for economic assessment in Scotland and Northern Ireland in the first cycle of WFD implementation.

While the RPA study offers some very useful thinking on what the approach for selecting measures could look like, it is only a scoping study: it does not address details and practicalities of the proposed approach, and it has no binding character. Of interest therefore is the current project 2 (a and b) of the CRP that will offer a more systematic and detailed approach to the selection of measures. As definite results are not yet available from these projects, the discussion focuses on the RPA-approach as a reference point.

6.3.1 Practical aspects of the RPA-approach

The RPA report recommends a combined approach for assessing potential combinations of measures, involving elements of both cost-effectiveness analysis (CEA) and cost-benefit-analysis (CBA). In doing this, a CEA serves to identify the most cost-effective combination of measures for a given water body, which then is assessed through a CBA to determine whether the total cost of measures has to be considered as disproportionate. The report does provide for a tiered approach (p. 10), meaning that the analysis does not necessarily result in a full-fledged cost-benefit analysis. It identifies three conditions under which the cost-effectiveness analysis itself would be regarded as sufficient:

- If there is wide agreement among stakeholders on the measures to be implemented;
- If the alternatives differ strongly in their output in terms of achieving good status;
- If either of the alternative measures would result in significant external costs and benefits, which are not accounted for in the immediate costs (e.g. impacts on recreational uses).

The RPA report lists these conditions where a more hands-off approach could be advisable (i.e. stopping at the stage of a CEA). At the same time, the recommended approach describes the CBA as a possible "next step of the analysis" and lists several reasons why the actual application of a CBA is essential (p. 13), the main reason being the assessment whether costs are disproportionate. In this way, the assessment of disproportionality is integrated much more into the process of selecting measures than is the case e.g. in the German handbook on the selection of measures (Interwies et al. 2004). This means that the process suggested by RPA needs to rely on the use of valuation studies to a greater degree.

Regarding the estimation of costs (both in the CEA and the CBA), the RPA report recommends including financial costs as well as economic costs (as suggested by the Green Book), but also to include environmental costs. For the latter category, the cost-effectiveness analysis of possible measures would only need to consider the cost of non-water environmental impacts, such as impacts on air pollution or on soils, which would be counted among the cost of measures (i.e. in cases where improving water quality has indirect effects on other environmental media). By contrast, a cost-benefit analysis would also require the valuation of water-related environmental impacts as part of quantifying the benefits of a measure. The RPA report recommends that the quantification and valuation of these costs will only be necessary where they are likely to change the relative cost-effectiveness of different measures; if this is not the case, a qualitative assessment will suffice. A similar approach is also suggested in the German handbook on the selection of measures (Interwies et al. 2004).

In some cases, side-effects need to be considered when assessing the cost-effectiveness of measures, referred to as "non water-related environmental and resource costs and benefits" in the RPA study. Such effects would arise e.g. if artificial wetlands constructed for nutrient removal also assume the function of a habitat for non-aquatic species (positive side effect), or if works to improve the morphology of a river impede water transport, leading to more road transport and associated impacts (negative side effects). Such effects can (but need not) be assessed through the use of valuation studies. Assessing the magnitude of side-effects in monetary terms would allow adding them to the cost of measures (for negative side effects) or subtracting them from the cost of measures (for positive side effects). Only the non-water-related environmental costs and benefits are assessed, as it is assumed that water-related effects are already included in the primary objective of the measure. As a consequence, only the existing valuation studies for environmental media other than water are relevant in this context (e.g. for benefits transfer), whereas information from water-related valuation studies cannot be integrated.

6.3.2 Elements for the selection of measures in Scotland and Northern Ireland

The most crucial difference between the developed RPA-approach and the realities in Scotland and Northern Ireland is that economic appraisal tools and especially monetisation of benefits through valuation studies are unlikely to be used in a systematic, river basin wide approach for the selection of measures for the 2009 programme of measures in Scotland and Northern Ireland.

This is mainly due to the limited time and resources available until the draft programme of measures has to be available in late 2007-early 2008, as well as missing experience with the integration of valuation studies into decision making.

Therefore, developing and implementing an approach that explicitly considers all up-downstream relationships of measures (from the technical as well as from the socio-economic perspective), integrates the different scales of effect of measures etc. will not be feasible for the first WFD cycle.

At the same time, direct financial costs of potential measures will need to be estimated and combined with expert judgements on the effects that measures will have on the environmental status of a water body. To this end, some basic information will be required in order to develop a draft programme of measures. Thus, at least this first selection of measures will mainly be based on expert judgements for the "cheapest way" of reaching the WFD objectives. These judgements will be discussed, further refined and finally validated by the procedures established for implementing the WFD requirements for public participation.

It needs to be stressed here once again that such decisions will not only require economic expertise, but also expert opinions from other disciplines and information sources. In fact, one of the most critical and difficult parts of the exercise, the assessment of the effectiveness of measures, is not an economic task. Also, assessment and planning methods that require less economic input (such as MCA as compared to CBA, see chapter 3) tend to require more data in terms of physical terms instead. Additionally and crucially, any approach chosen needs to be presented in a way that the policy makers having to stand up for these decisions understand and support them.

Of course, the approach that will be elaborated in project 2 of the CRP will be the reference point for the selection of measures also for Scotland and Northern Ireland. Nevertheless, some elements to be considered are listed below.

1. As mentioned above, **specific measures that are required in order to comply with other directives** have to be considered first in the planning process: This concerns the Nitrate Directive, the Integrated Pollution Prevention and Control Directive (IPPC) Directive, the Urban Waste Water Directive, the Landfill Directive, the Dangerous Substances Directive, and the Groundwater Directive. A practicable approach is necessary to assess which changes these mandatory measures will have on the status of waters in order to get realistic estimates on the real quality gap to be closed by the programme of measures under the Water Framework Directive. This assessment (or gap analysis) may also involve some type of scenario development.
2. The **potential use of national policy instruments / general measures** needs to be addressed at some stage. Certain measures that are decided upon at a higher administrative level can potentially play an important role in reducing the costs for WFD implementation. Such national measures or instruments would typically reduce pressures from an economic sector throughout all basins.[17]
   This includes in particular economic instruments (such as a fertiliser tax to reduce diffuse emissions from agriculture) or certain types of regulatory instruments (such as

[17] By national, we mean here "relevant to Scotland" or to Northern Ireland, although some measures / instruments may be considered for the entire United Kingdom. The results of the risk analysis developed for the river basin district characterisation reports, combined with the current policy agenda, should lead to a quick identification of the few national measures that are likely to be considered and that will require a separate analysis. It is expected that national measures may need to be supported by a cost-benefit (regulatory) impact assessment that would be lead by SEPA head-office economists.

a ban on phosphate in detergents). While their assessment can resemble that of more local measures, it will be crucial to develop a methodology for comparison of such options at different scale, without missing significant elements that are specific to instruments/general measures. This approach should also ensure that, if they are included in the programme of measures, they are justified in a way that makes them politically acceptable.

3. Which ever way the **process of selecting cost–effective sets of measures** is structured, it will be important – in order to reduce the information/expertise needed to the extent that is "fit-for-purpose" – to check if a complexity classification of WB (as described in chapter 6.2 above) might lead to the use of simpler assessments in a specific case. Based on this, the approach should start with the simplest possible methodology that delivers sufficiently robust results. Due to the lower complexity of water management decisions in Scotland and Northern Ireland, decisions for some groups of water bodies might be developed without even moving to a CEA in a strict sense, but using simpler approaches (i.e. based on expert judgement or using a scorecard approach, see also chapter 3).
4. Summarising this rough assessment, CEA will probably be the methodology used in most cases, albeit in a simplified form centred on financial costs. At the same time, some cases will have to move to an **extended CEA including wider economic impacts and side effects of a measure or a combination of measures**, in cases where side effects are significant and might lead to a different outcome of the analysis. In this way, situations can be avoided wherein the most cost-effective combination of measures (in terms of financial costs only) is found to be disproportionaly expensive in the derogation testing, while the second-best combination in terms of financial costs would not be seen as dispropotionately costly if all side-effects are considered . While such a consideration of the benefit-side is therefore useful, it should be treated restrictively (in terms of level of detail and number of cases considered), since it adds to complexity and information needed.

Finally, it has to be noted that the decisions on derogations (see chapter below) will directly impact the selection of measures. Therefore, based on the assessment of derogations, the draft programme of measures will have to be re-assessed.

Table 8 gives an overview of the main elements of the process of selecting measures, indicating the potential use of economic methodologies.

