

FINAL DRAFT DOCUMENT ON COST EFFECTIVENESS

Including the remarks of SCG

Cost Effectiveness Analysis document

Status box

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Author(s): CEA Drafting Group (list of members enclosed)

Background:

The background document contains a table with the state of play in several member states. Only a limited number of MS have developed methodologies. The number of methodologies that have been tested is even smaller. Some existing methodologies have been analysed and compared by a consultant on the initiative of the UK. The background document incorporates this study and the key issues identified are listed in the policy summary.

MS are obliged to perform cost effectiveness analyses for their river basin management plans, thus the results of the CEA activity up to now are described in the background document, while the policy summary lists the key conclusions and recommendations for the first RBMP.

Circulation and comments received:

The first draft for a policy summary and the two other chapters were presented to WGB, at its meeting of April 5th.

Timetable of finalisation process:

- ✓ May 5: Discussion during drafting group CEA meeting
- ✓ May 8 & 9, 2006: Discussion during workshop RBMP, Bonn
- ✓ May 15 & 16, 2006: Discussion during SCG
- ✓ May 24: last comments after SCG
- ✓ June 1&2 2006: Final discussion and endorsement on Water Directors' meeting of Chapter I and taking note and dissemination of Chapter II and III

Request to Water Directors:

The Water Directors are invited to:

- Acknowledge that a harmonized methodology on CEA does not exist, but there are various approaches adopted by the MS
- Acknowledge that there are significant gaps and this will have an impact on the ability to identify the most cost-effective measures for the first River Basin plans.
- Agree that the information given by the current document will be useful to all MS in developing their methodologies and they will contribute to the necessary better comparability
- Consider the virtue of further information sharing – particularly in terms of sharing databases of measures, costs and effects...
- Support that all available methodology/guidance documents will be uploaded onto CIRCA to facilitate further information sharing.



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Chapter I

Cost effectiveness analysis; Policy summary

1. Introduction

1.1 Why do we need a CEA?

The WFD requires Member States to undertake cost-effectiveness analysis in order to make judgements about the best combination of measures that will achieve the Directives objectives. Since these objectives are demanding and their achievement can be costly in both time and money it is most important to have an approach which is efficient. This should take account where possible the inevitable uncertainty about the baseline scenario, the risks, effectiveness and costs of measures, particularly for the first plan. Cost effectiveness analysis (CEA) supports the efficient use of resources. It will help all decision making particularly in difficult cases. However it should not be so complex that the CEA is done at greater cost than the potential benefits from better decision-making (such as increased efficiency). However, given the potential costs of the Directive faced by Member States and the uncertainty about the correct approaches, even a slight possibility that CEA will reduce the compliance costs would justify a substantial investment by authorities. It should also be recognised that while it provides a scientific & transparent basis for political decisions, it neither anticipates nor replaces the political decision.

1.2 Why do we need a document on CEA?

Since we have to perform the CEA at the level of the pressures and causes (deficit parameter), it is necessary to combine top-down (transboundary and district level items) and bottom-up (catchment and local water bodies) approaches. For transboundary issues a common understanding is needed to come to cost effective solutions in the whole River Basin. It is not the aim of the paper on CEA to harmonize approaches. Given the obligation on MS to use new tools to undertake a relatively new integrated approach to decision making under great uncertainty, a single approach to CEA should not be desired or expected. CEA in the first plan should be seen partly as experimental, contributing to better decisions in a phased approach to achieving the objectives of the Directive. Notwithstanding this limitation, and bearing in mind that many EU member states (MS) have not yet developed CEA methodologies, it is expected that this overview will help to clarify the national approaches and contribute to better comparability. Several MS indicated they are interested in exchange of views and experiences on CEA.

It is not intended to replace or supplant existing guidance documents.

1.3 Target group

This document has been written for an audience of:

- Water Directors and the policy officials overseeing the common implementation strategy,
- Policy officials, planners, water managers and economists developing national level tools for CEA
- Stakeholders and interest groups with concern over implementation of the Directive within and between MS.

It is not intended to be used by planners in preparing River Basin Plans. In most cases, it will be necessary to develop more specific and detailed tools for utilisation in the current water management.

2. State of play and key issues

The background document contains a table with the state of play of CEA in 15 member states, 11 pilot river basins and 2 stakeholders. Two years before draft river basin plans are needed, only a limited number of MS have developed CEA methodologies. The number of methodologies that have been tested in real life is even smaller.

The existing methodologies have been analysed and compared by a consultant on the initiative of the UK. The background document incorporates this study, and the key issues are listed below.

MS are obliged to perform cost effectiveness analyses for their river basin management plans, the results of the CEA activity up to now are described in the background document, together with the key conclusions and recommendations for the first RBMP.

For further information see the state of play document (Chapter II).

Although the current available methodologies are not yet fully developed, a first glance of some more important issues can be seen from these methods and available cases/examples (See chapter III).

2.1 Scale of CEA

There is a broad agreement that the CEA should only be performed in case of significant environmental or economic issues at the scale the issue is of importance (proportionality). The scale at which the CEA is performed depends on the scale of the problems (pressures) or the scale of the measures to address the problem. Pressures at the scale of a whole river basin, lead to a CEA for that same river basin scale. This should also apply to international river basins. On the other hand in the case of pressures with local influence, a CEA at the scale of a single water body may be needed. In many cases where there are multiple similar local problems, an approach based on representative sites may be the most appropriate.

Upstream Downstream issue (UDI)

Performing the CEA at the RB level helps to identify effective & efficient solutions for Upstream-Downstream Issues (UDI). The driving forces, impacts and solutions can be seen in their context and this may lead to more efficient PoM, in which all parties involved are better off.

Coordination of CEA

To perform a CEA at a scale above the water body level, coordination of definitions, information and methods is essential, especially for the transboundary river basins. At least a common understanding should be established to make the national approaches comparable.

2.2 Working with objectives

Before evaluating cost-effectiveness it is necessary to know the objectives. The CEA calculates the lowest costs of the PoM at which the WFD objectives are met. All Member States' documents note the difficulty in defining effectiveness at present given the fact that the objective of "good status/potential" still needs to be defined in practical terms (especially concerning the "new" items as hydromorphology and biological parameters). The timing of the start to comprehensive monitoring under the WFD compounds this issue. In case the final objectives are not decided on, provisional objectives can be used in the interim e.g. objectives from policy documents or objectives set with the help of expert judgements. This could increase uncertainty and as such may involve a cost. It should also be noted that one of the alternative approaches to defining good ecological potential requires some aspects of cost-effectiveness analysis (i.e. to help set the objective of good ecological potential on the basis of mitigation measures).

2.3 Identification of measures

Most available national documents would mention the difference between measures (which tend to be more technical in nature) and instruments (i.e. economic or policy instruments) but would include all of them in the CEA. Also a distinction has to be made between basic and supplementary measures¹.

CEA is not relevant for measures which are obligatory under existing EC-law unless these directives leave some discretion to the MS concerning the details of the basic measure. The existing EC-Directives already include a (political) CEA decision. Also the analysis of disproportionate costs needs this distinction (see main findings of the workshop on environmental objectives (Berlin, May 2005)). During that workshop it was concluded that 'the costs for basic measures according to the EC water related directives cannot be included into the cost-benefit analysis for justification of exemptions'

. Some national documents restrict the use of CEA to even more specific circumstances, i.e. in complex situations where the choice between measures is not obvious. CEA is usually considered to be a tool for selecting measures at the local level and national measures can be decided upon through more traditional policy-making methods. However, conducting a CEA at the local level may highlight the need for introducing a national measure, if a pressure common in several water bodies could be more effectively be addressed by a national measure rather than by local measures implemented in all the affected water bodies. Non-water measures are usually considered alongside water measures although there is a slight bias towards focusing on water measures.

2.4 Pre-screening of measures

All MS that have defined a CEA methodology have also prepared (or are in the process of preparing) a national catalogue of measures, with generic information on costs, effectiveness, mechanisms for implementation, uncertainties, etc... These catalogues have reached various levels of development but they can usually be used as a basis to perform the CEA at a local level. Based on such catalogues, the first phase of the local analysis would usually consist of carrying out a pre-screening of measures, either to eliminate measures that are not technically feasible (as recommended in the Dutch guidance) or those which are clearly not cost-effective based on preliminary estimates (as in the UK guidance).

¹ - **basic measures: measures required by other EC Directives (Art 11.3(a)) and**
- **supplementary measures: WFD-specific measures (Art 11.3 b-l inclusive and Art 11.4).**

2.5 Effectiveness of measures

The effects of a measure taken are difficult to calculate due to uncertainty about sources of pressures, dose-response relationships and an absence of adequate monitoring data. The question is how to deal with this uncertainty in the first RBMP and how to reduce uncertainty for the successive RBMP's. Prior to the assessment of cost-effectiveness it may be decided that in many cases it is not technically feasible to define the problem in such a way that a CEA can be performed. A pragmatic way forward is to test uncertainty in a sensitivity analysis which may or may not yield a clear result. At the same time it is noticed that the improvement of the knowledge base is crucial to reduce uncertainty for future RBMP's.

2.6 Uncertainty

Uncertainty may affect cost and effectiveness estimates but also the definition of good status at this early stage, since the good status objectives have not yet been defined with precision. MS advocate several strategies for dealing with uncertainty. These range from selecting the measures where uncertainty is less (as in the French document), to producing range estimates (as in the UK document) or seeking to obtain more information in order to reduce uncertainty. For this latter method, which is commonly advocated, it is necessary to review the full cost of obtaining such additional information, including delayed achievement of objectives, versus benefits of doing so. Nevertheless the term "uncertainty" could never be an excuse not to take the measures that are already obligatory or obviously cost effective.

2.7 Estimating costs

Proposed methodologies for estimating costs vary substantially from one MS to the next, depending on the stage at which they are recommending estimating environmental and wider economic costs. Some recommend valuing such costs only in qualitative terms at the CEA stage, with a more detailed analysis only at the CBA (cost benefit analysis) stage.

2.8 Assessing cost-effectiveness and evaluating combinations of measures

As a result of the diverse methodologies for estimating effectiveness and costs, there is also considerable variation in terms of estimating cost-effectiveness. Some national documents, such as the Dutch and the Spanish ones, advocate relying on a single indicator on cost-effectiveness, estimated as the total costs divided by the total effects. However, given the difficulties in quantifying all effects and costs highlighted in other documents, the presentation of such a single indicator would often be difficult which is why other MS prefer the presentation of appraisal tables combining qualitative and quantitative information to support the consultation process and decisions by decision-makers.

2.9 Consultation process and involving experts

All national documents which were analysed have identified specific circumstances where consultation of stakeholders and experts is required. There are differences in such circumstances, which reflect different modes of involving the public in general and the availability of information at the local level.

2.10 Cost-effectiveness analysis and further steps

All national documents which were analysed have identified a link between the CEA and other stages of the economic analysis mainly through the information that is gathered. Given the link between cost-effectiveness and later stages of the analysis, the CEA exercise can be used to gather initial information for the distributional impact analysis, which means that such information should be noted as an aside when the CEA is being performed. Information gathered for the CEA can also help inform the analysis of disproportionate costs although additional information, such as on the environmental costs and wider economic effects, would need to be gathered at that stage. This document also acknowledges that CEA has to be done before the assessment of disproportionate costs (see the findings of Berlin workshop May 2006)

3. Main conclusions and next steps

CEA will be useful for many decisions but where it isn't, do not do it. It does not help choose objectives (that requires information on benefits) but the processes are linked (can be done at once or iteratively)

All MS are going through a learning process and cost-effectiveness methodologies will need to be reviewed by 2009. The key is to start early. Where uncertainty is significant, pilots can be helpful.

Variations between methodologies most likely reflect differences in circumstances, which means that harmonisation is not a worthwhile objective

The methodologies that have already been set out provide a very useful resource for MS that have yet to define their own methodology

The adoption of cost-effectiveness methodologies should be seen as a key component of an improved way of carrying out water policy across Europe

Future development of CEA will depend on the objective setting process and results of monitoring.

Key topics for future developments have been identified:

- Sharing information on effectiveness
- Step by step approach
- Transboundary issue - comparability
- Case studies on practical approaches for CEA
- Measure-effect relations, and link with monitoring
- Uncertainty

Chapter II

State of play of the implementation of Cost effectiveness analysis in different member states, pilot river basin and stakeholders

The current chapter provides in a table the summary of the situation of implementation of CEA for 15 member states, 2 stakeholders and 11 pilot river basin. This table has been built on the basis of a template filled by the member states the NGO's and the PRB on the implementation of the CEA in their respective institution.

These templates with more detailed information can be found on CIRCA in the public library under the CEA file. The following table is structured in order to give information on the implementation of CEA in MS, Ngo's and PRB. The key information are dealing with:

- the existence and the use or not of a methodology
- the data available to implement CEA
- the existence or not of testing activities
- the identification of the key issues when implementing CEA
- the current gaps identified

The first lessons we can take from this state of play on CEA are the following:

- **There is an important attention given to CEA in the MS the PRB and the NGO's when implementing the WFD.** This can be established on the basis of the number of answers we have received. CEA is probably considered as a link between technical needs and social and economic concern when preparing the programme of measures and associated RBMP.
- **There is no CEA methodology available in Europe at this time allowing the integration of both "multisectorial" (household, agriculture,...), and "multiparameter" dimension (diffuse pollution, hydromorphological changes,...).** Nevertheless some countries have already developed "partial" methodologies others will do that in 2006-2007, others will use the methodologies coming from other countries. Some countries have forecasted to refine the methodology after 2009 in order to integrate the lessons coming from the first RBMP.
- **Some data are already existing for measures (catalogues), for cost and sometimes for benefits but they are still gaps in a lot of countries for data necessary to implement CEA.**
- **Testing of existing data and methodologies is ongoing in a lot of countries and PRB.** The results of the different testing will come in 2006 and 2007
- **A lot of key issues have been identified when implementing CEA. Frequently arising issues are: scale, uncertainty, transparency and public participation, international cooperation (for transboundary rivers), effectiveness of measures, use of CEA for disproportionate costs,...**

- **At this stage they are still a lot of gaps to implement a “multisectorial” and a “multiparameter” approach for CEA.** First as mentioned before there is no one “integrated” methodology today , which makes difficult the implementation of CEA when combining the measures dealing with different sectors and different parameters of pressure. Data are still missing on measures, costs, benefits and effectiveness. The results of testing are not completely available today. The involment of the public is not fully developed now. The link between CEA and disproportionate costs/exemption is not so clear up to now.

All the elements of the table of State of play for CEA show that the major part of the work and the improvements for CEA will be done between 2006 and 2009.

	Methodology	Data	Testing	Identified key issues	Identified gaps
Austria	Not yet But one for May 2006	Catalogues of measures with costs and effectiveness	After May 2006	Scale	Combination of measures
Slovak	Using ICPDR methodology	No information	No	Scale Uncertainty Involment of the public Links with disproportionate costs	Missing proper methodology Missing input data Missing tools and instrument
Finland and Oulujoki PRB	Not yet obviously Web Hipre decision aiding tool in case study	Partial information for sectorial measures (agriculture, industry) A catalogue of measures to be produced in 2006	Testing on Kyrönjoki RB during 2006 and 2007.	Public participation Transparency Uncertainty Combining measures Effectiveness of measures	Combination of measures
Belgium (Flemish region)	Yes being developed On the basis of German and Dutch handbook	Database on emissions Database on costs Costs for reduction of pollutants	Testing on the Scheldt river basin in 2006 Model tested in 2007	Uncertainty Effectiveness of measures CEA in the planning process	Link with public participation Lack and variability of the data for the model
Norway	Have national guideline on CEA, will be further developed in line with WFD in 2006. Will use semi-quantitative and qualitative effect assessments.	Review of experiences on CEA in 2003 (a lot of data on P and N). Overview of data on measures (hydropower) will finish in April 2006.	Autumn 2006: test of the national draft guidance	Effectiveness of measures CEA in the planning process	Side effects To compare measures with different "success parameters". Disportionate costs
Germany	Yes a handbook existing since 2004	Data on measures and instruments Costs estimates Evaluation of effects	Handbook tested in several RB	Combining technical measures and instruments Integration of historic costs (past measures) Upstream/downstream International RB	Improve knowledge on effects of measures

Netherlands	Yes a handbook is existing	Database on measures	Testing Hydromorphological changes in river Maas Pollution and water quality in Rhine	Scale Historic costs Upstream/downstream definitions	Effectiveness of measures at local scale
Slovenia	Not developed yet	No information yet	Testing at sub-basin scale during 2006 on PRB Krka	Not identified yet	Lack of resources Lack of expertise
Latvia	Yes, developed by project, for surface water, diffuse and point source discharges of N and P, based on financial costs of measures only.	Partial information for measures for surface water (agriculture & forestry, population & WWTP).	Tested in Jugla RB in frame of the project and in Salaca RB in frame of another project.		
UK	Yes A methodology split in 5 projects 3 already finished The two last before June 2006	Database on measures Database on costs	Testing in three RB: Ribble, Hampshire Avon and Loch Leven Three other ongoing on transitional and coastal waters	Scale Uncertainty Effectiveness of the measures Disproportionate costs	
Czech Republic	Not Yet Ministry of environment is working on CBA	Data on measures	Testing of POM in 2003 in Divoka orlice river but not on CEA	International collaboration Combination of measures Exemptions Cost recovery	Data on costs Methodology on CEA Improve international collaboration
Spain	Yes Using the approach of wateco Intersectorial approach	Database on physical data (soil, groundwater) Statistical data Regional data	Integrated testing on the Júcar RB result expected before end 2006 Testing on nitrates	Multisectorial approach Link with public participation Effectiveness of instruments (pricing, subsidies,...) Financing RBMP	Integrate morphological issues Disproportionate costs Measures dealing with cost of abstraction
Hungary	Not yet but there is a project for 2006-2007 aimed at elaboration of the economic analytical method and methodology guidelines of CEA.	A draft catalogue of measures with unit costs and effects, benefits and effectiveness to be produced in 2006. A final catalogue of	Testing on Tisza River Basin (above Kisköre) during 2006-2007. There are other pilot RBM projects in Körös RB (2006-2007) and Zagyva-Tarna RB (2005-2006).	Unit costs Effects, Benefits Disproportionate costs Public participation Regulation measures Affordability	Data availability Improve knowledge on effects and costs, social impacts of measures.