Table 8: Main steps for the selection of measures and the use of economics

Step	Description of the step	Scale at which task performed	Who	Main economic method	Need for valuation of environmental costs and benefits	Comment
Updating the risk-assessment with measures already in the policy pipeline	Based on the assessment of the risk of failing to reach the environmental objectives of the WFD, estimate the impact the implementation of Q&S, Nitrates, IPPC, other existing plans and programmes might have on the status of water bodies or group of water bodies ⇨ Revised risk-assessment accounting for measures and policies in the pipeline	National	Lead by SEPA/DoENI head-office technical experts with input from and economic experts	Not relevant	Not relevant	Integration between technical and economic expertise required See possibility to account for major changes in economic sectors that might affect pressures and risk First review of risk might identify the need for targeted/selected valuation studies that might strengthen systematically the different global analyses proposed below.
Identify potential national measures	Based on the results of previous step, identify pressures and environmental issues that exist in a large number of water bodies and areas of Scotland and that might justify a measure taken at the national scale ⇨ Identification of potential national measures	National or UK depending on issues	Lead by Scottish Executive and SEPA/DoENI, consultation of stakeholders through e.g. the Economics Advisory group	Not relevant	Not relevant	Possible national measures: • Reduction/ban of phosphate in detergents • Tax on fertilisers • Voluntary agreements for reducing pesticide use • … It is expected that the limited number of national measures identified will not be directly comparable as targeting different pressures/economic sectors.
Define the national measure(s) and assess their costs and impacts	For each national measure, to identify the institutional setup under which measure will be implemented, to design the measure, to assess all expected impacts in qualitative terms, to quantify whenever possible, to combine results and discuss with relevant groups, stakeholders and organisations ⇨ selection and practical definition of national measures	National or UK depending on proposed measures	Lead by SEPA/DoENI, specific role of SEPA/DoENI economist in guiding economic assessment Need technical input for assessing potential impact on water	Cost-benefit analysis in line with requirements of the Green Book – or Multi-criteria analysis (including results of partial cost-benefit analysis) if key impacts can not be quantified	Yes, valuation required for relevant: and significant • Non-water related environmental costs and benefits • Water-related environmental costs and benefits	Wider/indirect economic effects to be considered Cost-benefit analysis as proposed framework (and not cost-effectiveness) because the expected impact from national measures unknown and needs to be defined. Furthermore, no real comparison of measures (see comment above)
Assess the expected impact of national measures on risk for water bodies	Based on revised assessment of the risk of failing reaching the environmental objectives of the WFD, estimate the impact of implementing national measures on risk – possible feedback to previous step if these analyses shows that the overall expected impact of national measures is significantly higher/lower than estimated in previous step	National	Lead by SEPA/DoENI head-office technical experts with input from and economic experts	Not relevant	Not relevant	Similar work as in first step above

Table 8: continued

Step	Description of the step	Scale at which task performed	Who	Main economic method	Need for valuation of environmental costs and benefits	Comment
Selection of cost-effective set of measures	Based on previous results, and the different pressures/environmental issues identified in various water bodies/group of water bodies, possible measures are identified. The costs of these measures are then compared to the expected impact/effect for identifying the most cost-effective set of measures for reaching good water status. ⇨ cost-effective programme of measures for individual water bodies or group of water bodies	Local – water body or group of water bodies	Local SEPA/DoENI officer	Cost-effectiveness analysis; in simpler cases: expert judgement	Not relevant	Use of generic -financial cost information combined with local impact/effectiveness information In larger catchments with different water bodies interconnected, need for modelling and more detailed studies for assessing effectiveness – also possible need for collaboration between several SEPA local officers. Economic analysis one part of wider discussion on selection of measures.
Accounting for wider impacts in the selection of measures	Combining all the preliminary results of cost-effectiveness analysis obtained at the local level. Identify possible wider/indirect economic impact and non-water related environmental benefits and costs Describe these impacts/costs/benefits qualitatively. **If these impacts/costs/benefits are considered significant and might modify cost-effective set of measures, then quantify.** Based on results, propose adaptation of cost-effective programme of measure, discuss with relevant parties and feed to local level for adaptation/revision ⇨ revised cost-effective programme of measures at district/national scale accounting for wider economic impacts and non-water related environmental impacts ⇨ Revised cost-effectiveness at local scale	River basin district and/or national, local level at last stage	SEPA/DoENI head office, need close interaction with Scottish Executive and key stakeholders	Specific methods for assessing indirect wider economic impacts – integrated into wider cost-effectiveness analysis framework	In case quantification of impacts/ costs/benefits significant, then yes, valuation required for non-water related environmental costs and benefits	Review existing valuation studies at early stage in line with results of risk-assessment and identification of potential measures National measures proposed not accounted for in this assessment – direct use of results of previous step that has dealt with their assessment

6.4 Suggestions for dealing with derogations and disproportionate costs in Scotland and Northern Ireland

In order to assess what role valuation has for the issue of derogations, it is necessary to have a picture on how this process will be dealt with in practice. While the RPA-study offers some useful elements to such an approach, the derogation issue is one of the big remaining challenges in the practical implementation of the Water Framework Directive. So, based on the elements provided by the RPA-approach, some inputs are given below.

At the same time, it is already clear that the previous steps of WFD implementation, e.g. mainly the preparation of the selection of measures, will have a direct impact on what will be done for derogation. Depending on how detailed the analysis in preparation of the selection of measures is going to be, the incremental requirements for data collection and analysis will change for the derogation assessments.

6.4.1 Practical aspects of the RPA-approach

The RPA approach focuses on the selection of measures rather than the assessment of derogations. However, as described above (Chapter 5.2) the approach establishes a close link between the selection of measures and the assessment of disproportionality, which effectively amounts to a derogation test.

The report lists a number of criteria that could be used to assess the disproportionality of costs (p. 15):

- comparison of social costs to social benefits, whereby disproportionality would be linked to some pre-established threshold ratio;
- comparison of costs across proposed measures, sectors and / or other river basins;
- incremental benefit-cost ratio of including additional measures within a package of measures (i.e. increasingly stringent environmental targets);
- distribution of the costs among sectors in line with the polluter-pays-principle and to eliminate cross-subsidisation;
- past expenditure incurred by a particular sector for water quality improvement measures;
- significance of costs to a firm / sector and second-order economic effects;
- distribution of costs and benefits across all sectors.

Based on a discussion of these alternative criteria, the study recommends following a mixed approach, combining four criteria:

- benefit-cost ratios (expressed as net present values),
- economic viability tests (i.e. screening for hardships for particular firms / sectors),
- a crude test determining whether the sectoral distribution of costs is roughly in line with the polluter-pays-principle,
- and an assessment of distributional impacts of the proposed measures, indicating the incidence of costs and benefits and how these are passed on to different actors.

In this combined approach, the first three criteria mark the economic case for the decision whether a derogation could apply; the fourth criterion provides a supporting argument for the political debate. Hence, while the RPA approach recognises that the decision on derogations is ultimately a political task, it also foresees a central role of the CBA as the basis for this decision.

6.4.2 Adapting the approach to the situation in Scotland and Northern Ireland

The purpose of this section is not to present a definite criterion to decide whether costs are disproportionate or not – since this is inherently a political question rather than an economic one, and therefore needs to be decided politically. However, this section proposes a procedure for assessing disproportionate costs in a staged manner, indicating what methodology can be used, and how economic valuation could potentially be used in each step of this process.

In the implementation of the Water Framework Directive, two main types of situations can be expected where the assessment of disproportionate costs will play an important role:

- Assessment of the economic viability of a proposed set of measures and agreement on measures for an individual water use or a firm;
- Assessment of the economic viability of a proposed set of measures and agreement on measures for an entire sector;

In addition, and based on the analysis on the firm and sectoral level, a national-level comparison of social costs and benefits can be achieved through a CBA.

Therefore, a process needs to be set up that leads to reliable decisions both at the water body scale and at the level of individual water uses, as well as at the national or river basin scale, aggregating cases in which derogations might be applied in order to allow for a sectoral assessment of derogation.

Even if such a higher level look at derogations is not directly required by the Water Framework Directive, it seems useful to assess the sectoral implications of the proposed set of measures in order to decide on the need for derogations that will apply at the water body level.

The main elements of such an approach are described in Table 9 below.