		measures and CEA methodology at the end of the September, 2007			
Sweden	Yes, a draft. However a final methodology and handbook on CEA and CBA will be ready in June 2006.	Database on benefits exists. A feasibility study on setting up a cost/effectiveness database has been carried out. Way forward is being considered.	Drawing on experiences from e.g. Rönne å (VASTRA research project). Testing otherwise handled by the regional Water Authorities, see e.g. forthcoming NOLIMP project in Örekilsälven.	Scale Uncertainty (and link to disproportionate costs) Effectiveness of measures	Effectiveness of measures
France	Yes A thesaurus for measures A Note CEA in 7 questions	A catalogue of measures Working on the unitary costs	A testing in the seine Normandie District and adour garonne agency	Scale Uncertainty Involment of the public Links with disproportionate costs	Some data on costs Combining the measures
RSBP	Yes Development of a methodology for UK including monetary and non monetary fieds Involving the	- A research programm on: Developing a Cost-effectiveness analysis methodology (Done) - Benchmark costs for some measures (Ongoing) - Guidance on how to do CEA (ongoing) - Guidance on disproportionate costs, identification & assessment (ongoing) - Assessment of environmental benefits (ongoing)	From 2004 to 2010, United Utilities - a water company in the UK and RSPB are working together to deliver the Sustainable Catchment Management Programme (SCAMP), a ground-breaking project which will benefit water and wildlife.	Public participation Transparency Uncertainty Combining measures Effectiveness of measures	Assessment of monetary and non monetary costs and benefits
PRB Weser	Yes Use of the German	Compilation of regional studies	On going testing on the Weser (regional projects)	Costs Uncertainties	

	handbook		Criteria for the selection of measures to ensure river continuity, to reduce diffuse/point source pollution looking at socio economic costs and exemptions	Catalogue of measures Proportionality of costs	
PRB Suldal	Will test national methodology being developed in 2006.	Overview of relevant measures will be reported in 2006. Data show that effects will vary a lot from one location to another.	Testing on the Suldal PRB to be finished by autumn 2006.	Effectiveness of the measures CEA in the planning process (Uncertainty) (Scale)	Not used complete CEA on hydro-morphological impacts. Need to check if draft methodology will work and when in the planning cycle detailed assessments of measures should take place.
PRB Gascogne	Use of French methodologies	Data on costs	Testing on rivers de Gascogne to be done by 2006 Starting with a qualitative	Compare preventive and curative measures Combine economic and sociological analysis	Need of practical tools
PRB Jucar	Yes The test of an integrated simulation model is ongoing in Jucar	Database on nutrient emission	Testing of an integrated model including the transfer of pollutants to water on the Jucar in 2006	Effectiveness of the measures Comparison of different management options	Improvement of the transfer and dose/effect model

PRB Harju	<p>Yes Methodology developed around the concept of net present value Focused on sustainability of investments</p> <p>HMWB/disproportionate cost still lacking methodology</p>	<p>Data on costs for investment and maintenance</p> <p>Verification of data used in Harju WMP is needed</p> <p>Cost and effect data for generic agricultural measures has to be collected</p>	<p>First Testing in Harju river basin is completed (Harju WMP-study is ready); additional testing is advisable; particularly for generic measures and for analysis of HMWB/disproportionate cost. Testing was restricted to N and P with use of mass-balance model for gap analysis, and to groundwater issues and measures for sustainable groundwater use.</p>	<p>-Scale of the analysis - Incomparability of ranking for at one hand N and P and on the other hand groundwater related measures (other type of effect): comparison of measures hampering integral ranking. - difficult to combine local and generic measures in ranking exercise, given the lack of information of cost and effects of generic measures (for agriculture, forestry....). - timely involvement of key stakeholders proved to be useful (source of information).</p>	<p>-data on effects of generic measures. - identification of measures on local level (particular transparency and overlap on information about status of investment development) - data on cost of measures - morphological issues and link of those to ecological status.</p>
PRB Odense	<p>Yes</p> <p>A methodology is developed for, and tested on, the Odense river basin</p>	<p>Catalogue of measures to reduce nitrogen and phosphorous discharges, with data on costs and effectiveness.</p>	<p>Ongoing testing in Odense RB in 2006</p>	<p>Unit costs</p> <p>Benefits (water and non-water related)</p> <p>Disproportionate costs</p>	

		Including baseline measures		CEA for multiple pollutants Assessment of non-monetary costs and benefits	
PRB Oulujoki	Yes Methodology for hydromorphological changes and disproportionate costs	Data on costs of mitigation measures	Testing ongoing in Oulujoki river basin	Disproportionate costs	
Eurelectric	Yes A case study on cost effectiveness for hydropower production	Database and models on energetic costs Integration of environmental benefits for fishes	Testing realised in the Adour garonne river basin Cost effectiveness hydropower/salmonids	Disproportionate costs Scale PoM and exemption (extending deadlines and objectives) stakeholders involvement	
PRB Krka	Not yet, but test one expected by the end of 2006	Catalogue of measures in preparation Data on selected measures expected in June 2006	January ÷ June 2006 - draft cost-effectiveness database at sub-basin scale January ÷ June 2006 - draft results of the CEA for pilot river sub-basin	Not identified yet	Not identified yet
PRB Tevere	Yes (Wateco guidance, scientific literature, case studies) Cost-effectiveness analysis and also Cost-benefit analysis	Database on state of environment (monitoring), land use and water use; socio-economic data. Lows database. Scientific data on effectiveness. Data on costs of different type of	Yes On a portion of the Tevere river basin where there are mainly water quality problems due to nutrients, and on other portion with all items that deal with water.	Scale of data and measures due to decision level. Stakeholders to be considered. A simple financial analysis to do for each target group (also if we impose Best Available Technologies). Different time to apply	Uncertainty on the effectiveness of the measures to solve the problems. Agreement on institutional and stakeholders levels about different items of methodology. Discount rate to consider.

		measures.		different measures and rate to consider for the costs. Public costs and private costs (considering subsidies, etc). Final indicators also for different target groups (Drivers).	To include some externalities in the costs.
PRB Isère upstream	Yes for the first step (more detailed characterization at the local level) In progress for the second step (crossing local and district level contributions in order to establish a first draft of RBMP)	A catalogue of measures relevant at the district level Selection of the most effective measures with grids filled at the local level	Testing on the upstream Isère river catchment including its tributaries Cost effectiveness hydropower/GES or GEP	Scale for the CEA Criteria of HMWB designation	Identification of the most efficient combination of measures Link with cost/benefits analysis

Chapter III

Analysis of Member States and Pilot River Basin Submissions on the State of Play for Cost-Effectiveness Analysis in the WFD

Summary of Key Points of chapter III

CHAPTER OBJECTIVES

This Chapter has been prepared with DEFRA financing in response to Terms of Reference issued by the CEA working group of the Common Implementation Strategy in February 2006 for the project entitled: “Analysis of Member States and Pilot River Basin Submissions on the State of Play for Cost-Effectiveness Analysis in the Water Framework Directive (WFD)”.

Cost-effectiveness analysis (CEA) is a key plank of the economic approach embodied in the WFD, and particularly in its Annex III which states that “the economic analysis shall contain enough information in sufficient detail (taking account of the costs associated with collection of the relevant data) in order to make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Article 11 based on estimates of the potential costs of such measures”.

The requirement for conducting a cost-effectiveness analysis was only defined in broad terms in the text of the Directive, leaving much room for interpretation and adaptation to Member States (MS) specific circumstances. The evaluation of national documents on conducting CEA has allowed identifying areas of consensus and main differences regarding the methodologies to be used.

This chapter reviewed the place of cost-effectiveness in the economic analysis to be carried out under the WFD and reviewed alternative methodologies proposed by the MS that have published a methodology document for a number of critical issues as follows:

1. Determining the appropriate scale for conducting the analysis;
2. Choosing the measures to be incorporated in the analysis;
3. Carrying out the pre-screening of measures;
4. Defining the effectiveness criteria;
5. Estimating costs;
6. Assessing effectiveness;
7. Dealing with uncertainty;
8. Involving experts and the general public;
9. Linking the cost-effectiveness analysis to further steps of the analysis.

Recommended methodologies on each of those points set out in the MS documents are presented in tabular format in the body of the report, with examples and references to real testing situations or available tools wherever possible. The text in each of the country box reflects the way each country is addressing these points given the situation faced by that MS. Given the uncertainty about the role of CEA in the planning process, no attempt is made to either critique what are regarded to be equally valid approaches or to propose harmonisation.

MAIN FINDINGS

We have summarised our findings and conclusions on the basis of five main points below:

MS have adopted a broad range of approaches. All of them conform with the overall principles of the WFD

MS that have already defined their proposed approach to CEA have all aimed to define a methodology to identify the most cost-effective programme of measures for a river basin district, which is the broad aim of the CEA according to the WFD. All MS propose to follow a similar set of logical steps, making the comparison of the methodology used for tackling each of those steps relatively easy (as done in the body of this report, where each Table shows the approach adopted by each country on a particular methodological point). Key areas of similarity and key possible alternatives have been summarised in the report.

All MS are going through a learning process and cost-effectiveness methodologies will need to be reviewed after 2009

Different MS are working to implement cost-effectiveness analysis with existing data and methodologies into the River Basin Planning. After 2009, this work will need to be revised as it is recognised that MS are in the process of learning how to carry out CEA for the WFD. This will allow making the most of MS experiences and may permit making the obtained results and policy conclusions more compatible with each other. Further learning is particularly required for defining the appropriate scale for the analysis and combining qualitative and quantitative assessments.

Variations between methodologies most likely reflect differences in circumstances, which means that harmonisation is not a worthwhile objective

Based on this analysis, it clearly appears that there is no common approach for integrated cost-effectiveness analysis in MS. The methodologies developed by MS reflect the type of pressures they are faced with, the relative importance of public participation and data availability. They may also reflect different priorities in different MS and the resources available to undertake the assessments. Water management capabilities may vary substantially, particularly given that CEA will need to be carried out by non-economists in most MS. Some methodological options are easier to use to select ecosystem restoration options, others are most suited to choose between ways to reduce pollution loads and others are better suited to select the least cost options to save water in order to increase water flows and stocks in the natural environment. The information available, and the cost to obtain additional information, is also a reason that needs to be considered when explaining different choices taken with regard to CEA.

Notwithstanding this, in trans-boundary basins, it will clearly benefit all MS to engage in sharing of information to compare methods, definitions and data in order to improve consistency of approaches.

The methodologies that have already been set out provide a very useful resource for MS that have yet to define their own methodology

All national documents are usually in agreement with respect to the main areas of difficulty with the cost-effectiveness analysis, but vary in their approaches for tackling them. Some national documents go into more details than others for tackling certain issues (such as estimating costs for example, or combining measures into a cost-effective package of measures). Having access to all tools and instruments developed by the various national

documents may be useful to the Member States which have yet to develop their own methodology for conducting a cost-effectiveness analysis, as it would provide them with a choice of approaches to fit local circumstances.

The adoption of cost-effectiveness methodologies should be seen as a key component of an improved way of carrying out water policy at the European level

CEA should be seen as a tool to help decision-making as well as an information system to improve transparency. It is not an end in itself. Apart from contributing to the design of a RBMP by 2009, the CEA must be a constituent part of a new institutional framework to design and assess water policies. In this sense, CEA information will need to be updated during the implementation process of the RBMP, cost estimations will also need to be changed with the new information available, the package of potential measures will need to be widened with new technological options and results from R&D, and so forth. Building a CEA framework is therefore not a once for all task but an ongoing tool to inform, assess and design the current water policy options and to monitor, audit and improve the quality of water policy decisions in future.

1. Introduction

1.1 Objectives

This chapter has been prepared with DEFRA financing in response to Terms of Reference issued in February 2006 for the project entitled: “Analysis of Member States and Pilot River Basin Submissions on the State of Play for Cost-Effectiveness Analysis in the Water Framework Directive (WFD)”.

Cost-effectiveness analysis is a key plank of the economic approach embodied in the WFD, and particularly in its Annex III which states that “the economic analysis shall contain enough information in sufficient detail (taking account of the costs associated with collection of the relevant data) in order to make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Article 11 based on estimates of the potential costs of such measures”.

Following the publication of a guidance document on implementing the economic aspects of the Water Framework Directive by the WATECO working group and a series of pilot case studies, some Member States have developed their own guidance documents on cost-effectiveness analysis, which adapt the general principles to their local circumstances.

The objective of this chapter is to identify the range of alternative approaches and methodologies developed by Member States (MS) for undertaking cost-effectiveness analysis (CEA) in order to derive cost-effective programme of measures for implementing the WFD. It is hoped that this report will help the Commission and Water Directors understand the range of methodologies that Member States are planning to adopt and where the main alternatives lie. The report should also be of use to MS that have not yet prepared a cost-effectiveness methodology so that they can take inspiration from the suggested approaches, which they would need in any case to adapt based on available information and other constraints in their respective country.

1.2 Methodology

This chapter was developed based on consideration of the “Draft structure and first development for a document on cost-effectiveness analysis” prepared by the CIS working group on cost-effectiveness analysis. This document was used as a guide on the type of issues that needed to be analysed in more detail, such as the appropriate scale for conducting the analysis, how to deal with uncertainty, the role of the CEA in the planning process or how to evaluate the effectiveness of measures.

The chapter is based on an in-depth review of the methodologies put forward by Member States in documents prepared at the national level. The documents reviewed in each case are set out below. The nature of those documents differs slightly: whereas the document produced by the UK is intended to serve as an underlying methodology for subsequent development of a guidance document, the German and Dutch documents have already been prepared in the form of a handbook, for immediate application at the river basin level.

United Kingdom – We reviewed the methodology entitled “Developing Methodologies to Assess Costs and Economic Impacts Even-handedly for the Main Types of Measures”. This report was produced by a consortium led by RPA for the UK Collaborative Research

Programme on River Basin Management Planning Economics in September 2005. It contains numerous flowcharts and matrices that can be used as aides for conducting the analysis based on the recommended methodology. It is referred to as “UK” in this document. Since the publication of this methodology, the UK Collaborative Research Programme has supported the preparation of a more practically-orientated guidance document, which has yet to be officially released as the consultation process on the content of this document is still ongoing.

Germany – We reviewed the guidance document entitled “Basic principles for selecting the most cost-effective combinations of measures for inclusion in the programme of measures as described in Article 11 of the Water Framework Directive – A Handbook”. This Handbook was prepared by a consortium comprising of Ecologic and the Institute of Aquatic Resources Research and Management of Kassel University on behalf of the Federal Environmental Agency in 2004. It is referred to as “G” here.

Netherlands – We reviewed the document “In pursuit of optimal measure packages – Dutch handbook on cost effectiveness analyses for the EU Water Framework Directive”. This report was published by the working group Afwegingskader/ cluster Milieu EU KRW in September 2005. It is referred to as “NL” in this document.

France - We examined the document produced by the French Ministry of Ecology and Sustainable Development entitled “Seven questions and answers on the role of economic analysis in defining a programme of measures”, summarising the official position on France on selected critical issues and released in November 2005. This is referred to as the “Ministry of Ecology document”. We also reviewed the methodology developed and tested by the Agence de l’Eau Seine Normandie in the sub-basin of the Normandy bogs in May 2005. This document, entitled “Analyse Economique pour l’Elaboration d’un Programme de Mesures – Synthèse du test méthodologique sur les Bocages Normands, Mai 2005 is a document testing both cost-effectiveness and cost-benefit analysis methodologies simultaneously in a specific case. It is referred to as the testing document for the Normandy bogs.

Spain – We obtained comments from Spain based on an integrated prototype developed to implement the approach and experience acquired whilst conducting the Cidacos case study, which was included in the WATECO guidance document. In this document, the emphasis was placed on integrating the many elements that need to be taken into consideration for elaborating a river basin water management plan, including economic incentives and measures affecting different economic sectors and exerting pressures on different water bodies, through diverse quantity and quality parameters.

Denmark (Odense) – The submission from Denmark summarizes the approach taken for a project in the Odense Pilot River Basin and does not represent Denmark’s official position on CEA.

Other Member States have reviewed this chapter but did not submit inputs reflecting their own methodology as these were not yet approved at the time of writing (Sweden, in particular).

1.3 Chapter III Structure

This chapter starts with a general introduction about the place of cost-effectiveness in the economic analysis to be carried out under the WFD. It then reviews the alternative methodologies for a number of critical issues as follows:

10. Determining the appropriate scale for conducting the analysis;
11. Choosing the measures to be incorporated in the analysis;
12. Carrying out the pre-screening of measures;
13. Defining the effectiveness criteria;
14. Estimating costs;
15. Assessing effectiveness;
16. Dealing with uncertainty;
17. Involving experts and the general public;
18. Linking the cost-effectiveness analysis to further steps of the analysis.