Table 9: Main steps for the assessment of derogations and the use of economics

Step	Description of the step	Scale at which task performed	Who	Main economic method	Need for valuation of environmental costs and benefits	Comment
Assessing economic viability for individual enterprises	Assessing the economic viability of proposed measures for individual enterprises (check application of BAT/IPPC, assess costs of implementation of measures => burden for the enterprise, etc) . If burden considered as too high, check if next most cost-effective might deliver good water status with no specific burden on given other enterprise ⇨ Specific enterprise for which less efforts is proposed ⇨ Revised cost-effective programme if alternative measures can be considered as replacement ⇨ Request for derogation and less stringent objectives if not possible to reach objectives otherwise	Local level	Local SEPA/DoENI officer	Use of specific proforma for informing on different aspects considered and outcome of the assessment based on expert judgement/MCA	Not relevant	
Assessing sectoral implications of measures	Based on the aggregation of "request for derogation" at local level, identification of economic sectors that might receive specific treatment. Assessing at national level the implications for the sector in terms of turnover, employment + indirect wider economic effects, discuss results with relevant sectors and organisation ⇨ Identification of "compromised sector efforts" with regards to reducing pressures on water ⇨ Feeding to local level for adapting proposed measures – and assessing the need for derogation and less stringent objectives for specific water bodies if alternative measures not identified locally	National level to local	SEPA/DoENI head office economists for assessment and input into discussions with specific sector representative and Scottish Executive officials	Macro-economic analysis of impacts of specific measures, qualitative assessment (mainly MCA)	Limited to cases where it is obvious that alternative products might be developed and have significant environmental impacts elsewhere	Not a obligatory step – might move directly from previous step to next step, considered for facilitating the process and obtaining "compromises" with specific economic sectors that would reduce the need for (i) more complex cost-benefit analysis and (ii) litigation with Minister Wider economic effects considered, looking also at trade issues.

Table 9: continued

Step	Description of the step	Scale at which task performed	Who	Main economic method	Need for valuation of environmental costs and benefits	Comment
Cost-benefit analysis of proposed programme of measures	Based on the results of the previous step, aggregation at district/national level identifying areas where possible derogation might be relevant. Also, include outcome of more open process with stakeholders on disproportionate cost issues. Perform cost-benefit analysis for the revised programme of measures. Present results of the analysis to relevant organisations and stakeholders. Propose modifications in programme of measures and areas where less stringent objectives are economically justified ⇨ Revised programme of measures and related cost-benefit assessment ⇨ Proposed derogations for water bodies revised and finalised ⇨ Feeding to local level for adapting proposed measures	National	SEPA/DoENI head office undertaking assessment and input to Scottish Executive discussions and political negotiations, final decision by Minister	Cost-benefit analysis in line with requirements of the Green Book – or MCA including results of partial cost-benefit analysis if key impacts can not be quantified	Yes, valuation required for relevant: • Non-water related environmental costs and benefits • Water-related environmental costs and benefits	Wider/indirect economic effects to be considered. Economic analysis only small part in wider discussion on derogation, disproportionate cost issues and programme of measures, budgetary and financing issues receiving significant attention
Cost-benefit analysis of measures for individual water body	If outcome of previous steps leads to lack of agreement with individual enterprises. Then full cost-benefit analysis at the local scale for identifying level of efforts economically justified ⇨ Development of a SEPA position with regards to economic justification of derogation for individual enterprise	Local	SEPA/DoENI local officers and head-office undertaking assessment, feeding to Scottish Executive and Minister for final decision	Full fledged cost-benefit analysis including all direct and indirect impacts, if key aspects not quantifiable mutli-criteria analysis including results of partial cost-benefit analysis as criteria combined with other environmental, social and economic criteria.	Yes, valuation required for • Water-related environmental costs and benefits • Non-water related environmental costs and benefits (might be less of an issue here)	Very few cases expected, limited to issues and enterprises with clear national relevance
Reporting on the results of the economic analysis as support to defining the programme of measures	Combination of above mentioned studies and analyses for supporting from an economic point of view the decisions taken vis-à-vis the programme of measures ⇨ Specific sections of the river basin management plan	National	SEPA/DoENI head office	Not relevant	Not relevant	Not relevant

7 THE GAP BETWEEN INFORMATION NEEDED AND INFORMATION AVAILABLE

7.1 Summary: information needs to support WFD-related decision making through valuation studies

The assessment given in this document is as preliminary one, in order to support strategic thinking but not (yet) able to specify exactly what information will be needed. The main reason that prevents a better assessment of information needs is that the overall approach to the selection of measures and the treatment of derogations has yet to be determined.

7.2 Future information needs

Overall, the availability of valuation studies in Scotland and Northern Ireland is fairly limited, as is their use to support political decision making. To a large extent, this corresponds to the situation that can be found in many other EU countries. At the same time, the use of valuation studies in decision making is relatively common in England and Wales, which is why a specific investigation on the possible use of valuation studies was considered necessary for Scotland and Northern Ireland.

However, there are a number of approaches, methods, and tools exist that can help decision makers to gather, structure and interpret information in order to arrive at well-founded decisions. Some of these methods belong to economics in a wider sense, but do not (necessarily) require the monetary valuation of inputs or outcomes, including different types of CBA and CEA, Multi-Criteria analysis as well as more straightforward approaches like expert judgement or the use of scorecards.

In order to deal with the limited number of existing valuation studies upon which WFD-related decision making could be based, and to take account of the diversity of approaches that can be applied, the methodology for the selection of measures and the assessment of derogations needs to be based on a staged approach, for which some elements have been presented above.

In such a staged approach, the value-added of valuation studies for decision making will be limited in many decision situations. At the same time, there are situations in which original valuation studies may be necessary in order to shed more light on specific issues, be they especially complex decisions or decisions that are considered especially important and therefore require an in-depth analysis (e.g. in the case of national measures).

In order to describe the anticipated need for valuation studies in Scotland and Northern Ireland, it may be useful to consider the different phases of the WFD implementation.

- For the first phase of establishing and implementing the programmes of measures (by 2009), the main focus will be on derogation. Here, valuation studies would probably be of relevance for sectoral negotiations as well as for a smaller number of complex cases with many stakeholders and / or high economic stakes involved, or in cases where significant external effects are present, so that the envisaged "best" solution is disproportionately expensive, whereas the second-most cost-effective solution is not. For the selection of measures, valuation studies at this stage will primarily play a role for national measures (or policy instruments) that will be subject to a national-level (or Scotland- / Northern-Ireland-wide) CBA. For the selection of measures at the local level, there will generally be little need for valuation studies.

- For the second implementation cycle of the WFD, i.e. until 2015, the challenge would be to identify the more complex cases based on a refined classification of decision situations, and to carry out an elaborate assessment for these cases making use of original valuation studies or benefits transfer.

7.3 Additional information and effects on decision making

Going beyond valuation studies, the need for information and expertise in order to implement the discussed aspects of the Water Framework Directive are considerable:

- In many cases, approaches can be used that are lighter in terms of skill and data requirements than e.g. full-scale CBA. However, also for these lighter approaches, economic information as well as expertise and resources will be needed;
- Alternative approaches have the advantage of being closer to what policy makers and stakeholders know, are used to and accept. However, especially those methods that rely strongly on expert judgement are also more vulnerable to just repeating the preconceived judgements of the person carrying out the assessment.

8 CONCLUSIONS AND RECOMMENDATIONS

This project has described the use of different assessment and appraisal methods to support decision making for the implementation of the Water Framework Directive, with a particular focus on economic valuation methods.

8.1 Selection of a Proportionate Assessment Method

A number of assessment methods are available, and within the different methods, it is possible to distinguish different subtypes. This project has focused on six main types of methods: expert judgement, scorecards, satisficing techniques, cost-effectiveness analysis, cost-benefit analysis and multi-criteria analysis. Of these, only some types of cost-benefit analysis and cost-effectiveness analysis actually require the use of valuation studies. These methods differ in the type of input they require – data, manpower, skills – and in the type of output they provide – structured information, a ranking of options, or an quantified indicator to measure the performance of an option. Confronted with limited resources and limited manpower, one main challenge in WFD implementation is therefore to assess which methods can be most usefully applied in which decision situations.

This project has shown that shortcuts and simplifications are possible at various instances in the decision making for WFD implementation. Shortcuts concern either the type of assessment method that is applied – where a decision based on expert judgement or a scorecard can suffice for clear-cut cases, leaving more elaborate assessment methods such as CBA or MCA only for the few most complex cases. Alternatively, shortcuts may also concern the level of detail and the scope at which an assessment method is applied.