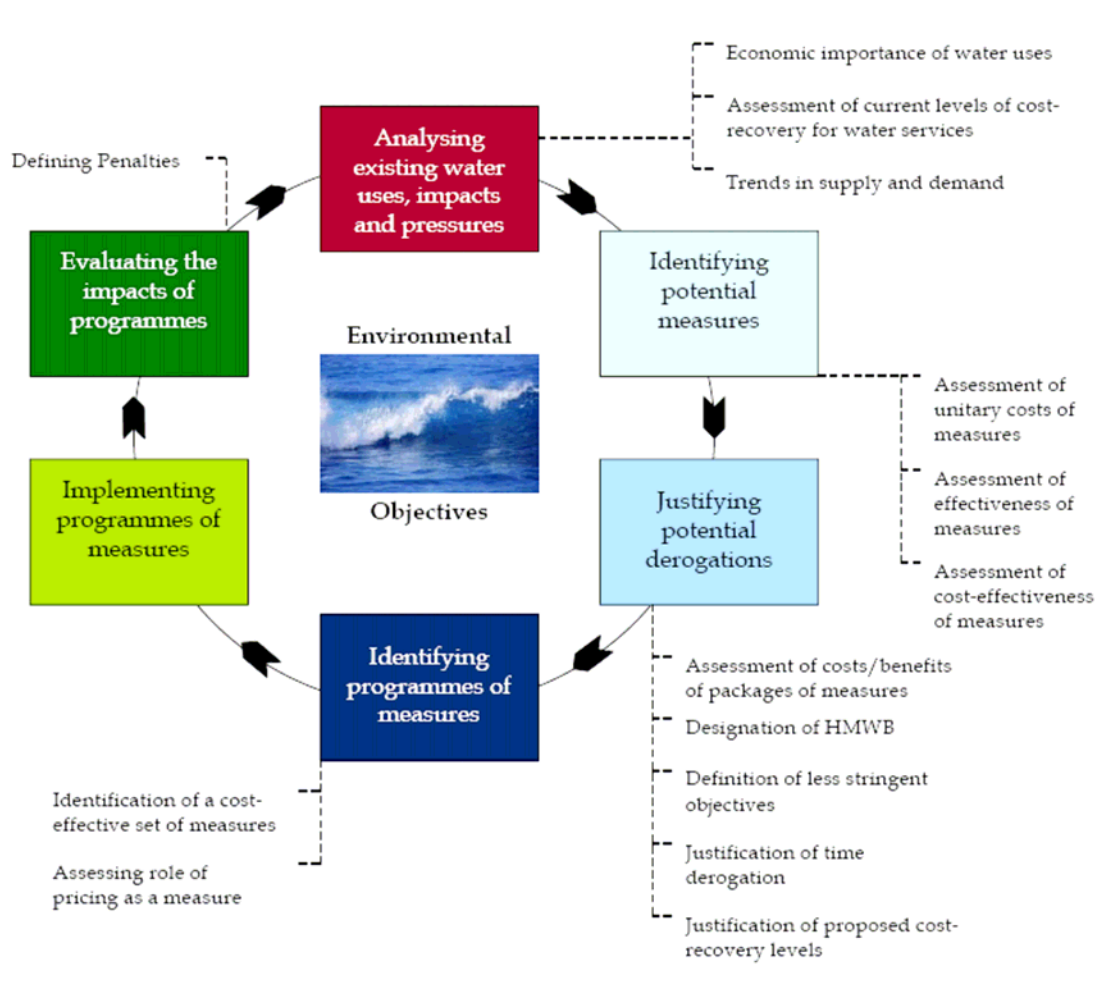
Recommended methodologies on each of those points set out in the Member States documents are presented in tabular format, with examples and references to real testing situations or available tools wherever possible. The text in each of the country boxes reflects only the way each country is addressing each of the key points and is not meant as a recommendation for a common European approach.

2. The place of cost-effectiveness in the WFD economic analysis

The main objective of the cost-effectiveness analysis in the context of the implementation of the WFD is to support decision-makers for making judgements about the most cost effective programme of measures to bridge a potential gap in water status between the baseline scenario and the Directive's objectives (as per Annex III of the WFD on the role of economic analysis). It can also provide information, in conjunction with information on benefits derived from expected improvements, for estimating whether those programmes of measures are disproportionately costly or expensive in order to justify potential derogation from the initial objectives, with either longer timeframes for achieving the objectives (time derogation) or lower objectives. Such economic analyses will help with the development of River Basins Management Plans by 2009.

These links between cost-effectiveness and the other elements of the economic analysis in the WFD are represented on Figure 1 below. Several elements of the economic analysis will need to be carried out on an iterative basis, which means that the cost-effectiveness analysis may need to be repeated several times.

Figure 1 – The link between cost-effectiveness and other elements of the economic analysis



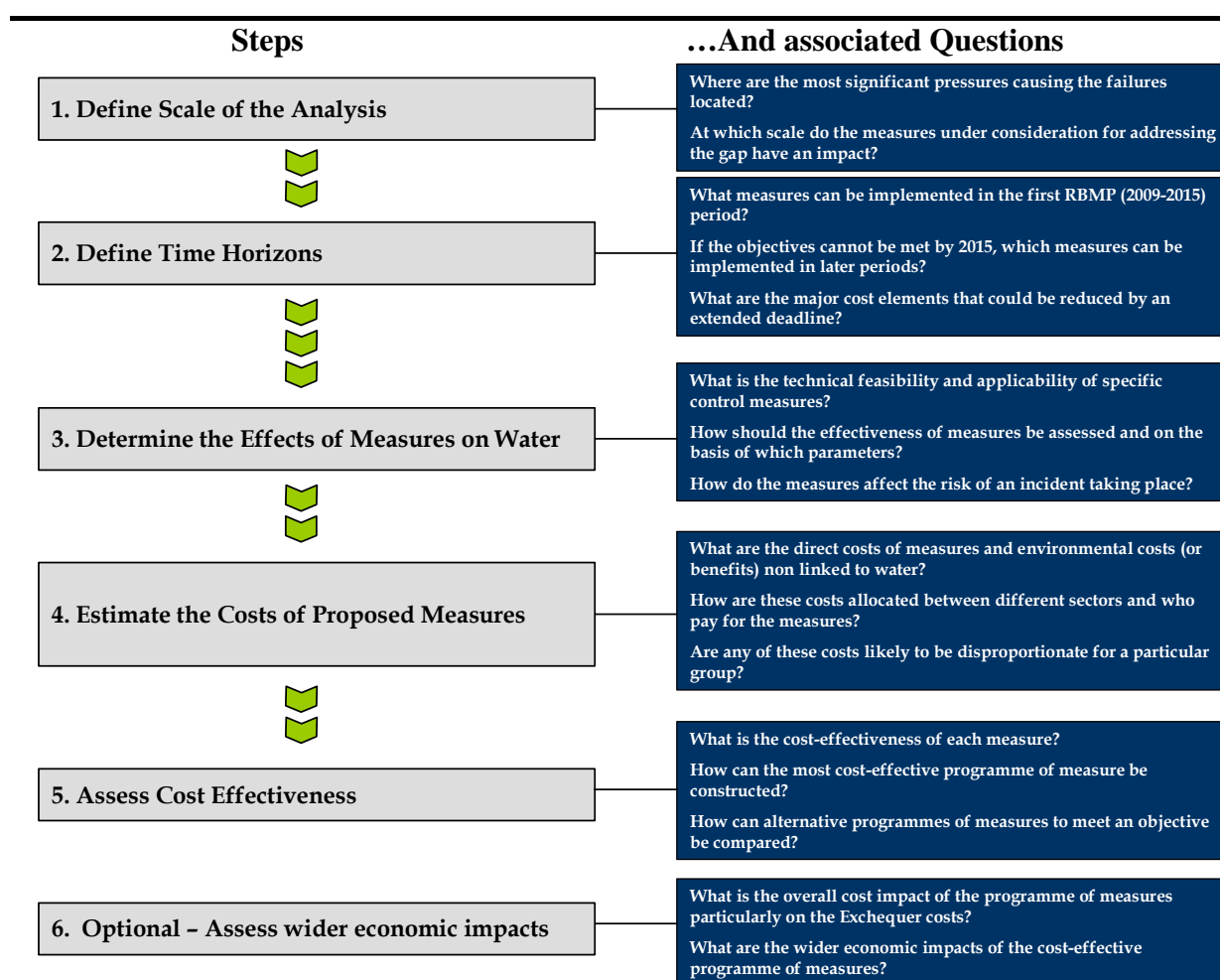
There are several pre-requisites for the cost-effectiveness analysis to be carried out. It requires that some other stages of the WFD implementation process have previously been completed:

- The objectives for the implementation of the WFD have been defined with the highest possible degree of precision and these objectives are known and understood in the same way by all stakeholders involved;
- Baseline trends of water uses, water services, water pressures and the ecological status of water bodies have been projected and any potential gap between the WFD objectives and the baseline ecological status has been identified for any relevant water body and for the different ecological parameter, together with significant water management issues;
- Where there are multiple activities contributing to a problem, the contribution of each activity to the problem has been identified;
- Where there are multiple parameters or quality elements affected, the relationship between these are known with precision;
- The set of all the potential measures for closing such gaps have been identified.

Member States do not have all such information available as yet. For example, the Directive's objectives are expressed in terms of achieving "good status" in the WFD but in several Member States, the notion of "good status" has yet to be defined in a detailed and practical manner, through the specification of environmental standards or conditions to be met. Besides, the identification of significant water management issues is not due until 2007.

According to the guidance document prepared by the WATECO working group, the cost-effectiveness analysis can be broken down into five basic tasks and an optional one (see the Information Sheet on cost-effectiveness analysis in the volume of annexes).

Figure 2 – Steps and Key Questions when implementing cost effectiveness



Source: WATECO guidance document

In the process of preparing the WATECO guidance document, the working group has identified a number of issues for which additional research and methodological insight would be required, several of which relate to the definition of a methodology for conducting cost-effectiveness analysis:

- On **environmental and resource costs** – What is the relevance of these intangible costs for the CEA? How can they be defined and how can they be used? Provided the measure of these costs is useful to decide on the least cost policy package, what valuation methods are available and how can they be used in the CEA framework in order to improve the decision process?
- On **uncertainty** – How can uncertainty be practically taken into account into decision making? In what ways can risk and uncertainty analysis may be of some help to improve the quality of the RBMP? In what situations will a sensitivity analysis need to be conducted? What is the value of the information needed to reduce the uncertainty in the decision process? When is a study to increase the information available and reduce decision uncertainty worthwhile?
- On **effectiveness** – How can the effectiveness of individual measures or combination of measures be assessed? How can one deal with measures that are simultaneously effective

to reduce pressures on quantity and quality? How can one deal with measures that are mutually exclusive? How can one deal with measures that need to be complemented with other measures or whose effectiveness depends on the availability of other measures?

- On **indirect economic impact** – which methods can be used for assessing the indirect economic impact of potential measures on key economic sectors? How can the impact of water policy measures on the local economy, price levels and employment opportunities be measured? Does the cost of assessing indirect effects compensate for the benefits of the new information we may get from this kind of studies?
- On the **role of prices and incentives** - what is the role of financial incentives as effective measures to reduce the demand of water services and thus water pressures? How can the effectiveness of financial incentives be assessed? How can the least cost combination of relatively inexpensive price incentives and relatively expensive direct measures be assessed? How can the monitoring and enforcement cost of price incentives be assessed? What are the properties of pricing schemes that increase compliance and reduce the need for monitoring and enforcement?

Some of these questions formed the basis for defining methodologies and guidance documents at the national level, reflecting national priorities and information availability. Key areas of such national documents are reviewed in the next section.

3. Key areas for comparison

This section examines how selected Member States are proposing to approach the main steps of the cost-effectiveness analysis for key areas that were identified as requiring further development or areas where alternative methodologies are possible.

Those key areas have been grouped as follows:

- The first set of sub-sections examines alternative methodologies for the key steps that make up the cost-effectiveness analysis, including determining the appropriate scale for the analysis, identifying suitable measures, carrying out a pre-screening of measures, evaluating effectiveness, estimating costs and finally, presenting the results of the cost-effectiveness analysis;
- The second set reviews cross-cutting issues, such as dealing with uncertainty and engaging with external stakeholders, via public participation and reliance on external experts;
- Finally, the last sub-section examines how the cost-effectiveness analysis can be linked to other components of the WFD economic analysis, such as the analysis of disproportionate costs.

For each of these issues, we set out the methodologies that have been proposed by Member States in their respective guidance documents or methodologies.

3.1 Determining the appropriate scale for conducting the cost-effectiveness analysis

The first step in the analysis consists of defining the required scale for the cost-effectiveness analysis, based on a consideration of where the most significant pressures causing failure of the WFD objectives are located. This sub-section examines what is recommended for deciding on the scale for undertaking the cost-effectiveness analysis and deciding on the most

appropriate combination of international, national, district and local assessments.

Summary of approaches

The WFD calls for the elaboration of programmes of measures based on the least-cost combination of measures by Member States at the level of each River Basin District or for the part of an International River Basin District that lies within its territory. Based on an evaluation of the practical issues involved with establishing such least-cost programmes of measures, all main documents (UK, G and NL) recommend carrying out the cost-effectiveness analysis first at the level where the environmental issue takes place. They also stress that integration between the analyses conducted at various scales should be verified at a later stage. The Dutch handbook goes into more details about how such integration can be ensured, as set out in the box on the Dutch methodology and example below.

Scale for the cost-effectiveness analysis	
WFD	The programmes of measures to achieve the Directives' objectives are to be prepared by Member States for each River Basin District (RBD) or for the part of an International River Basin District (IRBD) that lies within its territory.
United Kingdom	<p>The UK methodology recommends starting with the identification of risks and cost-effectiveness at the level of individual water bodies, as determined by the initial characterisation of water basins. Indeed, the methodology recommends carrying out a cost-effectiveness analysis only for water bodies where problems are comparatively more difficult to solve.</p> <p>The analysis may need to be broadened if pressures are common to more than one water body (including different types of water bodies), i.e. if the pressures are contributing to gaps in meeting the standards in other neighbouring water bodies. The scale of the analysis is unlikely to exceed the level of river basins, except when river basins are interconnected and where the analysis may need to apply to the level of the interconnected water bodies.</p> <p>To help systematic thinking about the issue of scale, the UK methodology distinguished between four types of problems:</p> <ul style="list-style-type: none"> • A local risk caused by a single pressure (Type 1); • Local risks caused by multiple pressures of the same type (Type 2); • Local risks caused by multiple pressures of different types (Type 3); • Similar risks caused by single pressure across several water bodies (Type 4). <p>Only the latter type (Type 4) would require the analysis of aggregate effectiveness of different general measures (or combination of local measures) applied to multiple locations or the evaluation of cost-effectiveness of new general (regional or national) measures. A local cost-effectiveness analysis could be used to highlight problems where potentially more cost-effective mechanisms could be implemented, for</p>

Scale for the cost-effectiveness analysis	
	<p>example at the national level.</p> <p>Note that these problem types have now been superseded in the guidance document under preparation in the United Kingdom.</p>
Germany	<p>The handbook recommends conducting cost-effectiveness analysis at the level of a given sub-basin first. The Handbook indicates that after the most cost-effective programme of measures has been identified at this level, it would be necessary to plan coordination with the programmes of measures in other sub-basins, which may lead to a reconsideration of the most cost-effective programme of measures. It would be necessary to check whether the proposed measures are possible if considered in the context of the other sub-basins and whether they are compatible with what is envisaged in neighbouring sub-basins.</p>
Netherlands	<p>The handbook assumes that the cost-effectiveness analysis should be performed at river-basin level since the most cost-effective programme of measures is to be derived at this level. However, for demonstration purposes in the handbook, the analysis is first explained for reducing an individual pollution source, then for similar sources within a single area and finally for different types of source in a single area. The handbook also examines in detail how upstream/downstream issues should be considered in order to build an integrated programme of measures and how transfers from one region to another may need to be considered in order to reduce the costs of measures whilst ensuring that one region does not bear more of its reasonable share of the costs (see Box 1 below for examples).</p>
France	<p>The Ministry of Ecology document recommends that appropriate measures be identified and the set of measures optimized for the geographical area affected by a significant water management issue. Given that the directive requires that objectives be set for each water body, in the absence of other aspects leading to downgrading of the status of the water bodies in the relevant area, the programme of measures thus derived will be considered as enabling attainment of good status for all of the water bodies in the area. For a single water body, the article 5 report may have pointed to specific and significant pressures that prevent the good status being achieved in a given area, without interfering with other water bodies. Additional actions may consequently be added to the programme of measures, without subjecting these actions identified to cost-effectiveness analysis, because of their local and specific nature.</p> <p>The testing document for the Normandy bogs does not recommend a specific methodology for defining the scale of the analysis. The test was carried out for the river Orne, a water body within a larger river basin.</p>
Spain	<p>The document suggests taking a two-step approach. First, one should consider measures at the administrative scale at which they are implemented and examine how they affect all water bodies within the administrative boundaries.</p> <p>Second, the interdependence between the different water bodies that</p>

Scale for the cost-effectiveness analysis	
	<p>make up the river basin should be taken into account. These interactions include the effect downstream of pressures and corrective measures taken upstream (for surface water) and the connection between surface and underground water bodies. The least cost package of measures is to be built up step by step, first by reaching the WFD objectives for a particular water source and then assessing the effects downstream and underground in a sequential analysis following the physical flow of the hydrological system. This requires identifying the programme of measures that solve environmental issues in the most up-stream sub-basin first then evaluating the impact on the next lower sub-basin.</p>
Denmark (Odense)	<p>The project chose the river basin scale for the CEA, with analyses undertaken for 12 sub-catchments, 11 smaller catchment areas for 11 lakes and the residual catchment area for the river basin and 5 ground water reservoirs. Special attention has been given to make an integrated Programme of Measures, i.e. integrating the interactions between sub-basins/water bodies in the river basin. To ensure coherence between the sub-basin analyses, the programmes of measures in the most up-stream sub-basins were identified first, before evaluating the impact that these measures have on the next lower sub-basin.</p> <p>For the purpose of this analysis, it was assumed that if a measure reduces the emission of a nutrient to a ground water reservoir, 20% of the effect can be felt in the down-stream catchment area. If a measure is taken in one of the lake catchments areas, it was estimated that 50% of the effect would benefit down-stream catchment areas. Measures taken in 4 of the 11 lake catchments have another lake catchment down-stream and it was estimated that 25% of their effect will benefit the Fjord (50% of 50% is 25%). These are simplified assumptions regarding the hydrology and ecological synergy effects. A hydrological or other form of geographical model should be used if a higher degree of accuracy and detail is needed. Such a need must however be weighted against the considerable resources needed to gather data for such a model.</p> <p>Besides, a higher degree of detail could have been chosen but ecological targets and needs for action would have needed to be set a more detailed level. This was deemed to be a time consuming exercise and that the degree of uncertainty could not have been lowered substantially by going into greater detail in this way.</p>

Box 1 – Dealing with scale issues in the Rhine East region: up-stream and down-stream issues

The Dutch handbook stresses that when a cost-effectiveness analysis is performed at the level of an up-stream river basin, the impact of the measures taken in the up-stream basin on the downstream basin should be tested. For example, if two Sewage Treatment Plants (STP) are discharging into a river which flows into a lake downstream, the impact of emission reduction in the upstream section of the river on water quality in the lake would usually be less

significant than the impact of emission reduction downstream. This would often mean that it may be more cost-effective to reduce emissions in the downstream STP, even if the costs of emission reduction at the upstream STP are lower. If the water quality between the two STPs is the most significant issue, then only the measures taken at the up-stream STP would be relevant.