Assessment methods are essentially methods to gather, interpret and present information. The complexity of an assessment method mirrors the complexity of the information that it requires. Therefore, applying shortcuts and simplifications means that decisions will be based on less information. This increases the risk of taking the wrong decisions if important factors are overlooked. It is therefore necessary to identify those decision situations in the WFD implementation process where shortcuts are applicable at a low risk of misjudgements.

There are different steps in the implementation of the Water Framework Directive where economic assessments and valuation studies may play a role, primarily the selection of measures (according to Article 11 WFD) and the issue of derogations (according to Article 4 WFD). These steps should be regarded as sequential, since the (dis-)proportionality of costs can only be assessed after the selection of measures has been decided.

The selection of measures is guided by cost-effectiveness considerations and thus includes some form of a cost-effectiveness analysis. This will generally not require the use of valuation studies, except for two cases:

- First, for cases where environmental side-effects (non-water related environmental costs and benefits) are expected to play a significant role. Where this is the case, they should be valued in monetary terms, possibly making use of benefits transfer. This assessment should be carried out at an aggregated level (river basin district or for the whole of Scotland / Northern Ireland);
- Second, for national or Scotland / Northern-Ireland-wide policy instruments, for which a monetary comparison of costs and benefits (both water-related and non-water-related) is required in line with the Green Book. Again, this assessment should be carried out at the national level of for the whole of Scotland / Northern Ireland).

For the decision on derogations, the assessment whether the costs of proposed measures are disproportionate needs to follow a staged approach, involving different assessment methods in a sequential order.

- The initial assessment whether costs are disproportionate at the firm level can be carried out using a proforma, relying mainly on expert judgement;
- In addition, a sectoral analysis may be carried out for the whole of Scotland / Northern Ireland (if necessary), which would assess the wider economic impacts of a proposed set of measures through an economic CBA or a Multi-Criteria Analysis;
- The next step would then be to conduct a CBA of the proposed programme of measures for the whole of Scotland / Northern Ireland, which would set out by aggregating the results of the previous step(s) across firms and across sectors;
- Finally, if all of the above fail to create an agreement among main stakeholders and affected sectors about the appropriate course of action, a full CBA of the proposed set of measures is required at the local scale.

For local or regional decisions, the complexity of water-related decisions is lower in most of Scotland and Northern Ireland than it is elsewhere in the UK and the rest of Europe. In particular, there is a large share of clear-cut cases, where water bodies receive only one or two pressures, where the cause of the pressure can be clearly identified, and where there is agreement among stakeholders about the appropriate course of action. In such cases, an elaborated economic analysis is misplaced: decisions on the most appropriate measures as well as on the (dis-)proportionality of costs can be based on the judgement of the local official in charge of identifying possible measures at the water body scale.
But there is also a smaller number of cases where confounding factors complicate decision making, especially in cases where there are

- Several pressures affecting the water body, which may be interdependent or which may stem from upstream areas;
- High stakes involved in or affected by water-related decision making, e.g. if a measure would seriously affect the competitiveness of a firm or a sector;
- A lack of agreement about the necessary measures to be taken;
- Vocal opposition from the parties likely to be affected by possible measures, etc.

For such complex decision situations, where different objectives need to be traded off against one another, economic assessment tools based on monetary valuation can provide useful insights. Monetary valuation has the advantage of combining multiple impacts into the same dimension, thereby making trade-offs more transparent, allowing a comparison of different types of effects, and translating the impacts into a common language understandable to stakeholders and decision makers – i.e., money.

However, expressing costs and effects in monetary terms is only one way of presenting the information, and will only be one (albeit central) factor in the decision making process. Assessments based on monetary valuation should not be misread as prescribing one optimal course of action. Ultimately, decisions need to be motivated politically – economic assessment methods in general, and economic valuation in particular, is a particular form of presenting information in order to support decision making. They should not substitute the political decision making process, but support it and place it on a sound scientific base. They achieve this by supporting a structured and transparent approach: where decision makers do not follow the course of action that is suggested by the assessment, they need to motivate their decision and to explain why a different course of action should be more suitable.

In many cases, the most complex part of the analysis will be to disentangle the differential pressures and impacts, and to assess the effectiveness of measures – an issue that needs to be addressed in all assessment method, and which needs to be quantified for all of the more complex assessment methods (CEA, CBA, MCA). In this regard, the marginal additional information required for moving from a basic assessment approach (expert judgement, scorecard) to one of the more sophisticated assessment methods (CEA, CBA, MCA) would be much higher than for moving from a CEA to a CBA or an MCA.

8.2 The Role of Economic Valuation in Decision Making

Whether or not a CBA is much more data-intensive and costly to conduct than a CEA depends above all on how the value of non-marketed benefits is assessed. If this is done through one or more original valuation studies, then these costs can be substantially higher than for a CEA. However, if benefits are assessed through benefits transfer, a CBA need not be much more expensive than CEA. Some qualifications apply:

- The time and money required to conduct an original valuation study may differ widely, depending on the robustness of the results required and the level of detail applied. It is possible to conduct a valuation studies for a few thousand Pounds in a matter of weeks, but such a study will be susceptible to criticism.
- At the same time, the use of benefits transfer is also not without problems in the context of Scotland and Northern Ireland, the main reason being that it introduces additional uncertainty. Since very few original valuation studies have been conducted locally in Scotland and Northern Ireland, transfer values would need to be taken from valuation studies conducted in England or overseas.

Faced with a limited budget and limited administrative capacities, the suggested way forward for the economic aspects of WFD implementation is to limit the use of valuation studies (and assessment methods that require the use of valuation studies) to those cases where they can be most usefully applied. This would mean that generally, valuation should not be used for individual decisions at the local level. Instead, valuation studies can be applied more usefully to generate generic data at the national level / at the level of Scotland and Northern Ireland.

This can be done e.g. in order to assess the costs and benefits of national measures, but also to address "frequently asked questions", if comparable problems are encountered in many local-level decisions. Generic data can also be usefully applied for valuing non-water-related costs and benefits of proposed measures, by identifying conditions under which such side-effects are likely to exist, and by presenting upper and lower-bound values for their (initial) assessment.

At the local level, original valuation studies are expected to play a role in a small number of cases only. Both for the selection of measures and for the assessment of derogations, the use of original valuation studies (and assessment methods making use of such studies) would appear necessary only in a small number of complex decision situations, i.e. for water bodies receiving multiple pressures or for water uses with a significant impact on the regional economy, but also for cases where there is no agreement about an appropriate course of action, or where there is a need for a "referee" to carry forward decision making.

To identify such complex cases and thereby to better focus the analysis, a grouping of decision situations into complexity categories and into clusters of comparable situations will be helpful, as this will give a better overview of the required information. In chapter 6.2, a first attempt for such a classification has been presented, which will however need to be refined in subsequent discussions with SEPA / DoENI administrative staff.

8.3 The next Steps: Suggestions for Follow-up Research, Testing and Guidance

In order to fine tune the proposed approach and to prepare the implementation of the economic analysis, the following preparatory activities are proposed:

- To identify the selected national measures / policy instruments that will be considered in the further WFD implementation process. Identification of the most relevant measures may involve specific consultation with all relevant stakeholder groups.
- Prepare a set of benchmark figures for costs and effects of the most common measures. Such a catalogue of benchmark figures would be used by local SEPA officers in their first analysis of costs and effectiveness, especially for the simple cases like water bodies affected by one pressure only.
- Determine and describe the expected impact of other ongoing activities and policies that will affect WFD implementation and the selection of measures, such as the choice of best available technologies (under the IPPC Directive) or the definition of good practices (in the common agricultural policy). This also includes other relevant European Directives and policies (Nitrates, Urban Wastewater, Groundwater) as well as national programmes and initiatives (e.g. Quality and Standards III project). The description of the expected impacts may also involve discussions or negotiations with key sectors affected by these measures.
- Training and capacity building of local SEPA staff in order to give a basic knowledge of cost-effectiveness and cost-benefit analyses and other assessment methods, their relative strengths and weaknesses and their possible usage. This also concerns the judgement on the complexity of the decision situation and the choice of an appropriate assessment method, as well as their possible integration with their existing routines.
- Development of tools (including models) to investigate and select cost-effective sets of measures in the larger catchments, especially regarding the integration between different types of analyses undertaken at different levels of decision making. This includes also a presentation of the overall process in order to ensure a good understanding by decision makers at all levels.