A supra-regional analysis could show whether the same objectives (in this case, the water quality in a lake situated downstream) can be realised at lower costs for the river basin as a whole than if each source would apply the same emission reductions. If the downstream STP was to bear a larger proportion of the costs just because of its location, then a system of compensation between the two could be envisaged. Whether such “transfers” will be implemented is a political decision. In the Netherlands, for example, the general principle is that water managers are not allowed to transfer problems to each other, which means that the regions upstream will have to ensure that the pollution of the water they pass on to the regions downstream remains within reasonable limits. As a result, if the cost-effectiveness analysis reveals that it would be cheaper to concentrate the pollution reduction efforts in the upstream region, this may be difficult to implement from a political point of view. However, the objective of the cost-effectiveness analysis in that case would be to highlight the trade-offs. The pilot project in the Rhine East region was instrumental in developing this methodology and identifying trade-offs there. The analysis there was carried out for two main cases:

- A case in which every region attempts to attain the objectives defined for its area by implementing only measures that can be taken within the region (referred to as “without transfer”);
- A case in which it is assumed that the regions situated upstream first have to attain the objectives and then examining how this affects the downstream regions and what additional measures may need to be taken downstream to meet the objectives there (referred to as “with transfer”).

The total costs of the cost-effective package of measures with transfer were 30% less than in the case without transfer, as in the case with transfer many measures are no longer necessary in the downstream region.

Evaluation and implications

In practical terms, there may be other issues that may dictate scale which may not have been considered. For example, it would be much simpler to conduct a CEA of measures when the risks within the water body are uniform, as opposed to where the risks change from stretch to stretch.

Some Member States, such as the UK, are intending to carry out cost-effectiveness analyses only in areas where there is a significant environmental issues and where it is difficult to choose between alternative measures. Therefore, it may be the case that the programmes of measures presented in the River Basin Management Plans by 2009 contain measures that have not been submitted to the cost-effectiveness analysis test as they were introduced to solve environmental issues that were deemed comparatively simple to solve. This is in line with the principle embodied in the Directive that the economic analysis should be proportionate and that the more detailed economic analyses should be concentrated on significant water management issues, areas with conflicts between uses and where the integration between environment, economic and social issues is problematic, i.e. where it can help in taking better decisions.

There is a broad agreement that the integration of cost-effectiveness analyses carried out at different scales need to be considered in details but there is relatively limited guidance for doing so, apart from what appears in the Dutch handbook. The latter also points out that a supra-regional analysis is only interesting if co-operation between the regions is relevant and interesting. It also requires that the same approach be taken in each of the region, which means that coordination activities would be required between regions to ensure that the methodologies used are similar.

The same would apply for conducting cost-effectiveness analysis in transboundary basins, for which comparable methodologies should be developed on the different sides of the border. The issue of conducting cost-effectiveness analysis (and indeed, all other types of economic analysis called for by the Directive) in transboundary basins has not been explored in much detail so far. These issues were initially explored when conducting pilot testing for the Scheldt and the Rhine river basins. To conduct a cost-effectiveness analysis in a transboundary river basin, it would first be necessary to identify the significant water management issues at the international level and to carry out an initial comparison of the proposed methodologies in order to define areas where coordination is required. The preparation of shared catalogues of measures (see Section 3.3. for more on this type of initiatives) may also be helpful so that an agreement about the type, cost and effectiveness of measures be more rapidly reached when carrying out the analysis in practice.

3.2 Choosing the measures to be incorporated in the analysis

The second step consists of identifying which measures can be implemented in order to meet the objectives. This sub-section examines the approaches that are taken to identify the measures that form part of the analysis, i.e. whether the analysis should include:

- Measures and instruments or mechanisms, and how these are defined;
- Basic and supplementary measures or only supplementary measures;
- National measures and site-specific measures;
- Non-water policies and measures

Summary of approaches

Measures and instruments or mechanisms - The WFD requires that programmes of measures be prepared to meet its objectives and it specifies that both technical measures (such as the installation of fish ladders or membrane filtration) and economic and fiscal instruments can be considered as part of the programme of measures. This is reflected in the majority of the national documents, particularly in the German document. In general, the assumption is made that instruments are to be implemented at a relatively high scale (national or even European) and may require more time to be implemented.

The Dutch guidance is focused on building programmes of technical measures, because of a possible time lag in the implementation of instruments and higher uncertainty associated with the impact of instruments (given that instruments can only have an impact if they affect stakeholders' behaviour, which is more difficult to predict with certainty).

In the UK methodology, no distinction between measure and instrument is made but there is a reference to alternative mechanisms for implementing a given measure. The French and Spanish documents do not consider the distinction between technical measures and

instruments to be relevant and they would include technical measures and financial instruments in their programmes of measures.

Definition of measures and instruments or mechanisms	
WFD	The WFD calls for the preparation of a programme of measures in order to achieve the objectives of the WFD (Article 11). Preamble No. 38 of the WFD indicates that “the use of economic instruments by Member States may be appropriate as part of a programme of measures”.
United Kingdom	A measure is defined as an action to be taken while a mechanism is defined as the delivery process for implementing that action. A measure could have a number of delivery mechanisms: for example, a measure could be to reduce the use of fertilisers, which could be implemented through a range of mechanisms such as a ban on fertilisers, taxes, voluntary agreements or codes of practice. It is useful to identify the mechanism by which a measure is implemented when estimating the certainty with which an effect may be expected. When a measure can be implemented through several mechanisms, this should be considered as distinct options and costs (and effectiveness) estimated separately. The Guidance contains a list of potential delivery mechanisms in Table 2-5 on page B-14.
Germany	A measure refers to a concrete technical precaution which tends to have a local effect whilst an instrument is administrative, economic or advisory in nature. Instruments serve to support the implementation of measures by creating incentives for the relevant players to modify their behaviour. However, the Guidebook indicates that both “measure” and “instrument” should be seen as “measures” as defined by Article 11 of the WFD. Once the most effective programme of measures has been identified, the methodology suggests examining the effectiveness of instruments to be used to support the implementation of such measures over the medium to long-term. As a general rule, it is deemed that instruments with a higher level of intervention intensity (for example, orders and prohibitions as opposed to voluntary agreements) have a higher degree of effectiveness. The Handbook recommends not delaying the implementation of measures to wait for the adoption of instruments, however, as this would require policy intervention and could take longer.
Netherlands	A measure refers to a technical measure, i.e. a physical intervention that leads to a desired effect such as a reduction in emissions. An (economic) instrument is what may be applied to implement the package of measures eventually selected. The purpose of the instruments (such as tax or prohibitions) is to change the behaviour of the various parties so that they would carry out the measures. The cost-effectiveness analysis focuses on selecting the most cost-effective measures, assuming that the choice of instrument is largely a political consideration. The choice of cost-effective instruments is therefore not dealt with in the handbook, although it indicates that the same methodology could be used to evaluate the cost-effectiveness of instruments, adjusting for higher uncertainty.

Definition of measures and instruments or mechanisms	
France	A measure can either be a practical action, financial incentives, new rules or a cooperation agreement. The definition of measure is therefore all encompassing. No distinction between measure and instrument or mechanism is made.
Spain	The difference between measure and instrument is not considered relevant in the Spanish document. Measures in general include any alternative intended to reduce demand for water services, increase supply of water services or enhance the efficiency in the provision of water services. Whatever the package of these kind of measures, it will be complemented with a financial plan that includes some economic incentives needed both as a measure to improve the ecological status and as a cost recovery instrument. The RBMP should also include “support” measures, of which the direct objective is not to improve ecology but to increase the effectiveness of the policy package, i.e. to increase the social acceptability of the water policy objectives or to improve the water management institutions and its capacity to enforce the RBMP.
Denmark (Odense)	The focus was on technical measures and not economic or fiscal instruments, assuming that the choice of instrument is largely a political consideration.

Basic and supplementary measures - Article 11 of the WFD draws a distinction between basic and supplementary measures. Annex III of the Directive indicates that the “economic analysis should contain sufficient information to make judgements about the most cost-effective combination of measures in respect of water uses to be included in the programme of measures under Article 11 based on estimates of the potential costs of such measures”. This would seem to suggest that the cost-effectiveness analysis is to be carried out for both basic and supplementary measures, although this is not explicitly stated in the Directive’s text. An alternative interpretation, which has been retained by most Member States which have published their methodology, is to say that a programme of measures should include both basic and supplementary measures but that only supplementary measures should be subjected to the cost-effectiveness test. Some MS restrict the applicability of the CEA further, as in Germany for example, by stating that it should be used only in “complex situations” and that a full cost-effectiveness analysis may not be required in comparatively “simpler” situations, particularly when supplementary measures are not needed.

Type of measures: basic and supplementary measures	
WFD	Article 11 of the WFD indicates that each programme of measures shall include “basic” measures and, where necessary, “supplementary” measures. “Basic” measures are the minimum requirements to be complied with based on existing environmental legislation and “supplementary” measures are those measures designed and implemented in addition to the basic measures, with the aim of achieving the WFD objectives.
United	The UK methodology does not make specific references to basic and

Type of measures: basic and supplementary measures	
Kingdom	<p>supplementary measures but it indicates that problems that can be solved by implementing “obligatory measures” specified in other EU legislation (such as UWWTD) or by measures already agreed do not call for the application of a full cost-effectiveness analysis. It specifies that measures that are under consideration or are being implemented through existing regulatory agency planning and control processes and which may have an impact on the achievement of WFD objectives should be included in the baseline scenario. This means that, whenever a cost-effectiveness analysis is required, it should exclude basic measures and include only supplementary measures. New basic measures will be subject to existing Regulatory Impact Analysis prior to their introduction and hence no additional CEA is required. For existing basic measures, the CEA is only relevant where there is some choice about their application. This would need to be examined in a case by case manner.</p>
Germany	<p>The Handbook recommends that a CEA be conducted only when a pressure situation exists which comprises significant multiple pressures. In such a complex situation, a detailed CEA would be required to identify the most cost-effective programme of measures. It does not specify whether both basic and supplementary measures are to be considered in the analysis. However, from the catalogue of measures and instruments proposed in the handbook, one can conclude that basic measures are not considered within the CEA.</p>
Netherlands	<p>The Dutch handbook was written to aid regional water managers to perform the CEA for the WFD. The primary aim is to determine the cost-effective set of technical additional measures to achieve the WFD objectives (additional means in addition to present policies and the implementation of basic measures, i.e. supplementary measures). The method described in the handbook is general and could also be applied to find cost-effective sets of technical measures to achieve the goals laid down in present policies through ‘basic measures’, although this is not required. The ultimate programme of measures should include the basic measures and the cost-effective measures to achieve the WFD objectives as far as possible. The CEA methodology therefore primarily applies to supplementary measures.</p>
France	<p>The Ministry of Ecology document recommends that CEA should not be used when the measures already decided (i.e. the basic measures) make it possible, by themselves, to achieve good status by 2015 (i.e. where there is no risk of failing to achieve the good status). It recommends that CEA be applied only to the new measures (i.e. supplementary measures), identifying the best, and least costly, route possible for achieving the objective.</p> <p>When there is a gap in good status, the testing exercise in the Normandy bogs recommends including basic measures in the evaluation of the combination of measures to achieve good status but recommends distinguishing between basic and supplementary measures for the cost evaluation.</p>

Type of measures: basic and supplementary measures	
Spain	<p>The methodology recommends including basic measures in the analysis of the combination of measures to achieve good status and to then incorporate supplementary measures on the basis of cost effectiveness indicators. It also recommends distinguishing between basic and supplementary measures for the evaluation of the costs of the programme of measures.</p> <p>The methodology also recommends introducing support measures such as education campaigns, regular reporting to monitor the degree of compliance, periodic reports on water uses and water efficiency, institutional facilities for voluntary compliance, and so forth. None of these measures affect the environment directly. These measures cannot be assessed in terms of water quality effectiveness but they are important to guarantee the effectiveness of the RBMP as a whole. In order to avoid double counting, these measures are defined as supplementary measures and their costs are treated as fixed costs.</p>
Denmark (Odense)	<p>Both basic and supplementary measures are analysed in conjunction. Basic measures include measures that are being implemented through existing regulatory planning and control processes, i.e. the third Action Plan for the Aquatic Environment (2005) and regional environmental planning (2001-2013). The effectiveness of basic measures is integrated in the analysis to identify the need for supplementary action/measures to achieve good status, and to “identify” potential interaction between measures. In the cost evaluation, a distinction is made between basic and supplementary measures.</p>

National measures and site-specific measures – The WFD does not establish a distinction between national measures and site-specific measures for the purpose of the CEA. The national documents focus on site-specific measures for the CEA and do not deal in detail with situations where it may be more cost-effective to introduce a national measure instead of site-specific measures.

For example, the UK guidance, which is currently under preparation, foresees the main role of the CEA for providing information on the relative cost-effectiveness of local delivery mechanisms, for example to choose the level of enforcement or whether to undertake an information campaign. The development of new national measures would be undertaken at a national level using established Regulatory Impact Analysis techniques. But as mentioned in the analysis of scale issues above, when similar risks are caused by a single pressure across several water bodies, the UK methodology calls for the analysis of the aggregate effectiveness of different general measures (or combination of local measures) applied to multiple locations or the evaluation of cost-effectiveness of new general (regional or national) measures. In such case, a local cost-effectiveness analysis could therefore be used to highlight problems where potentially more cost-effective mechanisms could be implemented, for example at the national level. In fact, the UK methodology encourages the identification of general measures that could be taken at regional or national level and be applied in multiple cases at the local level in a forward-looking manner (i.e. even identifying measures that could be taken in subsequent planning cycles, by 2021 or 2027). For each of the proposed measures and

instruments, the German handbook identifies the players involved (i.e. the relevant administrative/legislative level) for implementing the measures.

Non-water policies and measures – The WFD did not introduce a distinction between water and non-water policies and measures and nor did the national documents setting out methodologies for the CEA. Such distinction may be relevant from a practical point of view: some measures, such as the adoption of higher wastewater treatment standards would clearly be related to the field of water policy whilst other measures, such as the reduction of diffuse pollution at pig farms or changes in fertilizing practices are more directly related to agricultural policy. Non-water policies and measures are clearly considered in examples developed in national documents.

We will see later when discussing the catalogues of measures elaborated at the national level that the bulk of these catalogues tend to be focused on water-related measures, however, which could introduce the risk that mostly water-related measures would be included in the list of relevant measures when more cost-effective non-water related measures could be considered instead (see Section 3.3). Non-water policies and measures would also require a more detailed and explicit treatment of wider economic costs (see Section 3.5), which some MS are not planning to include at the CEA stage (and only at the cost-benefit analysis stage for evaluating disproportionate costs). The identification of synergies with non water policies and measures may help MS develop the most cost-effective programme of measures.

Evaluation and implications

The choice of measures and instruments to be included in the cost-effectiveness analysis may vary from one country to the next depending on the methodological, economic, social and political issues that countries are confronted with.

The distinction between measures and instruments, although it is made by several national documents, appears to be more important from a conceptual than from a practical standpoint. For example, although the Dutch guidance focuses on technical measures for elaborating their programme of measures, they state that this would not result in some more cost-effective instruments being discarded because it is deemed that economic instruments always need technical measures to be effective (for example, the instrument ‘forbidden’, i.e. no longer allowing a particular type of production, is seen as the technical measure to reduce production by 100%). Apart from the Dutch guidance which introduces this slight nuance, all other documents therefore treat measures and instruments (also referred to as “mechanisms”) as measures for the purpose of carrying out the CEA.

Most MS would distinguish between basic and supplementary measures (as per the Directive’s text), but would stress that CEA should be carried out primarily to select the most cost-effective programme of supplementary measures, given that per definition, basic measures have already been included in the baseline scenario (except when there is some choice or uncertainty about the mechanism for implementing basic measures, in which case a CEA may also be helpful). For the purpose of the disproportionate cost analysis, however, the entire programme of measures (incorporating both basic and supplementary measures) would likely be considered.

Finally, although national measures and non-water policies and measures are in theory included in the CEA, their treatment may vary slightly from MS to MS. For example, the UK

would prefer focusing the CEA on local implementation mechanisms and select national measures through more traditional means, such as Regulatory Impact Analysis techniques. Even if they are selected in such a way, the national measures would still need to be included in the programme of measures in order to get a full picture of the total costs of the programme of measures. The UK methodology also points to circumstances where the analysis of local water management issues may prompt the development of a national measure, when the same pressure is causing similar risks across unrelated water bodies.

We note that none of the documents explicitly consider the objectives of non water policies or seeks to distinguish between water policies and non-water policies.

3.3 Carrying out the pre-screening of measures

This sub-section examines the approaches that are taken to select relevant measures (“pre-screening”), in order to include only the relevant ones in the analysis.

Summary of approaches

Although this step is not specifically mentioned in the WFD (or in the WATECO guidance), all national documents put specific emphasis on the need to pre-select measures before initiating the cost-effectiveness analysis. This may be done from pre-existing lists or catalogues established at the national level in order to facilitate the task of water managers at the local level. All MS that have prepared a document have also prepared a catalogue of measures at the national level which are at various stages of completion. Some of them are available on the Internet (see below).

For example, France has developed a thesaurus in order to pre-identify a maximum of measures dedicated to solve different types of issues (diffuse pollution, point source pollution, hydromorphological changes).

Based on such a catalogue of measures, the UK methodology recommends that a pre-screening of measures be carried out so as to eliminate the measures that have the lowest cost-effectiveness, either because they do not meet a particular threshold or because they rank lowest in terms of cost-effectiveness. The Dutch handbook also requires that a pre-screening be done based on local experts’ judgment, to distinguish between theoretically possible measures and those that could be implemented in practice in the area. The German handbook, by contrast, does not recommend any specific pre-screening. The French and Spanish documents are fairly unspecific about the type and objectives of such pre-screening, although Spain is in the process of elaborating a methodology to check the impact of alternative pre-screening methods on the final result.

Pre-screening of measures	
WFD	Pre-screening of measures is not identified as a necessary activity and there are no specific references to pre-screening in the Directive.
United Kingdom	The UK methodology recommends that potential measures be identified in a systematic way, starting with an assessment of the pressures and identifying the measures that can address such pressures by removing, relocating or reducing the pressure or remediating the impact of the

Pre-screening of measures	
	<p>pressures by carrying out restoration work (see the Flowchart 2 – Identifying Measures on page B-11). Mechanisms to implement such measures should also be identified, bearing in mind that more than one mechanism may be used to implement a measure. This exercise can be done on the basis of catalogues of generic measures and mechanisms. For the purpose of evaluating costs, the UK methodology identified 16 different types of measures (see Table 3.2 on p. C-12).</p> <p>Pre-screening of measures may need to be carried out when there is a high number of measures that could be considered. This would need to be done based on preliminary cost and effectiveness estimates. Measures that do not reach a minimum threshold of effectiveness could be eliminated prior to conducting a more in-depth assessment. Such effectiveness threshold could be set as the achievement of good status, although it is highly unlikely that a single measure would be sufficient to reach good status, which means that a lower threshold would most likely be required. Alternatively, the measures that are eliminated could be the measures that rank lowest across all effectiveness attributes or a majority of them.</p>
Germany	<p>The Handbook identified seventeen measures and ten instruments, which are deemed to cover many of the significant problems defined by the WFD and which are reviewed in detail in Annexes to the Handbook. This is seen as an “open catalogue” of measures, which may need to be extended in specific cases. These measures and instruments are classified according to the category of pressure they can address, the polluter category and the deficit parameter.</p> <p>The Handbook recommends the use of a “cause/effect matrix” for each water body in order to assess the effect of individual measures on the particular body of water and identify which measures may be relevant. The effectiveness of measures on the water body indicators or pressure situation should be given a grade, such as “no effect”, “low improvement”, “medium” or “high effect”.</p> <p>The Handbook contains no further guidance as to how these grades can be attributed and on the basis of which criteria however.</p> <p>This classification is then used for the prioritisation of measures, depending on the effectiveness of the individual measure and on how widespread its effects are on WFD good status indicators. For example, if a measure has an effect on several indicators of ecological deficits, these effects would be compounded to derive the order of priority for this particular measure. Only the high priority measures would be considered further for the assessment of the most cost-effective combination of measures. Box 2 below shows how this can be done.</p>
Netherlands	<p>A list of measures has been prepared at national level in the Knowledgesystem Measures, available in Dutch on http://www.kaderrichtlijnwater.nl. This system contains generic information on the costs and effects of measures, but the handbook does not indicate how this generic information on costs and effects has been</p>

Pre-screening of measures	
	<p>compiled or on the basis of which methodology.</p> <p>As a first step, the handbook recommends that a selection of theoretically relevant measures should be made from this long list of measures, based on the analysis of the problem type, the cause of the load and the defective policy. Second, it is recommended that a number of measures be dropped as a result of regional knowledge, to keep only the practically relevant measures.</p> <p>The handbook recommends that such an initial “quick scan” be carried out as early as possible (2005) in order to identify what additional information needs to be collected and carry out the more in-depth analysis in 2006/2007.</p>
France	<p>A catalogue of measures (thesaurus) has been prepared at the national level, in excel format (available on request). Some measures have been carried out, and in a few cases they have been assessed. Such case studies will progressively be collected, and sheets describing them will be uploaded on the web, at www.eaufrance.fr and www.gesteau.fr. According to the Ministry of Ecology document, the CEA should start by identifying the possible measures to address each of the issues identified on the basis of reports prepared to fulfil the requirements of Article 5 of the WFD.</p> <p>The methodology used in the Normandy bogs recommends that a short list of measures suitable for the quality issues in the study area be drawn up. This will require evaluating the measures’ effectiveness and estimating the level of intensity at which it should be applied to be effective (surface, length, etc...).</p>
Spain	<p>A preliminary catalogue of measures has been developed in Spain. The catalogue will be complemented with experts, stakeholders and water management authorities’ contributions in each river basin. Each measure in the catalogue is fully identified with the relevant information needed to specify the measure in a particular water body. This information includes the financial costs depending on the scale of the measure, the parameters that may allow determining its effectiveness, the identification of other possible economic impacts and institutional constraints. For combinations of measures, the catalogue also includes information on complementarities, incompatibilities and synergies between measures. The pre-screening of measures starts with the basic measures. The guidance recommends starting by examining the water bodies at risk and the potential causes for such risks in order to help with the pre-screening of measures. Spain is in the process of developing a model in order to derive the least cost programmes of measures, which will be able to assess how the final result is sensitive to different pre-screening strategies.</p>
Denmark (Odense)	<p>More than 40 measures were identified that can address the pressures in the Odense Fjord (nitrogen, phosphorus and hydromorphological pressures) in the river basin by removing, relocating or reducing the pressure or remediating the impact of the pressure by carrying out</p>

Pre-screening of measures	
	<p>restoration work. The pre-identified measures can solve different kinds of issues and were categorized in measures related to agriculture (diffuse pollution), measures to protect groundwater, point sources measures, nature restoration /streams and measures at lakes. The identification and determination of available measures was based on local expert judgement to distinguish between theoretically possible measures and those that could be implemented in practice in the area, i.e. only measures that were deemed “reasonable” in terms of cost and effectiveness were included. This also involved setting a maximum dose of the measure available for each recipient. An example is numbers of hectares of agricultural land that can be converted to wetlands or number of houses that can be connected to the collective sewage system. Special attention was given to measures having overlapping effect in order to avoid double counting.</p>

Box 2 - Using a cause/effect matrix according to the German Handbook

The German Handbook recommends using a cause/effect matrix to identify measures that are suitable for inclusion into a combination of measures, because they are amongst the most effective. The impact that these measures can have on indicators of ecological deficits is first evaluated in broad terms, by attributing “x” if the effect is likely to be low, “xx” for a medium effect and “xxx” for a high effect. Prioritisation of measures is done based on how widespread the effects are on the various indicators of ecological deficits and on how effective they are for each. This is done in the matrix below (5.2) by counting the number of crosses and then classifying in order of priority, based on an assumed classification key (5.3). This allows filtering out ineffective measures at the initial stage.

Table 5-2: Example of a cause/effect matrix with classification of priority

Measure	Indicators of ecological deficits (Water Framework Directive, Annex V)				Sum total of individual evaluations	Classification of priority
	Macrophytes	Algae	Benthic invertebrate fauna	Fish fauna		
1.1			x	x	2	1
1.3				x	1	1
2.1	xx	x	xxx	xxx	9	3
4.2	x		xx	xx	5	2
5.1			x	xxx	4	1
5.3	xx		xx	xx	6	2

Table 5-3: Assumed classification key

Sum total of individual evaluations	Description of effectiveness	Classification
12 - 9	High level of ecological effectiveness	3
8 - 5	Medium ecological effectiveness	2
4 - 1	Low level of ecological effectiveness	1
0	No ecological effectiveness	0

Evaluation and implications

The catalogues of measures can help in sharing information on possible measures between MS. Several of them are still in the process of development but already provide excellent sources of information on potential measures.

The German catalogue of measures, presented as an Annex to the Handbook, contains a practical description of the measure, an analysis of the effects, of the time required, scale of implementation, interactions with other measures, cost estimates and uncertainty factors. It also identifies the likely players involved. Some of the measures included in the German handbook are non water-related, such as Measure 2.4 “Environmentally compatible handling of pesticides – compliance with the principles of good agricultural practice in plant protection”.

The Dutch Knowledge System Measures (www.paict.com) covers more than 200 possible measures, with a description of approximately the same type of information as in the German handbook. Because the system is still under construction (more measures will be included and data will be checked in the second half of 2006), it is only available in Dutch. The UK database contains 90 measures and additional measures are going to be added in the near future.

Considering the high number of measures that can potentially be considered, conducting a pre-screening at the local level prior to carrying out a full CEA appears critical, even though it is not specifically required by the Directive. The first stage of pre-screening, as recommended by the Dutch handbook, would usually be aimed at distinguishing practicable from theoretically possible measures and would not usually result in discarding potential measures if they can be practically implemented.

A further pre-screening stage, consisting of discarding some potentially less cost-effective measures, may introduce the risk that some cost-effective measures be discarded at an early stage, however, because the information available for such pre-screening was incomplete or inaccurate for example. This would be particularly true for measures that may not be very cost-effective in and of themselves, but would have a positive correlation with and support the introduction of other measures. When the cost-effectiveness is at a relatively advanced stage, it would therefore be useful to look back on the measures considered prior to the pre-screening stage to verify that none of the potentially interesting measures has been discarded early in the process. This is what the model being built by Spain is intended to do (we note that Spain is also proposing to not include support measures in the cost-effectiveness analysis, precisely because their cost-effectiveness may be relatively low even though they would support the effectiveness of the whole programme). Above all, the pre-screening process should be transparent, follow objective criteria and clear guidelines.

3.4 Defining the effectiveness criteria

This sub-section examines the approaches taken to defining the effectiveness criteria (such as biological indicators, ambient quality or emissions, doses, technologies) and how effectiveness is defined when multiple standards are relevant (such as hybrid standards, qualitative assessment or other) because good ecological status is defined based on various parameters.

Summary of approaches

The WFD does not define effectiveness, apart from stating that the programme of measures must help attain the WFD's environmental objectives in a cost-effective way. As a result, there are considerable differences in methodologies proposed by MS for evaluating effectiveness and in the degree of emphasis placed on evaluating the effectiveness of an individual measure versus the effectiveness of a combination of measures. For example, whereas the UK methodology places comparatively more emphasis on producing a detailed assessment of the effectiveness of each individual measure on the quality indicators on which they can have an impact, the German handbook is more focused on examining how combinations of measures can be derived (this partly reflects the fact that detailed assessments of the effectiveness of measures were carried out for preparing the catalogue of measures). The methodologies for constructing combination of measures are discussed later in the sub-section 3.6. entitled "Assessing cost-effectiveness".

The UK methodology sets out an extensive list of effectiveness criteria (including magnitude, speed, durability, adaptability and practicability of effects, as well as side effects) although it later acknowledges that the most important characteristic is the magnitude of the effect, which needs to be expressed in terms of intensity and geographical scale). By contrast, the French document and particularly the methodology tested in the Normandy bogs chose not to assess the effectiveness of each measure but rather to examine directly the effectiveness of a

combination of measures to achieve “good status”. The German handbook recommends characterising the effectiveness in a summary fashion (with a varying number of crosses), in order to facilitate the construction of combinations of measures at a later stage. Note that testing of alternative measures of the effectiveness of measures is still ongoing in some Pilot River Basins.

Evaluating the effectiveness of an individual measure	
WFD	Effectiveness is not specifically referred to nor defined in the text of the Directive. The objectives of the cost-effective programme of measures to be constructed are to meet the WFD’s environmental objectives, as defined in Article 4. Therefore, effectiveness needs to be defined in relation to such environmental objectives.
United Kingdom	<p>In the guidance, effectiveness attributes are grouped as follows:</p> <ul style="list-style-type: none"> • Magnitude of effects, i.e. the performance of a measure to address the gap in the environmental parameter; • Characteristics of effects, such as the speed, the durability and the adaptability (i.e. the ability to adapt the measure in response to the results of monitoring, which may be important when the environmental response is uncertain) of those effects; • Practicability, reflecting what is locally acceptable and for which local delivery mechanisms or planning processes are in place ; and • Side effects within the water body or non-water body effects, which could be positive or negative. Indeed, a measure whose primary effect is on a given environmental standard (or quality element) may also have side-effects on other environmental standards. <p>Information on the magnitude of effects is the bare minimum to be collected about each measure. It should be expressed in terms of:</p> <ol style="list-style-type: none"> 1. Intensity of effect (e.g. reduce concentration by a given amount); and 2. Geographical scale of effect (e.g. over what length of river). <p>These parameters can be expressed either in absolute terms or as a percentage of the gap in environmental standard to be reduced (this requires that the gap itself be recorded both in terms of intensity and geographical scale). The intensity of effect can be expressed as a function of the effort put in, i.e. the application of resources to achieve a desired effect. Indeed, the same measure could be applied with varying degrees of effort and resulting effect.</p> <p>The inclusion of other effectiveness attributes would depend upon information availability and the type of measures that are being considered. For example, when comparing combinations of measures with varying requirements for intervention to maintain effectiveness over time, it would be important to compare the durability of effect for each measure. These additional attributes are most likely going to be expressed in qualitative terms (low, moderate, high) rather than in numeric terms. Key information concerning certain attributes that cannot be specified in numeric terms should not be lost and should be adequately recorded to be taken into account at the decision-making stage. These additional attributes may help in differentiating measures which otherwise have</p>

Evaluating the effectiveness of an individual measure	
	<p>similar magnitude of effect. They will also need to be reported when comparing combinations of measures (see below). The methodology contains worksheets in Appendix B of Section B of the report which allow keeping track of all effectiveness attributes in an orderly fashion.</p> <p>The definition of effectiveness in the UK methodology, which is comparatively complex, means that the combinations of measures will ultimately need to be compared based on a variety of parameters rather than a single one. An example of such comparison matrix is given in Box 3 below. The methodology places limited emphasis on deriving a combination of measures as it is more focused on estimating effectiveness for a given measure. Nevertheless, it recommends conducting pair-wise comparisons between measures to highlight ways of building the most cost-effective programmes of measures. Where there is a common and quantifiable relationship between the effects of different measures on the same environmental parameters, it may be possible to combine the attribute values for magnitude and certainty of effect for the individual measures to form a single set of values for a combination of measures. The methodology points out that the choice of the “best” combination of measures will depend on the level of risk that is deemed acceptable.</p>
Germany	<p>The German handbook does not give any overall guidance on estimating the effectiveness of measures but rather proposes a detailed evaluation of effectiveness for the seventeen measures and ten instruments are featured in the catalogue of measures, based on a review of the literature. These estimates act more as guides to estimating effectiveness at a local level rather than definitive estimates or off-the-shelf values that could be used without adjustment.</p>
Netherlands	<p>The handbook points out that defining effectiveness is not easy given that the WFD objectives are defined in two ways: maximum concentrations and ecological objectives. Drawing the link between the two can be difficult: for example, it may be difficult to anticipate the effect of reducing the concentration of 1 kilogram of zinc on the biodiversity for macrofauna or fish in general or in a given water body. Nevertheless, the handbook requires that the effects be described at least in general terms (through bandwidths or qualitatively).</p> <p>In the Handbook itself, effectiveness is defined in terms of reductions in the discharges into surface water (emission reductions). This is justified by the fact that the WFD objectives are often formulated in terms of maximum concentrations and that the costs and effects of measures are usually described in terms of emission reduction. This assumes that the relation between emission reduction and progress towards fulfilling objectives is known in some detail, which would require the elaboration of regional water quality models. A similar methodology is also employed for the analysis of hydromorphological measures, although this requires some adjustment (see Box 4 on the use of a comparable approach for hydromorphological measures).</p> <p>The methodology suggests reviewing the effectiveness of measures implemented at different points in case of point source pollution. For</p>

Evaluating the effectiveness of an individual measure	
	<p>diffuse pollution, the methodology points out that there is an uncertainty with respect to the impact of a given level of emission reduction at farm level on emission reduction in the surface water. The effect of alternative measures must therefore be adjusted by the impact they have on emission reduction in the surface water.</p> <p>The Handbook also examines the case where multiple standards are relevant, because good ecological status is defined based on various parameters. It reviews the specific case of eutrophication, which can be prevented by reducing N and P loads and recommends the use of “eutrophication equivalent” (see Box 5 for an application of this methodology for eutrophication). An alternative methodology (if measures have effects on various substances) consists of:</p> <ul style="list-style-type: none"> • First, defining the substance that is causing the most serious problem and carrying out the cost-effectiveness analysis for this substance; • Next, determining to what extent the set of measures produced by this analysis will simultaneously fulfil the objectives for the other substances; • If it does not, the analysis can be repeated with the remaining measures for the substance that will then cause the most problems in attaining the objectives (and repeat the same steps subsequently for the remaining substances, until all objectives are attained). However, it may be that for the last substance, the emissions are pushed back more than necessary. In that case, one could consider implementing the last measure included in the package of measures only partially, as a result of which the objectives for the last substance would be fulfilled exactly. However, it may be that measure included in the package at the start of the analysis become superfluous because measures that were given lower priority in the package will also reduce the emissions of the substances analysed first.
France	<p>The Ministry of Ecology document does not provide any specific guidance on evaluating the effectiveness of a particular measure. It only recommends evaluating its contribution to achieving the environmental objective (in percentage terms) in a qualitative way.</p> <p>The document for the test in the Normandy bogs notes that a key problem for comparing effectiveness is that, with respect to the environment, effectiveness is multi-dimensional (for example, effectiveness for reducing nitrates, phosphates or improving flow) and may need to combine quantitative assessments (e.g. nitrate rate at 40mg/L) with qualitative ones (e.g. elimination of eutrophication problems). Several solutions are offered:</p> <ul style="list-style-type: none"> • Building combinations of measures with similar effectiveness for all criteria; • Evaluating effectiveness for an overall indicator (e.g. the length of river that has acquired good status) rather than for certain criteria (N, P, etc...).

Evaluating the effectiveness of an individual measure	
	<p>This second solution was retained in this methodology, on the assumption that it appears to be more in line with the objectives of the WFD. The approach consists of building combinations of measures that reach a given level of effectiveness (“good status”) and then to evaluate and compare the costs of each combination. This means, however, that the cost-effectiveness of each measure is not evaluated separately and that the methodology does not give any indication on how the individual measures can be prioritised to build such combination.</p> <p>In the absence of a clear definition of “good status”, the test relied on eight parameters (nitrogen, phosphorus and phytoplankton, micro pollutants, microbiological indicators, MES, habitat and hydromorphology) and defined a minimum threshold for each of these parameters to define “good status”.</p>
Spain	<p>The effectiveness of a measure is defined as the expected contribution of this measure to close the gap between the baseline and the objective value for a given parameter measuring a component of the ecological status in the water body where the measure is applied (for example, water flow increase, reduction in physical units in the concentration of a particular pollutant, etc.). Indirect effects on other connected water bodies are not considered at this initial stage, but are considered later on when integrating water measures at a river basin scale. Such effectiveness indicators are dependent on the coverage or intensity with which the measure is applied (number of farms affected, number of firms covered, percentage of leaks mended, etc.)</p>
Denmark (Odense)	<p>The emphasis was placed on estimating the effectiveness of individual measures, defined in terms of reductions in the nutrient (nitrogen) discharges into surface water (emission reductions). Although there were several pressures at play in the river basin, nitrogen was the only parameter that could be fully quantified in terms of target reductions for different measures, as explained in Box 6.</p> <p>The effectiveness evaluation was based on available data from national work on the third Action Plan for the Aquatic Environment (2005) which includes scenarios for the Odense river basin. The data can be used considering that the evaluated scenarios for the reduction of nitrogen and phosphorus loads to surface waters were more extensive than the requirements that were actually decided later on. In some cases, estimates of effects based on local knowledge was used, including based on extensive monitoring work carried out by the County or data for wetland restoration projects. To estimate the effectiveness of area related measures/diffuse pollution on surface waters a differentiation in retention coefficients was made between measures implemented in river valleys (low retention) and higher grounds (high retention).</p>

Box 3 – Comparing combinations of measures based on effectiveness as per the UK methodology

As indicated above, the effectiveness of each measure, and hence, of each combination, is made up of multiple effectiveness attribute values. In order not to loose important information

(other than magnitude and certainty of effect), the methodology recommends setting out all attributes in a matrix format (as on Table 2-18 below), and to leave the attribution of weighting factors to those different attributes to the preferences of individual decision-makers.