- In the field of economics, there is further research need in order to assess the validity of a benefits transfer between England and the rest of the UK, especially in view of differences in water uses, as well as the different types and intensity of pressures affecting water bodies in the different parts of the UK.
- Conduct a series of interviews with decision makers on (i) how decisions are taken, (ii) which role they see for valuation studies / monetary estimates of environmental costs, (iii) based on this, sketch the possible way forward for economics in WFD implementation in order to ensure that suggestions actually meet the demands of decision makers and are taken up by them.
- Carry out a sensitivity analysis to assess the validity of the proposed (and possibly refined) approach to categorisation (see chapter 6.2), and to review the impact that the choice of different assessment methods has on the outcome of the analysis. As yet, there is no comparative study that has applied different assessment methods to the same water management decision. It would be most helpful to have such a comparative study for a limited number of critical cases that are most relevant to the WFD implementation in Scotland and Northern Ireland.

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APPENDICES

Appendix I Freshwater valuation studies in the UK

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Fresh Water – Economic Valuation Studies from Scotland and Northern Ireland							
Davis J. and O'Neill C, 1992	Rivers	Use value	Benefit of maintaining access to angling licenses and permits for recreational angling in Northern Ireland.	• CVM – dichotomous choice; • Mail survey of 700 anglers (response rate of 22%); • Payment vehicle: angling permit.	per angler per year (sum in brackets is actual market price of permit): • Anglers with Prior Experience: £36.04 (28.5); • Anglers with No Prior Experience: £26.06 (28.5); • Anglers with Prior Exp. Purchasing Licenses: £20.5 (12.75).	**Northern Ireland**	The survey makes no attempt to include factors such as income, club membership, education, etc., since the distribution of such factors was assumed to approximate the true population. Hence, not ideal for transfer.
O'Neill, C.E. and J. Davis, 1988	Lakes Reservoirs	Use value	The effects of three alternative definitions of demand on estimated parameters are explored in a TC-study of aggregate demand for recreational angling.	Travel Cost: 600 face-to-face interviews were conducted at 15 randomly chosen angling sites.	Estimated user benefits (£, millions): 10.7; 32.88; 13.48 (difference arise from different model specifications).	**Northern Ireland**	Transferable.
Bateman, I.J., Cooper, P., Georgiou, S., Navrud, S., Poe, G.L., Ready, R.C., Ryan, M. and C.A. Vossler, 2004	Lakes	Non-use	1. WTP to avoid an (otherwise inevitable) increase in lake acidity; 2. WTP to decrease lake acidity from a non-changing level.	CVM: 1096 respondents in both Scotland (including the area near the lakes) and England.	Respondents were only willing to pay to prevent a deterioration, not to improve on the current situation. WTP results not actually reported in the summary viewed – see full paper.	**Highlands, Scotland**	
MacMillan, D.C. and Ferrier, R.C. (1994)	Fisheries	Use Value	Benefits of recovery in the Galloway salmon fishery by linking changes in water chemistry to catch per unit effort, and then to changes in the economic value of the fishery. Summary from: MacMillan (2001)	Hedonic price	Market value of fishery: Under scenario 1 (*status quo*) the market value of the fishery was predicted to decline gradually from £12.6 million in 1988 to £11.7 million in 2033 in response to declining catch. Under scenario 2 the market value of the fishery rose to £13.6 million, and under scenario 3, £14.0 million after 50 years, as a result of improved water chemistry.	**Galloway, Scotland**	

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Hanley, Bell, Alvarez. 2001	Coastal	Use value	Value of water quality improvements from current levels to meet minimum EU standard	Combined revealed and stated preference Sample size: 414 visitors to particular beaches.	Mean Increase in Consumer Surplus for Coastal Water Quality Improvement: £7.81 per person per year £0.48 per person per visit	**Scotland**	Transferable for coastal schemes alone
Day et al. 2001	Coastal	Use value	Value of water quality improvements from current levels, where EC bathing water standards are consistently breached to the minimum acceptable EC mandatory levels at two beaches (Ayr and Irvine) in Scotland.	CVM: payment ladder; Sample size/pop: 351 and 432 residents; Survey admin: one to one interviews; Payment vehicle: increase in local council taxes;	Mean WTP per household per year to improve bathing water quality for: Ayr beaches to meet standards: £10.43 Irvine beaches to meet standards: £6.36	**Ayr and Irvine**	Transferable for coastal schemes alone
Dunkerley, J. (1999)	Coastal	Use value and non-use	Benefit to local population from local collective services for the removal of visual pollution from the beach foreshore.	CVM: open-ended Sample size: 317 households surveyed door-to-door. Payment vehicle: increase in local council tax.	Mean WTP per household per year for the environmental improvement: £18.23. 95% confidence interval: £13.60 - £22.87.	**Broughton Ferry, Dundee, Scotland**	Potentially transferable in the context of removal of sanitary sewage from beaches.
Jones, P.J., Side, J., Kerr, S., Brooksbank, J., and Pelling, M. (1997)	Coastal - estuary	Use and non-use	Value of environmental goods in a range of scenarios, focussing on intertidal mudflats recognised as important for wildfowl and wader species designated as a SSS: WTP to reduce pollution from a sewage outfall located in Torry Bay; WTP to purchase the bay in order to improve its preservation prospects; WTP to pay to establish the bay as a nature reserve; and WTP to prevent loss of all mud flat habitats in the Firth of Forth.	CVM Sample size: 315	Summary to be found under: http://www.icit.org.uk/firth_of_forth.htm ' "It was found that the valuations would have been sufficient under each scenario to have a significant effect on the decision making process. Overall 23% of respondents indicated both that they thought it was right to use money to express the value of the environment and were confident that ways in which they personally value the environment could be fully reflected in monetary value, whilst 21% thought it was wrong and were not confident"	**Torry Bay, Firth of Forth, Scotland**	Potentially for estuarine studies