Decision-making with this type of information can be complex because there are often multiple perspectives that need to be considered, each with their own criteria about how to combine the assessment of each of those attributes. In such a context, transparency is key and decision-making methods must be selected carefully in order to gain consensus. Testing in the Ribble basin found that comparing more than four measures at a time made for unwieldy combinations. In addition, it may be preferable to separate morphology measures from water quality measures, otherwise considering too many permutations can become complicated.

To summarise the presentation of this information, the UK methodology recommends the preparation of simpler appraisal tables showing, for each combination of measures, a combination of quantitative and qualitative assessments:

- The delivery mechanism and level of effort;
- The pressures addressed;
- The effectiveness as a range, with the % of the gap addressed and the % of the geographical scale where the gap is reduced;
- The time for the measure to be effective;
- The certainty of outcome;
- The costs (in a quantitative terms as a range) as well as the non-monetised costs (in qualitative terms);
- Other factors, such as the issues affecting sustainability, synergies, antagonisms and policy conflicts.

Table 2-18: Illustration of Comparing Combinations using Effectiveness Attributes

Environmental Parameter	Intensity		Scale
	Current	Target	
Parameter X	0.01 mg/l	0.005 mg/l	5 km of river
Parameter Y	1.0 mg/l	0.2 mg/l	10 km of river
Available Measures	1	2	3
Level of application	National	Local	Local
Parameters affected	Parameter X	Parameters X & Y	Parameters X & Y
Units of Effort	Apply ban on polluting subst.	mg/l discharge consent	M ³ stormwater storage
Degrees of effort	Single	Stepped	Continuous

Alternative Combinations	Combination 1		Combination 2	
Measures applied	Measures 1 & 2		Measures 1 & 3	
Intensity of effect (max effort)				
Parameter X	0.005 mg/l		0.005 mg/l	
Parameter Y	0.8 mg/l		0.8 mg/l	
Scale of effect (max effort)				
Parameter X	5 km (100% of gap)		5 km (100% of gap)	
Parameter Y	10 km (100% of gap)		10 km (100% of gap)	
Certainty of Effect	Lower	Upper	Lower	Upper
Parameter X	0.004 mg/l	0.006 mg/l	0.004 mg/l	0.006 mg/l
Parameter Y	0.6 mg/l	1.0 mg/l	0.7 mg/l	0.9 mg/l
Characteristics of Effect	Measure 1	Measure 2	Measure 1	Measure 3
Speed of Effect	VH	VH	VH	H
Adaptability	L	M	L	L
Practicability				
Local Acceptability	M	L	M	H
Existing Delivery Mechanism	L	H	L	M
Side Effects on other WBs				
Env. parameters affected	-	P	-	Q
Magnitude	-	+15%	-	-30%

* Only two combinations of measures are shown for this illustration.

Box 4 - Using the Dutch cost-effectiveness methodology with hydromorphological measures: the case of the Meuse

Hydromorphological measures and ecological interventions can be prioritised according to their effectiveness at achieving a given ecological effect. For example, in the diked Meuse, the hydromorphology has been considerably affected by human interventions. This is reflected in the ecological quality parameters. The main problems are inadequate fish stocks, limited quantity and diversity of water plants as well as limited quantity and diversity of macrofauna. Potential measures examined to address those problems included: improvements of possibilities for the migration of fish, improvements of habitats along the river banks and restoration of water flows. The effectiveness of these measures for addressing those problems could only be characterised qualitatively (with plus and minus signs). It was observed that it would be very difficult to add them up. For example, wood in the water has positive effects on a totally different group of macrofauna than the recovery of the water flow in the Meuse. Finally, certain measures are best implemented in combination with others, but some measures are not very interchangeable. The theoretical list of measures had to be adjusted to reflect what can be implemented in practice, and the costs of measures adjusted to local circumstances.

This case study illustrated that it is possible to perform CEA with qualitative data on the

effects of measures. The size of the various measures to arrive at similar effects (e.g. to arrive at the same ‘+’ for macrofauna, either 1 kilometre of side channel had to be made or 20 kilometres of nature friendly river banks) was estimated and multiplied by unit costs (these cost figures were highly tentative and mostly focused on investment costs, as operating costs were deemed very difficult to estimate).

Box 5 - Evaluating effectiveness when multiple standards are relevant in the Dutch handbook

Eutrophication can be prevented by reducing N and P loads simultaneously but to various degrees. The Dutch handbook recommends the use of “eutrophication equivalent”, where 1 kilogram of P is considered to be just as harmful to the environment as 10 kilograms of N. Effects of measures also need to be adjusted for the impact that emission reduction may have on surface water, as a reduction in emission for a diffuse source of pollution would have a lower impact than for a point source of pollution. The results of such (hypothetical) evaluation are shown on the Table below:

Measures	Addition of methanol	Expansion of active silt process	Adaptation of feed composition	Increase removal of slurry
Where?	STP (point)	STP (point)	Pig farm (diffuse)	Pig farm (diffuse)
Emission reduction Kg N at source	198,971	0	197	1,195
Emission reduction Kg P at source	0	38,263	23	803
Effect on surface water *	1	1	5	5
Effect on surface water *	1	1	20	20
Eutrophication equivalent	$=0.1 \times 198,971 = 19,897$	38,263	$=23/20 + 0.1 \times 409/5 = 9$	$=803/20 + 0.1 \times 1,195/5 = 64$
Costs at source	175,000	7,475,000	132	6,910
Cost / eutrophication equ.	9	195	26	108
Ranking	1	4	2	3

* The effect on surface water is estimated as the kg of N / P reduction from source per kg of N / P reduction in surface water.

By using eutrophication equivalents, it is possible to carry out a cost-effectiveness analysis for several substances simultaneously and several types of measures. The analysis above shows that addition of methanol in the process at the Sewage Treatment Plant would be the most cost-effective measure for reducing eutrophication. It would always be necessary to consult regional ecologists on this to fine-tune regional analyses (especially to determine the impact of measures on surface waters). A similar type of methodology is proposed in the Dutch handbook for analysing various heavy metals simultaneously. This consists of attributing weighing factors to each heavy metal based on their dispersion coefficient.

Box 6 – Focusing on nitrogen for the CEA in the Odense Fjord (Denmark)

The Odense Fjord (inlet) catchment is situated on the island of Fyn central in Denmark. Neither the Fjord nor most of the surrounding lakes are expected to fulfil the criterion of Good Ecological Status (GES) in 2015. The waterbodies are primarily affected by diffuse run-off from agriculture and nutritional sewage outlets from scattered settlements. The environmental state of 25 out of 28 water course reaches will not meet the objectives due to physical and hydromorphological conditions caused by, among other, things like heavy-handed maintenance, and/or waste water discharges from scattered settlements and storm water discharges. Agriculture is the major source of nitrogen pollution in the river basin, accounting for approximately 70% of the waterborne N-sources and approximately 60% of the airborne N-sources. Groundwater is of generally good quality, but it can be locally contaminated with nitrate as well as pesticides and other hazardous substances. Modelling based on historical data has shown that the nitrogen load to the Odense Fjord should be reduced from approximately 2,200 tonnes / year to approximately 1,000 tonnes / year, in order to achieve Good Ecological Status. The phosphorus load will also have to be reduced.

In the pilot project, nitrogen was the only parameter that could be fully quantified in terms of target reduction for each recipient and effect from various measures. For phosphorus, it was possible to quantify the needed reduction, but the effect in terms of leaching and run-off was deemed uncertain due to questions of retention and time-lag.

It was therefore not possible to give a full cost-effectiveness analysis for this parameter. Another type of parameters for achieving good status is related to physical and hydromorphological status of the water bodies. A need for improvement was identified on the parameters hydro-morphological structures, water run-off and restoration of nature. Many of these effects can only be achieved through one type of action, e.g. re-winding of streams. Several of the measures available have effects on multiple parameters (i.e. both nitrogen, phosphorus, hazardous substances etc.). This means that the cost-effectiveness of the management plan cannot be established through choosing the most cost-effective measures for improvement on each of the parameters. Cost-effectiveness can only be used in this bottom-up way for nitrogen pollution where several measures are available with reduction in emission of nutrients as the main or sole effect. For the management plan as a whole, cost-effectiveness is achieved through comparison of the total cost of alternative combinations of measures in various dosages, at various positions in the River Basin.

Evaluation and implications

All Member States documents note the difficulty to define effectiveness at present given the fact that “good status” still needs to be defined in practical terms and comprehensive monitoring has not yet started. For example, the UK methodology notes that, before evaluating cost-effectiveness, it is necessary to know the default targets for the type of water body (e.g. good ecological and chemical status for surface water bodies) expressed in terms of the Quality Elements listed in Annex V of the WFD and/or in terms of surrogate environmental standards. The methodology notes that this classification work still has to be completed. As a result, the methodologies presented in the documents can only be tested in limited circumstances at present, as the necessary information (i.e. the definition of good status) is not yet available for extending this analysis at the river basin level.

Even when comprehensive but relatively complex methods for defining effectiveness are proposed, they may be difficult to implement in practice because “good status” is likely to be multi-dimensional. Whereas it may be possible to assess in detail the effectiveness of a measure for reaching an improvement in a given parameter (for example, a reduction in

phosphorus), assessing its effectiveness for improving the biological quality of a stretch of river may be more difficult.

The choice of methodology may therefore be driven by the type of pressure observed and any limiting factor, such as whether a single parameter can be identified as problematic or whether the problem is much more multi-dimensional in nature. In the latter case, a combination of quantitative and qualitative assessments may be required.

3.5 Estimating costs

The next step consists of estimating the costs of proposed measures. This sub-section reviews the approaches taken to defining costs, including financial costs and economic costs defined in either qualitative or monetary terms.

Summary of approaches

The WFD did not define which costs should be included in the estimation of costs for the purpose of the CEA, although it did explicitly mention the inclusion of environmental and resource costs. This results in a broad diversity of methodologies for estimating costs from one MS to the next.

The UK methodology contains the most detailed advice about how to estimate costs, and recommends distinguishing between non-water environmental costs and wider economic costs (such distinction is not made in the German or Dutch handbooks for example). All three documents (UK, G, NL) seek to circumscribe the conditions in which the elements of cost other than the direct costs should be evaluated. Given that such valuation is likely to be costly, they recommend estimating other costs only in limited circumstances, such as when it is not possible to differentiate measures based on direct costs alone or when indirect costs are likely to be substantial and could potentially justify obtaining derogation based on disproportionate costs.

It is important to note that different terminologies are used from MS to another to describe costs (e.g. direct and indirect, financial, economic, wider) which hampers comparability.

Estimating costs	
WFD	The WFD refers to costs in its article 9, which states that “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”. This article is primarily concerned with the recovery of costs rather than the estimation of costs for the purpose of the CEA however.
United Kingdom	<p>The UK methodology recommends estimating the total costs of a measure in a comprehensive manner, including both financial and economic costs. It proposes ten sub-steps for estimating costs, the last one consisting of the identification of the most cost-effective combination of measures.</p> <p>The estimation of costs is based on a formula that includes all cost</p>

Estimating costs	
	<p>components (see Box 7 below), including the sum of the recurring and non-recurring financial costs (i.e. the operational costs on the one hand and the capital costs on the other) for the parties implementing the measures and the regulators, minus any cost savings and net transfers plus the additional costs that are not captured in the directly affected market, such as the non-water environmental costs (or benefits) and the wider economic effects (e.g. any knock-on effects on other sectors). All costs should be combined and then converted into estimates of (net) present value costs and equivalent annual costs.</p> <p>The wider economic impacts would need to be quantified in more detail only if they are deemed to be significant based on preliminary estimates. The UK methodology notes that it will not always be possible to attach a monetary value to those costs, depending on the scale at which the analysis is being conducted. As a first step, broad and detailed assessments can be carried out at the local/sub-regional scale which would involve quantifying the direct costs of implementing the measure together with a qualitative assessment of non-water environment costs and benefits and wider economic effects.</p> <p>Qualitative information should be retained for non-valued impacts. All costs should be estimated in full when the knock-on effects on other economic sectors are likely to be significant, when there are several different options requiring expenditure by different stakeholders, or when there are disputes on the possibility that the costs may be disproportionate. This will be needed only for a sub-set of measures and sectors.</p>
Germany	<p>The Handbook recommends distinguishing between direct (or operational) and indirect (or economic) costs.</p> <p>Direct costs relate to the implementation of specific measures, such as the cost of structural measures in water protection or administrative costs for tax collection. Direct costs can be estimated on the basis of experimental values and the Handbook provides range estimates for those costs for each measure. Direct costs would include investment costs, depreciation, on-going operating costs and financing costs (where applicable). These costs are to be presented either in net present-value terms or in annual equivalent costs. A sensitivity analysis should be included as part of any cost comparison.</p> <p>Indirect costs are incurred when the measures restrict or change the uses of a water body, or require adaptation measures. Given that such costs may be time-consuming to evaluate, they should be considered in greater detail only if:</p> <ul style="list-style-type: none"> • The direct costs of different measure combinations are so close that prioritisation on the basis of direct costs is not possible; • Significant economic costs can be assumed for at least one of the favoured combinations of measures and instruments. <p>To assess whether the economic costs may be significant, a preliminary assessment should be conducted, based on the compilation of uses for the</p>

Estimating costs	
	<p>initial characterisation. A detailed methodology for evaluating economic costs is not provided in the handbook, however, as it is deemed beyond the project brief.</p> <p>Detailed cost estimates are provided in Appendix 1 of the handbook for the seventeen measures and ten instruments critical for implementing the WFD.</p>
Netherlands	<p>Costs are defined as all the costs related to the implementation of a measure, including investment and operation and maintenance costs. All costs are expressed in annual terms (this requires estimating a depreciation amount for investment costs). In some testing, it was not possible to get anything else apart from capital costs of measures, so the evaluation of costs is limited.</p> <p>Economic costs, such as possible loss of employment or indirect effects, would only be described in quantitative terms once the selection of the most cost-effective package of measures has been made. It is recommended that indirect effects be taken into account in the assessment of disproportionality rather than as part of the cost-effectiveness analysis. The latter was proposed since at the regional level for which the handbook was written (e.g. individual water bodies), indirect effects were likely to be insignificant.</p>
France	<p>The Ministry of Ecology document recommends that all costs that would result when each measure is implemented should be identified for the purpose of conducting the CEA, including any saving in costs. Such an assessment, however, should not take account of non-traded environmental costs, as these are used only for specifying whether or not the programme of measures is disproportionately costly, an assessment to be conducted at the CBA stage.</p> <p>If the indirect effects cannot be assessed in financial terms, a simple qualitative assessment and indication of the areas affected may be sufficient, given that the purpose of the analysis is mainly to provide local parties with a decision-making aid, and not to decide on a combination of measures based only on cost and effectiveness data. The social, economic and environmental impacts would therefore have to be taken into account in the decision-making as well.</p> <p>The methodology used in the testing for the Normandy bogs suggests that both direct costs (investment and operation and maintenance costs) as well as indirect costs (savings and induced costs, through the socio-economic impact of the measure) be incorporated. However, it does not set out a detailed methodology for evaluating such costs.</p>
Spain	<p>The Spanish methodology recommends estimating the total costs of a measure in a comprehensive manner. A clear distinction is made between financial (financial payments that need to be made to implement the measure) and economic costs (real use of resources and real opportunity costs). The emphasis is placed on economic costs as the main criteria for choosing the proper combination of measures. Financial costs,</p>

Estimating costs	
	<p>including subsidies, taxes and other transfers are not considered as real costs because it is deemed that they do not imply the use of any economic resource. As a result, financial costs do not play a role in the selection of the least cost of measures. Nevertheless the analysis of financial costs is to play an important role in further analysis when assessing the financial viability of the RBMP.</p> <p>Environmental costs are only considered when the measure produces an environmental impact outside of the river basin or it has a non water related environmental impact. Otherwise, when the impact is on the same water body, it is deemed that taking account of such environmental costs would lead to double counting. For the same reason, resource costs are not considered in the cost assessment. For all other aspects, the cost assessment of measures follows the WATECO guidance and standard economic valuation methods.</p>
Denmark (Odense)	<p>A distinction was made between financial costs (actual expenses experienced by certain groups of society) and socio-economic costs (costs to society, including both monetary as well as non-monetary effects on all groups within society but excluding redistributions within society, such as national taxes/subsidies). The socio-economic cost estimates formed the basis for prioritisation and hence, for the combination of measures, while the financial figures alone concern the distributional consequences of implementing the optimal package of measures in the basin. All costs were presented in terms of annual equivalent costs.</p> <p>The socio-economic cost calculation must also take into account the indirect (non-water related) effects of the measures. This was complicated by at least two factors. Mainly, the available data on the socio-economic value of many of the indirect effects was insufficient. That means that an incomplete number of side-effects could be included in the analysis at this time. In the analysis, it was chosen to use cost-estimates without side-effects as the basis for cost-effectiveness evaluation. The combination of measures were then reviewed according to a description (and quantification and valuation where possible) of the side-effects of all the measures. The prioritisation of the measures could then be altered on such basis.</p> <p>Not all measures could be costed with the available data. Due to changes in the CAP and the increasing marginal cost of abatement in waste water treatment, new estimates had to be found.</p>

Box 7 - Estimating costs according to the United Kingdom methodology

The UK methodology has developed a general formula for estimating the total costs of a measure. The present value of the total incremental costs of adopting a measure are estimated as the discounted sum of the non-recurring (mainly capital) and recurring (mainly operating) costs of a measure, minus any transfers associated with the measure, such as taxes, subsidies or compensation payments between private operators (e.g. by port operators to neighbouring land owners) plus the net value of the non-water environmental costs and the net value of the

wider economic effects, as measured by changes in producer surplus and consumer surplus in related markets.