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Hanley, N., Bell, D. and B. Alvarez-Farizo (2002)	Coastal	Use value	Value of water quality improvements from current levels to meet minimum EU standard	Combined revealed and stated preference Sample size: 414 visitors to 7 beaches.	Mean Increase in Consumer Surplus for Coastal Water Quality Improvement: £5.81 per person per year £0.48 per person per visit	**Scotland**	Transferable for coastal schemes alone
Rivers – Economic Valuation Studies from England and Wales							
Coker, A. Tunstall S., Green, C.H. and Penning-Roswell, E., 1990	Rivers	Use	Benefits of river improvements and creation of new recreational opportunities through a new flood alleviation scheme. Baseline - channel partly filled with water sometimes. Rubbish on banks and in water. No pathway. Two improvement scenarios: • Scheme A – Channel filled with water; rubbish cleared; gravel pathway provided; • Scheme B – paved pathway and seats provided. Extensive planting in water. Banks extensively landscaped.	CV – open-ended.	Not reported.	Maidenhead Ditch, England	Its small sample size and date means it is not an ideal study for benefits transfer.
Radford A.F. Hatcher A., Whitmarsh D., 1991	Rivers	Use value	Total expenditure by anglers on recreational fishing activities.	Mail survey to random sample of anglers fishing in NRA regions. 1652 usable responses (regional response rates of 31-57%).	£ 15.01 – £103.54 per angler per day (depending on the region – see database for full details.	Northumbria, North West, Severn Trent, Southern, South West, Wales, Wessex and Yorkshire	Actual expenditure data only and from 1988 – not directly transferable.
Green, C.H. et al, 1990	Rivers	Use and non-use value	River water quality improvement.	CVM	• WTP (non visitors): 17.9 per person per year; • WTP (visitors): 20.5 per person per year.	UK	It has not been possible to obtain the original copy and hence any information on baseline that could be useful for benefits transfer.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Garrod, G. and Willis, K., 1996	Rivers	Use and non-use	Two scenarios were tested in the study: 1. improve upon flow levels in the Darent River; 2. maintain or improve upon flow levels in all 40 low flow rivers in England.	CVM: open ended; Sample size/pop: 325 residents and 335 visitors; and 758 households; Survey admin: one to one interviews.	River Darent (per household per year): • residents: £11.68; • visitors: £8.20; • General public: £4.41. All low flow rivers (per household per year): • residents: £21.14; • visitors: £17.26; • Non-users: £14.23.	Darent River, South East England and all 40 low flow rivers in England	Particularly useful for low flow alleviation schemes.
EFTEC and CSERGE, 1998	Rivers	Use and non-use	Recreation and amenity benefits related to the effects of water abstraction upon river water quality, vegetation / algae, fish and water levels. Four scenarios: • Change scenario 1: 5 cm increase to natural flow; no change in water quality; • Change scenario 2: 5 cm decrease in water level; good to average quality; • Change scenario 3: 45 cm decrease in water level; average to bad quality; • Change scenario 4: 1 meter decrease in water level; average to bad quality.	2 surveys CVM – payment card Sample size/pop: 472 regional respondents and 178 users; Survey admin: one to one interviews; Payment vehicle: water bills.	(1) Mean WTP per household per year (for users and non-users): for a 5cm increase in water level: £4.85; to avoid a decrease in water level of: 5cm: £3.00; 45cm: £7.02; 1m: £15.70; (2) Mean WTP per household per year (for users only): for a 5cm decrease in water level: £5.78; to avoid a decrease in water level of: 5cm: £5.61; 45cm: £15.20; 1m: £16.91.	River Ouse, County of Yorkshire	Particularly useful for marginal changes in river flows.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Jacobs GIBB Ltd, 2002	Rivers	Use and non-use	Scenario 1 – full improvement of water levels for the 30 worst affected rivers in the Thames Region involving them returning as far as possible to their natural state, drying out less often and supporting more wildlife. Scenario 2 – full improvement of water levels for the Mimram only involving it returning as far as possible to its natural state, drying out less often and supporting more wildlife. Some variations: • full recovery of the natural flow on the Mimram so that it dries out only once every 20 years, instead of once every 4 to 5 years, as it does now. • partial recovery: Mimram runs dry once every 10 years instead of once every 20 years.	CVM: payment ladder; Sample size/pop: 650 households; both local residents and those living 130km away.	Average User WTP values for the River Mimram (full recovery) (distance (km), Users, Non-users (£2002/household/yr for 5 years)) 0-0.5 9.84 6.46 0.5-3 7.44 6.46 3-12 1.98 1.20 12-130 0.74 0.74 WTP to relieve low flows on all 30 low flow rivers: Users of Mimram: £35.40 (se = 28.98) Non-users of Mimram: £26.66 (se=29.57) WTP to only partially relieve low flow on Mimram: Users: £8.98 (se=1.10); Non-users: £1.43 (se=3.24);	within 130 km of Mimram, SE England	Particularly useful for changes in flow levels and also provides distance-decay information, which improves accuracy of results aggregated over a distance.
Environmental Resources Management, 1997	Rivers	Use and non-use	Meeting Environment Agency target for the alleviation of low flow in rivers.	(1) anglers – open-ended CV (2) misc informal recreationists: iterative bidding CV (3) General public – CV discrete choice and choice experiment. 722 usable surveys overall.	WTP of £5-13 per household per year (depending on location).	River Piddle: South Dorset; Malmesbury Avon: North Wiltshire; Wylye: South Wiltshire; Allen: North East Dorset; Tavy & Meavy: South West Devon; Otter: South East Devon	Useful for benefits transfer in the UK.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Garner, J.L. Green, C.H. Tapsell, S.M. Rivilla M.J., Fordham M., Portou J., and Tunstall S., 1995	Rivers	Use value	Two scenarios: 1. Benefits of maintaining current river recreation; 2. Benefits of improving river, through river restoration scheme (bends created, softer appearance for retaining walls, create wetland/pond areas and landscape resulting in improved water quality/flood protection).	• CVM – iterative bidding; • Random sample of 252 local residents (within 400 metres of site); • Payment vehicle: local tax.	1. Today's visit: £6.86 per adult; 2. With restoration scheme: £8.75 per adult per visit, £25.67 per adult per year.	River Skerne, Darlington	Transferable for the specific benefits listed.
Garrod, G.D. and K.G. Willis, 1991	Rivers	Use	Amenity value of waterways.	Hedonic price.	Existence of local river/canal amenity increased house price by 4.9%.		Only useful for schemes that lead to significant changes.
Tapsell S. M., Tunstall S.M., Costa P.L., and Fordham M., 1992	Rivers	Use value	Three scenarios explored: • Option A – Benefits of maintaining river with concrete channel and iron railings on both sides (current condition). • Option B – Benefits of improving river through addition of new meander and new plants & trees, and reed beds in river. • Option C – Benefits of improving river through New meander, two wetland areas providing habitat for water birds.	• CVM • Sample: 357 park users, 352 residents – within ¼ mile radius of site.	£/ visit: Option A • Park users: 2.05; • Residents: 1.58. Option B • Park users: 2.91; • Residents: 2.43. Option C: • Park users: 3.61; • Residents: 3.45.	Ravensbourne River, SE England	Transferable for the specific benefits listed.
White, P.C., K.W. Gregory, P.J. Lindley and G. Richards, 1997	Rivers	Non-use	Preservation value of the otter Lutra lutra and the water vole Arvicola terrestris.	CVM –	• Mean WTP for an action plan to restore both the otter and water vole populations: £11.46 per person per year. • Mean WTP in British pounds for an action plan to restore the water vole population: £7.81 per year.	Regional, UK	Only relevant for the species mentioned.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Green, C. H. and S.M. Tunstall, 1992	Rivers	Use and non-use value	Value of three different potential benefits from water quality improvements: 1) the additional enjoyment to existing users; 2) the increase in amenity enjoyment to residents living near the river corridor; 3) the overall non-use value.	CVM	Residents: arithmetic mean (lump-sum/ one-off payment) for water quality good enough a) for Water birds £642, b) To support many fish, dragonflies and to allow many different types of plants to grow both in the water and on the edges £660, c) To be safe for children to paddle or swim: £683.	UK	It has not been possible to obtain the original copy and hence information on the baseline that would be useful for benefits transfer.
Green, C.H. and S.M. Tunstall, 1991	Rivers	Use value	Value of improvements in river water quality at 12 different river-side sites across the UK from current to 'Good enough': • For water birds (e.g. swans, coots, ducks etc) to use the water; • To support many fish, including trout, and dragonflies, and to allow many different types of plants to grow both in the water and on the edge; • To be safe for children to paddle or swim.	3 CVM surveys: iterative bidding: • Sample pop: i) residents living next to rivers; and ii) residents living away from rivers; • Survey admin: one to one interviews.	Mean WTP for Improvement in Water Quality in a United Kingdom River: • £18.59 per household per year; • WTP/month £2-2.34.	12 river-side sites across the UK (not specified)	Useful for benefits transfer.
Georgiou S, Bateman I, Cole M, Hadley D, 2002	Rivers	Use and non-use	Three water quality schemes are evaluated (small, medium and large improvements) which range from ability to boat in river, increase in wildlife, and ability to swim in water.	• Contingent ranking and CVM; • Sample size/pop: 675 residents; • Payment vehicle: increase in council tax; • Survey admin: one to one interviews.	Mean WTP per household per year for: • unit increase in RFF index (CR) (95% CI) : 5.18 (5.03-5.31) ; • 1% saturation increase in dissolved oxygen (CR) (95% CI): 0.62 (0.59-0.66); • 1 mg/litre decrease in BOD (95% CI): 3.12 (2.90-3.33); • WTP for 1 mg N/litre decrease in total ammonia (95% CI): 5.15 (4.55-5.74).	River Tame, Midlands	Very useful for benefits transfer when either qualitative or quantitative data are available – makes link between qualitative perceptions of water quality and quantitative measures.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
ECOTEC Research and Consulting, 1993	Rivers	Use value	An improvement in the aquatic ecosystems (fish and plant life) that are being negatively affected by acid deposition – resulting in increasing animal and plant life. The changes depicted in the survey demonstrate the effects which might result from the exceedance of critical loads.	• CVM • Sample: 1,606 (587 users, 1019 non-users). Refusal rate (22% and 26%); • Face-to-face interviews; • Payment vehicle: increase in water rates for 10 years.	Mean Willingness-to-Pay per household per year • non users: £ 29.03 (49.18); • users (non-anglers): £ 38.76 (38.76); • users (anglers): £44.34 (51.65).	UK wide	Deals with acid deposition only – not directly relevant to AMP schemes.
Green, C.H. and K.G. Willis, 1996	Rivers	Use value	Value to anglers for improvements in water quality. Water Quality improvements that allow different types of fishing. C1 = good quality coarse fishery; C2 = moderate quality coarse fishery; C3 = poor quality coarse fishery; T1 = good quality non-migratory trout fishery; T2 = moderate quality non-migratory trout fishery; T3 = poor quality non-migratory trout fishery; S1 =good quality salmon fishery.	• CVM: open ended / iterative bidding; • Sample size/pop: 512 anglers and 542 head of households,	• Non use value for improvements in quality per km per household per year: from poor to medium: 0.0022; from medium to good: 0.0060; • WTP One day's fishing permit.	UK	Transferable.
Radford A F, Riddington G and Tingley D, 2001	Rivers	Inland waters	Use.	Actual expenditures made by anglers in their most visited areas as well as their visits to the three case study areas of River Thames, The Afon Teifi, and urban Leeds.	Actual expenditure Postal surveys to anglers. Useable responses: 127 riverine fisheries, 207 stillwater fisheries and 219 canal fisheries.	National coverage and three case study areas of River Thames, The Afon Teifi and urban Leeds	Transferable but actual expenditure alone.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
House M, Tunstall S, Green C, Portou J and Clarke L (Middlesex University), 1994	Rivers	Use value	Value of enjoyment to visitors, residents and anglers for low flow alleviation.	CVM	WTP of £24-27 per resident household per year.	Wallop Brook and Little Stour River Ver, River Wey and River Misbourne in NRA Thames region	Value of enjoyment method is not recommended and hence neither the transfer of its results.
Johnstone, Claire A, 2004	Rivers	Use	Marginal changes in river quality.	Travel cost method. Two models used: one to predict the numbers of trips and the other to predict angling site choice.	Consumer surplus values per trip for a 10% change in river attributes ranges from £0.04 to £3.93.	Miscellaneous English rivers	
Wetlands / Lakes / Floodplains							
Pearson, M, 1992	Lakes Reservoirs	Use value	Protection of Rutland Water reservoir from a future outbreak of cyanobacteria, thus maintaining the recreational and amenity values of the site.	CVM: open-ended; Sample size/pop: 641 visitors; Refusal rate: 17.4%; Survey admin: one to one interviews; No pilot study.	Mean WTP to prevent an outbreak of cyanobacteria: £19.67 per household per year for 10 years. Or £71.2 lump sum (one-off payment).	Rutland Water, Leicestershire	High quality study, but most relevant to the context of a cyanobacteria outbreak.
Bateman, I., K. Willis, and G. Garrod, 1993	Wetlands Floodplains	Use	Value of preserving the present landscape of the Norfolk Broads (from flooding) – prevent conversion to more mud flats, wider estuaries, and the effects of more salt water on fauna and flora, and to preserve today's landscape of the Yorkshire Dales.	CVM (IB and OE) Yorkshire Dales: residents and visitors (300 of each) – face-to-face interviews Norfolk Broads: visitors (total of 3,206 usable interviews) – pilot of 433 visitors.	• Mean visitor WTP for the Norfolk Broads per household per year ranged from: £93.99 (sd=181.41) to £95.88 (sd=£151.45); • Mean visitor WTP for the Yorkshire Dales: £23.62 (sd=£33.79) household per year; • Mean resident WTP: £26.89 (sd = £58.15) per household per year.	Norfolk Broads National Park, Yorkshire Dales National Park	A strong study but its results are only relevant for unique resources such as the Broads.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Bateman, I.J. and Langford, I.H. (1996),, 1996	Wetlands Floodplains	Non-use	Value of preserving the present landscape of the Norfolk Broads (from flooding).	CVM- open ended mail survey: 1,002 households at 3 distance zones (310 usable responses).	Mean WTP per year (non-users): £26.16.	Norfolk Broads	A strong study but its results are only relevant for unique resources such as the Broads.
Garrod G., Powe N. and Willis, K., 2000	Wetlands Floodplains	Use and non-use value	Environmental impacts caused by increased water abstraction from Hardham acquifer in summer and recharge of acquifer with water abstracted from River Rother in winter.	Choice experiment • Sample size/pop: 412 households; • Survey admin: one to one interview; • Payment vehicle: water bills.	• WTP to avoid (achieve) a one percent decrease (increase) in the number of birds: £1.52 per household per year; • WTP to avoid (achieve) a small decrease (increase) in river flows: £4.25 per household per year; • The number of birds and diversity of plants found at the wetlands: £21.24 per household per year.	Hardham acquifer and River Rother in West Sussex	Transferable.
Economics for the Environment Consultancy Ltd (EFTEC), 1999	Lakes Reservoirs	Use and non-use value	Impacts of increased water abstraction from the Weir Wood Reservoir. Changes under increased abstraction are: temporary decrease in water levels in summer resulting in more mud than currently exposed. Water quality remains 'good' however, it will attract slightly more wading birds attracted by increased areas of exposed mud. There will also be slightly less resident water birds affecting only some species due to loss of nesting sites at particular times.	CVM pilot study: Sample size/pop: 50 visitors: Survey admin: one to one interviews Payment vehicle: water bills.	WTP to maintain current situation: £23-26 per household per year.	Weir Wood Reservoir, North Sussex	Its small sample prevents it from being an ideal study for transfer.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Spurgeon J, Colarullo G, Radford A F and Tingley D, 2001	Inland water	Use Value	Maintaining and/or improving water quality and angling opportunities in the respondents' most frequently used waterbody. In the general public survey, the following definitions were used for water quality: Poor: a lot of litter, usually smelly, sewage, no fish, little or no vegetation; Fair: some litter, rarely smells, some fish, some vegetation; Reasonable – not defined; Good: little or no pollution, clear, many fish, good vegetation; Very good – not defined.	• Contingent valuation and expenditure data; • Telephone survey of 806 anglers and face-to-face interviews with 843 respondents across the eight Environment Agency regions.	Per household per year: WTP to increase water quality from none to poor (5% and 10% truncation): £ 7.64 (5.3-2.96); WTP to increase water quality from poor to reasonable (5% and 10% truncation): £ 4.79 (2.34-1.73); WTP to increase water quality from reasonable to good (5% and 10% truncation): £ 7.64 (4.59-3.46); Maintain good (5% and 10% truncation): £ 10.19 (7.75-5.50).	River Thames, The Afon Teifi, Leeds, The River Wye, and 'a river near you'.	Valuations of changes in river quality relate to different rivers for each individual, and hence the analysis of these WTP together is dubious (the study does not attempt to identify quality changes for specific rivers). Also sample sizes for each change.
Bateman, I., Willis, K., Garrod, G., Doktor, P., Langford, I. and Turner, R.K., 1992	Wetlands Floodplains	Use and Non-use	Preserving the Norfolk Broads in its current state against the threat of flooding.	CV	WTP of £66 per user household per year, £26 per non-user household per year.	Norfolk Broads National Park	