The UK methodology proposes simple formulas for estimating the costs of 16 different types of measures on Table 3.3., page C-15 reflecting the cost components that need to be taken into account for each type of measures. It mentions that those formulas are mainly indicative and will not be developed into operational guidance. More specific guidance is provided for estimating each category of costs, as follows.

Estimating non-recurring and recurring costs. The estimation of non-recurring costs is very comprehensive since it includes capital costs, design costs as well as hidden or transition costs. A specific category of the latter costs are the “sunk costs”. Sunk costs are the costs of the assets already invested, which typically would have no value in alternative uses. These costs would impact the ability of actors that have already incurred them to switch to alternative production methodologies, for example. The UK methodology recommends that sunk costs be considered in the assessment, particularly for the evaluation of disproportionate costs and the need for potential time derogation. Hidden (or transaction) costs are also incorporated in the assessment of recurring costs, which incorporate fixed, variable and semi-variable costs, taking account of the quantity and price effects on consumer surplus. Hidden costs may consist of the non-financial costs of self-employed family labour for example. As all of those costs would depend on design or technological assumptions, it is recommended that such factors be recorded in order to support the cost estimates.

Estimating transfer costs (or benefits). A key difference between financial and economic costs is the “transfer costs” or benefits, which correspond to transfer of resources from one stakeholder group to another without consumption of resources. For example, taxes are transfer payments from the private sector to the public sector and subsidies as part of the Common Agricultural Policy can be qualified as transfers. It is recommended that taxes aimed at internalising an environmental cost should not be treated as a transfer, as they provide a measure of the non-water environment costs and benefits associated with a given activity. This is consistent with the methodology in the WATECO guidance.

Estimating non-water environment costs/ benefits. These costs relate to impacts on the environment that are not directly related with meeting the objectives of the WFD, including changes in habitat, landscape, emissions to air, noise, etc that may result from changes in land use or the construction of new treatment plants for example. Water-related environmental impacts should not be considered as they are captured through the evaluation of effectiveness for the different measures.

Where it is not clear whether an effect is water or non-water related, this should be recorded in the CEA methodology to ensure that costs are not overlooked and to avoid any risk of double-counting. These costs should first be defined in qualitative terms, as well as in quantitative terms. It is suggested that a check-list be developed to list the types of impacts that may be relevant to the different types of measures. These costs should be estimated if: they are likely to be significant (i.e. more than 5% of the estimated non-recurring and recurring costs), there is likely to be a conflict over the selection of measures and/or consultation with stakeholders suggests that they want to see more of the costs quantified. A variety of methods are recommended for estimating those costs, including the use of willingness to pay estimated derived from original valuation studies (first best) or benefits

transfer, or the use of costs based methods such as replacement costs or mitigation costs.

Incorporating wider economic costs. The methodology recommends screening measures to determine the potential for them to give rise to wider economic effects, either individually or in combination. For example, “local” measures at a port may affect its ability to respond to changes in shipping demand and, as a result, impact not only the port’s long-term viability but also those sectors servicing the port and on the regional or general economy more generally. If such screening identifies a potential issue, moving to a more in-depth assessment of wide economic effects at the regional or potentially national level would be necessary. The methodology proposes a series of questions to identify whether the evaluation of wider economic costs is necessary or not. It also suggests ways of estimating such costs, including using an expanded partial equilibrium model, based on the analysis of the supply and demand relationships for the relevant primary and secondary markets.

Discounting. Future streams of costs are to be discounted to reflect the time preference of money and the opportunity cost of capital for the sectors incurring the costs, although no specific methodology is proposed for estimating the cost of capital for those sectors. For water operators, it is recommended to use the cost of capital estimate set by Ofwat (the regulator of water and sewerage services in England and Wales) in the last periodic review of prices and for other sectors, the rates applied under IPPC. Discounting for economic costs is to be undertaken using the UK Treasury’s discount rate of 3.5% (which goes down to 3% in year 31 and 2.5% in year 76). Discounting also requires specifying the time period over which costs are projected. This should reflect the life of the assets, which could go from 20 to 30 years for water assets to 100 years for flood and coastal protection investments.

Timing issues. Discounting of costs is deemed particularly important as measures may be taken in several phases over time and costs may materialize at different points in time (typically, non-recurring costs would materialize once but recurring costs could emerge at various points in time). Considering timing issues can also help in examining the potential attractiveness of delaying action, which could result in significant cost reductions.

Evaluation and implications

There is no common methodology for evaluating the costs at the CEA stage, especially with respect to which non water environmental and resource costs should be included at this stage. The general recommendation usually consists of stating that a more comprehensive evaluation of such costs should be done for further stages of the economic analysis, such as the analysis of disproportionate costs or of the distributional impact of the proposed programme of measures. Non water resource and environmental costs, as well as wider economic effects, would usually be included at the CEA stage only if these costs are likely to be large. Early warning signs should therefore be developed to ensure that those costs are not ignored so as to avoid selecting inappropriate or costly measures (effective public participation processes would usually provide such “early warning signs”, except in the case of environmental costs if there are no stakeholder groups representing the interests of the environment).

Some wider economic costs may only become apparent or relevant when aggregating the programmes of measures for an entire river basin, even if such costs were minimal for programmes of measures prioritised at the level of a single water body. This issue might need to be specifically considered when examining the cumulative impacts of decisions at a regional or national level.

Even if environmental and wider economic costs cannot be fully measured, they should be recorded in a qualitative manner, in order to aid further analysis if an evaluation of disproportionate costs is required at a later stage. When more detailed assessments of environmental costs and wider economic impacts are carried out (for example, for the assessment of disproportionate costs), the methodology should be clearly spelled out.

Note that cost databases are under preparation in certain MS (particularly UK and NL) as part of the preparation of national catalogues of measures. A coordinated cost database, especially with information on environmental costs and benefit transfer values, could contribute to improved consistency between those estimates but should be treated with extreme caution. There are a large number of reasons why cost figures are likely to differ from region to region within a MS, let alone between MS.

3.6 Assessing cost-effectiveness

The last step consists of presenting the results of the cost-effectiveness analysis, based on effectiveness and cost estimates. This sub-section examines what is suggested for assessing cost-effectiveness, including dealing with non-financial impacts in qualitative terms.

Summary of approaches

As the WFD did not specify the way in which cost-effectiveness should be measured, the approaches adopted by MS vary quite considerably. The Dutch handbook and the Spanish document recommend evaluating cost-effectiveness on the basis of a single indicator (defined as the annual costs divided by the annual effects) and that combinations of measures be constructed through relying on the most cost-effective measure first, then the second most cost-effective, etc... The Dutch handbook, mostly concerned with aiding local decision-making, would recommend incorporating mostly direct costs for this purpose, as indirect costs would become significant only when considered at a larger scale.

The UK and German methodologies point to the limitations of such an approach, given the difficulties of quantifying effectiveness (and even costs) in a single indicator. As a result, defining a single indicator for cost-effectiveness could lead to losing important information on unquantifiable characteristics of the effects or costs, particularly environmental or indirect costs. Instead, they recommend building matrices setting out all the characteristics of the measures, including in qualitative and quantitative terms and relying on experts and perhaps stakeholders to define preferences between those characteristics.

The German handbook also places particular emphasis on the fact that the effects of measures may be correlated (negatively or positively) and that it is therefore not possible to add their effects, although adding the costs may be easier. This concern is shared by the Dutch handbook, but the German handbook proposes a more detailed methodology for addressing it, by building “correlation matrices” between measures. In the Dutch handbook it is suggested to describe a combination of measures as a separate measure (with costs and effects).

Assessing cost-effectiveness and evaluating combinations of measures

Assessing cost-effectiveness and evaluating combinations of measures	
WFD	The WFD did not specify the way in which cost-effectiveness should be presented or how combinations of measures should be compared.
United Kingdom	The UK methodology does not recommend presenting a single indicator of cost-effectiveness or ranking , as it is deemed that this could cause losing too much information. Instead, it suggests presenting surrounding information in order to avoid simplifying the actual trade-offs. Table 2.1 on page D-4 “Summary Table for Determining Cost-effectiveness” proposes a convenient format for presenting cost-effectiveness results, including the delivery mechanisms and level of effort, the percentage of gap addressed and the percentage of the geographical scale over which the gap is reduced, the time required for the measure to be effective, the certainty of outcome, the monetised costs (as a range) and the non-monetised costs, and other key factors, such as issues affecting sustainability, synergies, antagonisms, policy conflicts, etc).
Germany	<p>As in the UK, the selection of the most cost-effective programme of measures is not to be done on the basis of a single indicator but rather on the basis of evaluating trade-offs between the probability of target achievement by 2015, the ecological effectiveness of the measure/instrument; the time scale until effectiveness, the direct costs and the indirect economic costs. The evaluation should start with the evaluation of effectiveness and then move on to the evaluation of costs. Not much additional guidance is provided on how this trade-off analysis should be performed, however. It is recommended that the trade-off criteria be represented in a table in order to facilitate decision-making, in the context of participation by the general public.</p> <p>In most cases, the Handbook notes that a combination of only two measures would be insufficient to reach the targets and additional measures would usually be required, so the main emphasis is placed on deriving programmes of combined measures. The effectiveness of a combination of measures is estimated based on the correlation between the effects of several measures, to be estimated based on causal relationships and local knowledge. This is done in the form of a matrix, as shown in Box 8 below. The methodology also examines the interactions between measures and instruments, which could be antagonistic, neutral or complementary.</p> <p>The resultant combinations of measures are described with respect to ecological effectiveness, the timeframe until effectiveness and the likelihood of successfully attaining the targets. With respect to the timeframe, the assessment criteria are whether the combination of measures will take effect quickly and well before 2015 (“short-term”), or slowly and with a time delay but before 2015 (“medium term”) or essentially after 2015.</p>
Netherlands	The Dutch handbook recommends prioritising the measures based on their cost-effectiveness, defined as the annual costs divided by the annual effects . Cost-effectiveness is defined as the ratio between the annual effectiveness (expressed, for example, as the kg of Phosphate

Assessing cost-effectiveness and evaluating combinations of measures	
	<p>being reduced per year) and the annual costs.</p> <p>From the analysis of the cost-effectiveness of individual measures, a package of measures can be compiled by first including a measure for which the costs per unit of intended effect are the lowest. If it is not sufficient to meet the good status objective, the measure that ranks second can be added in and this can be repeated until the combination of measures is sufficient to meet the objectives. As in the German handbook, the Dutch handbook points out that given that measures are mutually dependent on each other, it may not be possible to add the effectiveness and cost of individual measures to derive the overall effect of the package measure and total costs (although the latter may be easier). Therefore, it is suggested to describe a combination of measures as a separate measure (with costs and effects).</p>
France	<p>The Ministry of Ecology document recommends that key characteristics of the measures be presented in summary tables, with the names of the contracting authorities (for implementing the measures), an assessment of the costs, an evaluation of the contribution that each measure will make to achieving the objective (as a percentage of the total effect required to meet the objective), an evaluation of the uncertainty of the effects, note of the impacts that the measure may have on other fields (such as landscape) and the magnitude of the side effects. The aim of this qualitative assessment is to specify the most relevant implications of the measures, as seen by the parties locally involved. The measures are then grouped to constitute two or three strategies that should be sufficiently different from each other. Consultation should then make it possible to propose the strategy that, overall, emerges as the most appropriate and most efficient. If the gap between the status estimated for 2015 and the good status is small, it is likely that only one strategy will be possible. In the last step, cost-effectiveness analysis should be used to help decide on the priorities and assist in optimising the deployment of the most efficient measures. This can be carried out simply in qualitative terms, using a table describing the measures to be used.</p> <p>In the testing document for the Normandy bogs, the assessment of the cost-effectiveness of measures is carried out for each of the 8 parameters which are deemed to characterise “good status” in order to construct combinations of measures with the same level of effectiveness (i.e. to achieve “good status”). These combinations should be done on the basis of a given strategy (i.e. preventative vs. curative for example). The elaboration of such combinations requires using modelling tools in order to evaluate expected effectiveness. However, the methodology acknowledges that building combinations of measures with the same level of effectiveness can be difficult, especially as those measures may have side effects on other parameters (for example, they may have similar effectiveness on surface waters but reach different levels of effectiveness on ground waters). It does not recommend a specific method to prioritise measures and build a combination of measures.</p>
Spain	<p>The Spanish methodology recommends that the unit-cost effectiveness estimates form the main element for appraising the costs of measures,</p>

Assessing cost-effectiveness and evaluating combinations of measures	
	presented as the costs per effect. This allows producing a ranking of measures based on their cost-effectiveness and constructing a proposed programme of measures to achieve a given objective. Cost effectiveness indicators are obtained as the total economic cost of a measure divided by its effect on an ecological status parameter. These cost effectiveness indicators are the main information used to rank measures for a particular objective (reducing the gap in a given parameter) in any water body and obtaining the respective marginal cost curves.
Denmark (Odense)	<p>As explained in Box 6 above it has only been possible to prioritize measures based on their unit-cost effectiveness in costs per kg reduced nitrogen load to surface waters. Cost-effectiveness was defined as the annual unit costs of measures (DKK/ha) divided by the annual N-reduction effect (kg N/ha).</p> <p>There are several possible approaches to evaluate combinations of measures, ranging from a fully programmed algebraic model to manual iterations in a spreadsheet. A model can handle a large degree of detail and is appropriate for large numbers of recipients. It also gives the opportunity to give a larger degree of geographical accuracy in the analysis of disproportionate cost on some areas. The approach with manual iterations is the more pragmatic solution, and the one that was used here. It should be chosen in situations with fewer recipients and fewer interrelations between location and environmental impact and economic costs respectively. It can successfully be used in connection with the management plans needed for WFD implementation. This means a lower degree of geographical detail and does not guarantee the fulfilment of the targets at water body level. This however, can be helped by setting a minimum dosage for some of the measures in each of the chosen, larger catchment areas and ground water reservoirs. Since all data is gathered in a spread-sheet and the manual iterations give a real sense of the mechanisms at play, this approach is very transparent. The spread-sheet based model gives the opportunity for interactive scenario building, where the results of a change in the combination of measures is immediately clear.</p>

Box 8 – Evaluating correlation effects between measures as per the German handbook

The German methodology allows comparing a higher number of combinations of measures as this is done purely in qualitative terms, based on an assessment of overall effectiveness rather than based on specific effectiveness attributes and starting with combinations of only two measures. The table below shows a matrix of measure combinations for the case example “Große Aue”. This shows that there are 5 combinations of two measures that may be derived as the main combination as they get “+++” in effectiveness terms. These are the combinations with the best ecological effectiveness, which can then be considered in greater detail in subsequent steps. Since in the majority of cases, a combination of two measures is likely to be insufficient to attain the target, additional measures may need to be added subsequently to the selected “main combinations”, based on knowledge of the local situation.

Table 5-18: Matrix of measure combinations for the case example "Große Aue" ¹⁸						
Measure sheet number:		Ecological effect of the combinations of measures				
		2.1	2.2	5.1	5.3	5.4
		All substances (P, N, pesticides)	Limiting of N	Passability	Inherent dynamics	Improvement of bank and bed structure
Diffuse sources	2.1		+++ ^a	++	+++ ³	++
	2.2			++	+++ ²	+++ ¹
Morph. changes	5.1				++	++
	5.3					+++ ^b
	5.4					

Key: Positive correlations (+++ very good effect, ++ good effect, + minimal effect) are shown in the top right, and negative correlations (- negative effect) are shown in the bottom left.
The numerals in superscript represent the numbering of the main combinations, and do not reflect prioritisation.

Evaluation and implications

There is a wide variety of methods for evaluating and reporting on the cost-effectiveness of a combination of measures for achieving good status, perhaps reflecting the variety of approaches which are possible at this early stage in developing CEA for basin planning, even more than in other areas.

Reporting a single indicator of cost-effectiveness has the advantage of simplicity and may help prioritizing measures in a transparent manner (see for example, the prioritization of measures for reducing eutrophication in the Dutch handbook presented in Box 4). Reporting all characteristics of costs and effectiveness in matrix formats has the advantage of not losing any information (which may be particularly important for linking the cost-effectiveness analysis with further steps of the analysis, such as the assessment of disproportionate costs). In theory, such an approach could be refined further through the allocation of weights to the main attributes, which would need to be agreed upon by all stakeholders, but this would risk becoming too complex and would be impractical.

Instead of focusing on the estimates of cost-effectiveness per se, it would be more important to ensure that a process of prioritisation based on a comparative evaluation of costs and effectiveness has indeed been used to aid decision-making, as suggested in the French document.

3.7 Dealing with uncertainty

This sub-section analyses the approaches that are suggested to deal with uncertainty about the effects and the costs of measures and how this may affect the ranking of measures. It also reviews what is recommended when data availability is limited or when there is no data.

What is uncertainty?

Uncertainty exists where there is more than one possible outcome to a course of action. The form of each possible outcome is known, but the probability of reaching any one outcome is not known. Uncertainty may affect several aspects of the cost-effectiveness analysis and reduce the reliability of results. Areas of uncertainty when carrying out the cost-effectiveness analysis may include:

Uncertainty around good status. Good ecological status (GES) has not yet been defined. There is thus significant uncertainty surrounding the objectives that measures need to achieve, which in turn means that Member States have to develop their programmes of measures in a context of uncertainty. There is uncertainty about the ultimate goal of GES and what conditions in morphology, chemistry and physical parameters are needed to support this. Intercalibration might lead to further uncertainty as boundaries for GES may lie within wide ranges across Member States. Once established, good status will need to be applied as a classification of water bodies in terms of their predicted status. Uncertainty is fundamental to classification, which is based on a sampling of parameters and estimated confidence. The EU Drafting Group on Environmental objectives is currently developing a paper, which will provide a common understanding of the level of environmental objectives, Member States want to achieve. The 4th version of this paper has recently been released on the Circa website.