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Bateman, I.J., Cole, M., Cooper, P., Georgiou, S., Hadley, D. and G.L. Poe, 2004	Lakes Rivers Wetlands	Use and Non-use	Willingness to Pay for three nested ecological and recreational improvements/schemes in the University of East Anglia (UEA) lake and the River Tame in Birmingham from current levels of poor quality; and Part and Whole protection of the Norfolk Broads from saline flooding, from current levels of no protection.	CVM: sample sizes of 149, 675 and 139 for UEA lake, River Tame and Norfolk Broads respectively.	• UEA; • WTP to filter run-off water before entering a lake of £16-34; • WTP to do the above plus plant a reedbed of £15-33; • WTP to do both of above plus dredge sediment from lake of £36-67. Range from different ways of presenting question • Tame: WTP of £9-24 for water quality improvements, depending on scale of improvement and question presentation; • Norfolk Broads: £10 WTP for whole protection of Norfolk Broads from saline flooding, £4-8 for part protection; • Units for WTP figures not known (i.e. per respondent or per household).	Norfolk broads, River Tame, UEA	
Bateman, I.J., Langford, I.H., Turner, R.K., Willis, K.G. and Garrod, G.D, 1995	Wetlands	Use and Non-use	WTP to protect against saline flooding in the Norfolk Broads	CV, testing three elicitation methods (open-ended, dichotomous choice and iterative bidding). 2897 respondents.	The mean willingness to pay for the entire OE sample was £67.19 (95% CI = £59.53-£74.86). The mean willingness to pay for the DC sample was £140 and the mean WTP in the IB procedure was £74.91 (95% CI = £69.27-£80.55). Units for WTP figures not known (i.e. per respondent or per household).	Norfolk Broads National Park	

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Brouwer, R., I.H. Langford, I.J. Bateman, T.C. Crowards and R.K. Turner 1997	Wetlands	Use and non-use value	Valuation estimates for different wetland functions including flood control, water generation, water quality, and biodiversity.	• Meta analysis; • 30 studies conducted between 1985 and 1996. The studies contained over 100 value estimates related to wetlands.	£WTP per household per year: for saltwater wetland £59.09 for marine wetland £23.87 for lagoonal wetland £143.62 for lake wetland £45.00 for freshwater: wetland £61.93 for riverine: wetland £75.38 for lacustrine: wetland £38.69 for palustrine: wetland £38.80 for ground water: wetland £132.16 for fresh & salt water wetland £249.71 flood control £97.36 water generation £22.60 water quality £55.20 biodiversity £80.01	Various – global	The method of meta-analysis provides useful information and representativeness even though most of the original studies are from other countries.
Canals							
Adamowicz, W. L., Garrod, G.D. and Willis K.G., 1995	Canals	Use value	Benefits of maintaining the UK canal network in a state fit to support boating activities and maintaining towpath facilities.	• CVM – open-ended; • CE – pairwise comparison; • Sample: 758 households across Great Britain (327-CV, 431-CE); • payment vehicle: national tax; • Pilot survey conducted.	• CVM: £7.42 per household per year or £159,080,570 per year; • CE: £26-£45 per household per year.	various canal sites throughout the UK	Not relevant for individual schemes with marginal impacts.
Willis, K. and Garrod, G., 1991	Canals	Use	Amenity value of waterways.	Hedonic price	Existence of local river/canal amenity increased house price by 4.9%.	12 canal sites across Britain	Only relevant for significant schemes.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Garrod, G. and Willis, K., 1994	Canals	Use	Maintaining the benefits that residents gain from a waterside location (canals).	Hedonic Price: 2, 000 usable property records (1985-1989) with 1, 787 in London area and 275 in the Midlands.	London premium: 2.92% house price – on waterside 1.4% price – adjacent to waterside Midlands: 5% price.	Greater London & Midlands	Only useful for schemes that lead to significant changes.
Willis, K., and Garrod, G., 1990	Canals	Use value	Benefits of maintaining the current recreational opportunities of canals. Consumer surplus on each type of informal recreation was estimated by the individual travel cost method: assessment of how much people were prepared to pay to undertake different activities, such as boating, dog-walking, fishing, walking, etc.	• Travel Cost • Sample: 925 interviewed in person at both canal sites (393 responses)	(1) Benefits of recreation and amenity of Lancaster canal, by different type of user (per visit, £, 2001): Dog walkers: 0.04; shortcut takers: 0.01; fishermen: 0.05; boaters: 0.08; visitors to attractions: 0.10; walkers: 0.09; (2) Benefits of recreation and amenity of Montgomery canal, by different type of user (per visit, £2001): Dog walkers: 0.02; shortcut takers: 0.03; fishermen: 0.18; viewers to canal scene: 0.31; nature lovers: 0.06; walkers: 0.09; shop, pub, or café: 0.22.	Montgomery and Lancaster canals, in Shropshire and Powys	An important omission from the study was any measure of income, which makes it less than ideal for benefits transfer.
Willis, K.G. and G.D. Garrod, 1995	Canals	Use and non-use	A program maintaining boating, heritage and towpaths.	CV (open-ended) and choice experiment.	£6.78 per household per year.	River Darent	
Demand-side							
Hanley, N., 1991	General	Use value	Reduction of nitrate levels in drinking water supplies from current levels where WHO limit (50 mg/litre) is occasionally breached to case where it is never exceeded.	• CVM: open ended; Sample size/pop: 400 households; Refusal rate: 66%; • Survey admin: mail survey.	Mean WTP £ 15.89 per household per year.	East Anglia	Useful for schemes impacting on nitrate levels.

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
McMahon, P., 2001	General	Use and non-use	Two surveys were conducted: USER SURVEY: non-mains connected household willingness to pay for provision of a sewer mains and household connection. NON-USER SURVEY: willingness to pay to avoid the environmental and amenity values associated with non-mains sewerage or inadequate private drainage systems.	CVM USERS: 153 telephone interviews (68% response rate). Payment vehicle: to water company NON-USERS: 400 telephone interview of households. Payment vehicle: Water bills	USER: Mean WTP for connection to mains sewage: £ 3433 one-off payment per household (95% confidence interval: £3156-3519) NON-USER: Mean WTP per scheme (conservative estimate, taking into account embedding) : £0.3728 one-off payment per household	USER: Sussex NON-USER SURVEY: Southern Water sewerage services area, namely Isle of Wight, Hampshire, Sussex & Kent	Transferable for sewage connection schemes only.
Coastal waters							
EFTEC 2002	Coastal	Use and non-use value	Value of a 1% decrease in risk of getting a stomach upset from bathing in the sea.	CE and CVM Choice experiment: sample size/pop; 235 general public CVM: open ended and dichotomous choice; CV survey admin: mail shot and one to one interviews; Sample size/pop: 325 mail respondents; 249 general public; and 235 visitors to a particular beach	£1.10 -2.00 per household per year	UK	Transferable for coastal schemes alone
Georgiou et al. 1996	Coastal	Use value	Value of health risk reductions from improving bathing water quality. Version 1: WTP for an improvement in water quality from current status to the EC standard Version 2: WTP to avoid drop in water quality below the EC standard Source of pollution is effluent.	CVM: open-ended; Sample size: 400; Survey admin: one to one interviews; Payment vehicle: increase in water rates.	WTP to achieve a gain in water quality to meet the EC standard at Great Yarmouth is found to be £15.67 per household per year Mean WTP to avoid a drop in water quality below the EC standard is found to be £13.83 per household per year for the entire sample at Lowestoft beach.	UK	Transferable for coastal schemes alone

Reference	Resource type	Value type	Change being valued / valuation scenario	Method	Results (£2001) – not all results are in 2001 prices + Units	Location	Comments for Benefits Transfer
Georgiou et al. 2000	Coastal	Use value	Value of meeting revised Bathing Water Standard: respondents were in fact valuing an improvement which would reduce the risk of illness by a perceived expectation of 3 cases in every 100 bathers.	CVM: open-ended; 3 surveys: Sample size/pop: i) residents; and ii) people in vicinity of the beach;	WTP to reduce risk of gastroenteritis by 3%: Norwich: £35.50 - £42.77 per resident household per year Great Yarmouth: £9.99 - £20.40 per resident household per year £18.03 - £28.62 per day tripper per year £26.32 - £38.14 per holiday maker per year Lowestoft: £21.95 - £37.84 per resident household per year £22.01 - £27.86 per day tripper per year £24.58 - £33.21 per holiday maker per year	East Anglia, UK	Transferable for coastal schemes alone
Rivers – Economic Valuation Studies from Republic of Ireland							
Curtis (2002)	Rivers	Use Value	Value of salmon angling to users	Travel Cost On site survey of anglers from the Ireland, N.Ireland, Germany and other European countries. Sample size: 118 observations.	Consumer surplus range: Approx. £98 - £137 Total value (WTP) of salmon angling to users (consumer surplus plus travel costs, fishing expenses, accommodation and meals: Approx: £175 per angler per day.	Co. Donegal, Ireland	Transferable for salmon fishing.

Appendix II Overview of most recent dutch water valuation studies

Study	Study year	Estimation of the public benefits of	Method	Economic value (average WTP/ household/year)	Results used for
Brouwer (2003)	2002	Surface water quality improvements in the Netherlands as a result of the revision of the EU Bathing Water Quality Directive	CV (DC)	€35-45	Pre-feasibility CBA (cost assessment based on CEA) supporting the decision whether or not to agree to proposed stricter bacteriological standards for bathing water quality in the Netherlands
Brouwer et al. (2004(b))	2002	Ecological restoration of lakes and lakeshores in the lake district of Friesland	TC (individual TC model)	€50-185/visit	Pre-feasibility CBA supporting the formulation of environmental standards in the specific area under the WFD and the introduction of dynamic lakeshore management
		Ecological restoration of lakes and lakeshores in the lake district of Friesland	CV (OE)	€58-93	
Brouwer (2004a)	2004	Biodiversity conservation in and around water bodies in the Netherlands as a result of contaminated sediment cleanup	CV (DC/OE/PC)	€10-50	Pre-feasibility CBA supporting the decision whether or not to increase investments of public money in the cleanup of contaminated sediments in Dutch water bodies
Brouwer (2004b)	2003	Good ecological status of water bodies in the four main river basins in the Netherlands as foreseen in WFD	CV (DC)	€103-108	Pre-feasibility assessment of the public benefits of improved water quality and the implication for the formulation of environmental objectives and future water pricing and taxation
Brouwer (2004c)	2004	Good water status of water bodies in the Scheldt river basin as foreseen in the WFD	CV (DC)	€25-30	Pre-feasibility assessment of the public benefits of improved water quality and the implication for the formulation of environmental objectives and future water pricing and taxation

Explanatory notes:
DC: dichotomous choice WTP question
OE: open ended WTP question
PC: WTP question using payment card
CBA: cost-benefit analysis
CEA: cost-effectiveness analysis