Uncertainty around future trends. When predicting changes/trends of pressures on water bodies and hence effectiveness of measures, between now and 2015, decision makers are faced with two complications. There is uncertainty surrounding the baseline scenario, i.e. the reference situation against which the effects of the proposed measures are assessed and estimated, on the types of pressures and on the risks of not achieving good ecological status. There is also a lack of nationally consistent data surrounding pressures and uncertainty about applicability of transfer methodologies.

Uncertainty around effectiveness estimates. There may be uncertainty with regard to the effectiveness of the measure itself, either because of geographical, political or behavioural (e.g. response to economic instruments) circumstances or because of imperfect knowledge about the technical performance of a physical measure. For example, uncertainty exists about the extent to which point and diffuse sources contribute to (impact on) the water quality problem through the often-complex environmental source-effect chain in time and space. If it is impossible to identify the main sources of pollution, it will be impossible to determine which measures are most effective.

Uncertainty around cost estimates. There may be considerable uncertainty as to the actual likely costs that would arise from the introduction of a measure. There will be uncertainty about direct financial costs of the measure and also about the wider economic costs. Moreover, environmental costs are typically transferred from other sources and their application to specific areas will therefore be subject to uncertainty.

Summary of approaches

The WFD did not specifically referred to how uncertainty should be dealt with but all national documents have identified this issue as an important one to be dealt with for all aspects of the evaluation (costs and effectiveness estimates).

The UK methodology goes into most details about how to deal with uncertainty and proposes alternative methods for dealing with uncertainties: such methods were modified based on

testing results, as it was deemed that the first method (including lower and upper bounds and type of probability distribution) was too complex to implement. It is also the only document that explicitly considers how a situation where there is no data or data availability is limited can be dealt with, and how the potential benefits of obtaining more data to reduce uncertainty can be estimated.

Dealing with uncertainty and lack of data	
WFD	The WFD does not make any specific recommendation or does not include any requirement for dealing with uncertainty.
United Kingdom	<p>Effects. The certainty of effect is to be recorded as a specific attribute for each measure, with the following information: type of probability distribution (rectangular, triangular or normal) and lower and upper bounds of uncertainty around the most likely estimate of the effect.</p> <p>Costs. Initially, the UK methodology recommended that uncertainties in cost assumptions were to be reflected through the use of low, medium and high estimates with associated probabilities. If those probabilities are not known with precision, equal probabilities should be assigned to each. Such ranges should reflect the most obvious factors that can affect the cost estimates, such as timing, size/scale of the measure, duration required to meet the assumptions regarding the effectiveness of the measure as well as some sector-specific or even company-specific issues. The methodology recommended conducting a sensitivity analysis which requires focusing on key variables and identifying switching points, i.e. those values at which the recommended policy decision would change from selecting a particular measure to another.</p> <p>However, testing of this methodology showed that it is too subjective and requires too many assumptions to be made. An alternative methodology would consist of assessing reliability and accuracy bands, in the way that it is currently done in the water sector in England and Wales for monitoring performance (see Box 9 for more details).</p> <p>When data availability is limited, the UK methodology recommends carrying out the analysis at increasing levels of detail, first at the broad level (level one), then at a detailed level (level two) before moving on to the in-depth level (level three). Moving to a higher degree of detail would be necessary when:</p> <ul style="list-style-type: none"> • Non-quantified costs are likely to be significant and could change the ranking of measures in cost terms; • The level of uncertainty surrounding the cost estimates is so great that it is impossible to develop a robust ranking of measures in cost terms. <p>Moving from one level to the other would require additional data to be collected. When data is only available for a sub-set of the costs, this should be indicated together with a description of whether those variables may be significant. For example, if the broader economic costs are not estimated because the analysis of costs is only conducted at the broad or detailed level, the resulting cost estimates will be fundamentally “uncertain” since they will not incorporate all costs and this should be</p>

Dealing with uncertainty and lack of data	
	<p>signalled. If the economic costs are incorporated but their assessment is uncertain, the factors for such uncertainty should be recorded. A “Value of Information Analysis” could help understand the value of delaying an investment decision to obtain more information on which to base such decision. This may reduce the probability that a measure is disproportionately costly.</p> <p>It also recommends testing the sensitivity of the choice of cost-minimising measure on this lack of information. This testing can either be done by taking minimax and maximin criteria (to define a range for the estimates) or estimating expected values based on underlying probabilities. If the ranking is sensitive to small changes in costs, the analysis should progress to the next stage and aim to quantify all of the costs which were previously described in qualitative terms.</p>
Germany	<p>The German handbook does not set out a specific methodology for addressing the issue of uncertainty. That may be due to the fact that the effects are not specified in quantitative terms but rather in qualitative terms, with a varying number of crosses and a qualitative description. In the description of the main measures presented in Appendix 1, it sets out an “uncertainty factor”, which consists of analysing the factors that could have an impact on the effects (or costs) of the measures.</p>
Netherlands	<p>To deal with uncertainty about costs and effects, the methodology recommends using ranges, with a lower and upper estimate. Such ranges may be wider for more experimental measures, for which the effects are more uncertain. Rather than attaching probabilities to each of those estimates, the methodology recommends carrying out sensitivity tests, by carrying out one cost-effectiveness analysis using lower values and one using high values for all parameters. If this has an impact on the ranking of measures, it is recommended that such uncertainty be noted explicitly with an assessment of possible implications. This could also lead to the gathering of additional information in order to improve knowledge and reduce uncertainty.</p>
France	<p>The Ministry of Ecology document states that uncertainty will subsist in a number of cases, due to the impossibility of transposing general results (on the effectiveness or on the costs of measures) obtained in an experimental location to another site. These uncertainties will have to be managed by adopting, as a priority, the most efficient and least uncertain measures. Where uncertainty is too great, local “workshop sites” should be set-up so that full-scale experiments can be monitored appropriately, and uncertainty about the impacts subsequently reduced. Locations for these “workshop sites” should be identified as soon as possible, even before adopting the programme of measures. That will make it possible to use the initial results to draw up an interim evaluation of the programme of measures and decide on any modifications that may be required. In the event of uncertainty over how a water body in the area is changing (because, for example, of difficulty in telling whether the eutrophication danger has been appropriately reduced, because of a</p>

Dealing with uncertainty and lack of data	
	reduced speed of flow in the water body), the measures will include strengthened monitoring of the status in the water body, in order to specify any additional action that may be needed when updating the management plan. The testing document for the Normandy bogs did not seek to address the issue of uncertainty in specific terms.
Spain	All assumptions and hypothesis needed in the different steps of the CEA methodology should be documented in a proper and transparent way. Some of these assumptions may be more critical than others, because the final RBMP and its costs may be heavily dependent on them and they are particularly uncertain. These critical assumptions must be identified and a sensitivity analysis needs to be conducted in order to judge how the least combination of measures and its cost depends on the value of a particularly uncertain variable, and, consequently, how likely it is that a RBMP would not be successful at reaching its objectives. This information will also be used to decide whether a study to reduce uncertainty in this critical parameter is worthwhile or not.
Denmark (Odense)	The issue of uncertainty and lack of data was not dealt with specifically. However, it was clear that the lack of data on cost-effectiveness relating to other pressures than nitrogen meant that the analysis was limited to this parameter.

Box 9 – Assessing reliability and accuracy of estimates in the UK

As an alternative to using lower and upper bound estimates and probability distributions, the UK methodology recommends using two different indicators on the level of confidence that can be placed on cost estimates: reliability and accuracy. This type of methodology is already used by Ofwat, the regulator of water and sewerage services in England and Wales, to assess the submissions presented by water companies for the periodic review of prices. The reliability band of A would normally be associated with accuracy bands of 1 or 2. Once the reliability and accuracy of the cost estimates have been assessed, it would be necessary to assess whether a more detailed analysis should be undertaken to improve either the reliability or accuracy of those estimates. For example, if the reliability band is assessed as being either C or D, further work should be undertaken to improve the reliability of the underlying data, particularly if it could affect the ranking of the combinations of measures.

Table 10.1: Framework for Reliability Bands

Reliability Band	Main source of data used in standard cost estimate
A	Costs generated specifically for the measure, purpose and site being assessed.
B	Costs taken from similar project/measures within the same region/area.
C	Costs taken from similar projects/measures but from a different region/area.
D	Costs based on generic information and/or different projects/measures.

Table 10.2: Framework for Accuracy Bands			
Accuracy Band	Accuracy to within +/-	But outside +/-	Comments
1	5%		Source data are directly relevant to the measure and site/area being assessed and/or costs have been accurately adjusted for site specific factors.
2	10%	5%	Source data are relevant to measure or similar measures but for other (similar) sites or areas and/or costs have been adjusted reasonably accurately.
3	25%	10%	Source data are relevant to measures or similar measures but may relate to different (non-similar) sites and/or there is less confidence in the results of site specific adjustments.
4	50%	25%	Source data are relevant to similar measures but relate to different (non-similar) sites and/or confidence in the results of site specific adjustments is low.
5	100%	50%	New/innovative measure or where source data are not specific to measure and are from a non-similar site. Adjustments for site specific factors have not been made.
X		100%	Difficult to specify measure and/or costs data not readily available or based on other measures that are incompatible with the measure being costed.

Evaluation and implications

No common methodology has been defined for dealing with uncertainty. A sensitivity analysis around at least the effect and cost estimates could help identify any “threshold values”, i.e. the points at which the ranking of cost-effective measures change. If the ranking of measures is very sensitive to cost and effectiveness estimates, then additional information should probably be collected in order to carry out a more in-depth assessment and narrow down the uncertainty. This may be done through additional studies or the setting up of “local workshop sites” but the trade-offs between obtaining this additional information and the possible errors linked to high uncertainty should always be explicitly considered.

3.8 Involving experts and the general public

This sub-section reviews the recommendations made for involving the public as well as stakeholders and expert groups, particularly to help identify measures, confirm results and evaluate impacts.

Summary of approaches

Consultation and stakeholder participation forms integral part of the process of implementing the WFD as a whole and is called for by the Directive itself.

The national documents identified specific circumstances where involving the general public or experts can be of particular use. Early involvement of stakeholders, particularly for the pre-screening of measures, can ensure the legitimacy of the process and avoid having to reincorporate previously discarded measures at a later stage. The German and Dutch handbooks both stress the need for transparency and for providing all necessary cost and

effectiveness information in order to be able to justify decisions on trade-offs through public participation.

The role of experts is deemed particularly valuable to adapt generic national information to local circumstances, assess the practical relevance of measures and adjust cost and effectiveness estimates.

Consultation process and involving experts	
WFD	<p>The WFD (Article 14) promotes the active participation of all interested parties in the development of River Basin Management Plans, and requires Member States to inform and consult the public. Involving stakeholders into the economic analysis can prove very useful as it brings expertise and information, it provides opportunities to discuss and validate key assumptions and it increases the ownership and acceptance of the results of the economic analysis.</p> <p>The Directive only specifies key dates for consultation, but it does not specify dates for the participation process, as this will depend on local institutions.</p>
United Kingdom	<p>The methodology proposes to carry out the CEA in five steps, which are presented as useful “staging posts” for stakeholder interaction for individual problems or across programmes of measures:</p> <ul style="list-style-type: none"> • Problem definition; • Identifying measures; • Predicting effectiveness; • Developing combinations of measures; and • Comparing combinations of measures. <p>Stakeholders should also be involved in any “pre-screening” of measures, which consists of eliminating measures deemed to have a low cost-effectiveness at an early stage of the CEA, prior to the examination of combinations of measures. This would ensure transparency and minimize the risk of discarding measures early in the process that would be reintroduced by stakeholders later on.</p> <p>Expert judgment may be relied upon mainly in the following circumstances:</p> <ul style="list-style-type: none"> • When there are significant gaps in knowledge on the effect of measures, especially in quantifiable terms; • When the overall effect of a combination of measures cannot be determined by simple methods of aggregation by the practitioner; • To account for technological change and innovation in order to project the future costs of measures (and methods of implementation); • To assign probabilities to different outcomes in terms of costs of measures.
Germany	Organising early consultation should lead to greater efficiency when

Consultation process and involving experts	
	<p>selecting combinations of measures and greater acceptance for the chosen measures. At all stages, emphasis is placed on transparency and traceability of decisions. For example, if a preliminary assessment of economic costs concludes that a more detailed assessment of such costs is not required, not considering economic costs should be appropriately justified during the course of public participation. The weighting of individual criteria in the trade-off process should be coordinated with affected interest groups. In more complex cases, more structured assessment methods such as multi-criteria analysis or scenario analysis could be relied upon to clarify the trade-offs.</p> <p>Expert judgement is to be relied upon mainly for the following activities:</p> <ul style="list-style-type: none"> • To evaluate correlation between the effects of different measures; • To determine economic costs; • To weigh the various decision-making parameters during the course of selecting an efficient combination of measures; • To coordinate with other planning instruments.
Netherlands	<p>Transparency is required to make public participation possible. Representatives of all relevant sectors should be involved in the performance of the cost-effectiveness analysis (including regional water boards for example).</p> <p>Expert judgment is to be relied upon mainly for the following activities:</p> <ul style="list-style-type: none"> • To assist with the initial analysis of the most important problems and possible measures; • To evaluate the effectiveness of measures on ecosystems based on regional knowledge.
France	<p>The Ministry of Ecology document recommends carrying an initial consultation in the geographical area where significant water management issues have been found in order to identify the measures to address those issues. It then suggests a significant role for public participation when an initial RBMP has been elaborated, with local stakeholders being consulted on :</p> <ul style="list-style-type: none"> • The technical obstacles to carrying out the works (i.e. time needed for various procedures and for carrying out the work, etc.); • Whether the cost of the works is high in relation to the expected benefits, as seen from a local perspective; • How much time will be needed – because of the accumulated pollution and/or inertia of the ecosystem(s) – for the environment to respond to the reduced pressures; • The impact of measures to restore the hydromorphology on various activities. <p>Opinions from local parties will then form the basis for justifying any request for exemption from the 2015 good status objectives.</p>

Consultation process and involving experts	
	The testing exercise in the Normandy bogs is not clear about whether the testing involved the consultation with the public and at which stage. Experts were consulted in order to define the scale and the type of the problems and identify the measures that could be selected in order to achieve “good status”.
Spain	<p>The methodology recommends involving stakeholders for:</p> <ul style="list-style-type: none"> • Identifying measures and the pre-screening of measures; • Checking the effectiveness and economic impact of measures; • Comparing combinations of measures. <p>There is also consideration of expert involvement, especially to evaluate the effects of individual measures and combinations of measures (biological and morphological) as well as their costs.</p>
Denmark (Odense)	Public participation was seen as a very important part of the process in the Odense Fjord. A summary description of what was done and key lessons learned is presented in Box 10 below.

Box 10 – Organising public participation in the Odense Fjord (Denmark)

Fyn County (the water authority) invited stakeholders to participate to a public participation process at a much earlier stage than required in the Danish legislation regarding the WFD. The process in Fyn County was different from what the future process will be in other basins, according to new Danish legislation related to the WFD. The plans for involving stakeholders were made during the period December 2003 to February 2004. In order to create a platform for involving stakeholders in the process, three boards worked in parallel with the contents of the Basic Description and Program of Measures for the catchment of Odense Fjord: the National Scientific Advisory Board, the Regional/Political Advisory Board and the Regional Technical Working Group:

- The National Scientific Advisory Board has 20 members and about 25 technical contact persons from several institutions and research centres. The purpose of this group is to ensure that methods used during the whole process will have the desired positive effect on the environment.
- The Regional/Political Advisory Board has 50 members primarily from local stakeholders. The purpose of this group is to ensure that all relevant stakeholders are informed and in acceptance with the process of developing a Water Plan. Its role is to ensure that every relevant stakeholder has an opportunity to contribute to the preparation of the Water Plan.
- The Regional Technical Working Group has 18 members. This group is working with the purpose to discuss the whole process in detail, including proposed measures. The members of this group have technical skills to perform this task. Members come from stakeholder groups in the catchment of Odense Fjord. Some stakeholders are represented by national experts as well (agriculture).

The three boards were invited to ensure that the process of preparing a Water Plan was done to everybody's satisfaction. Private companies involved in manure treatment technology and consultants were involved as well. Participants were involved through half-yearly meetings in

advisory boards, ongoing technical dialogues and ad-hoc meetings. Relevant materials from the steering committee, from advisory boards and from technical groups were placed on: <http://odenseprbuk.fyns-amt.dk>.

Some of the main conclusions of the public participation process in the Danish case study were:

Identification of stakeholders

- A stakeholder analysis is very useful and should be done at the very beginning of the process.
- More public participation than what is called for in Danish legislation is needed in order to ensure later acceptance of the water plan. In order not to jeopardize well proven relationships, public participation should be built on previous experience.

Networking

- Strong stakeholders (from a financial or organization point of view) can influence the work process strongly. Weaker stakeholders may make alliances to ensure their common interests.
- The competence and mandate of participating stakeholders must be clear, as should the objectives of a working group. Terms of Reference for the group work should be prepared from the start.
- Stakeholder meetings give an opportunity to create understanding of other stakeholders' views and opinions on important environmental matters.

Acceptance

- One cannot expect complete acceptance of proposals from the authority.
- Consensus among stakeholders cannot be expected, as different political interests are bound to be exposed. A political decision is necessary at some point in time and you can one can achieve acceptance of opinions through an open dialogue.

Evaluation and implications

The national documents envisage a significant role for stakeholder consultation and expert judgment, in line with the WFD. They have clearly identified areas where such consultation could play a crucial role for the CEA. The specific institutional mechanisms or type of processes for doing so, including the role of the organisation in charge of leading the consultation, how to organise the consultation or to define a specific timetable, are not defined explicitly in those documents.

This is largely because these aspects are spelled out in specific guidance focusing on the organisation of stakeholder participation for all aspects of the WFD implementation. Note that some aspects linked to the implementation of the programmes of measures would need to be explicitly dealt with in such guidance on stakeholder participation, such as how to resolve conflicts, particularly in cases where the proposed combination of measures may affect certain economic sectors more severely than others. However, this would be dealt with in more detail when assessing the distribution of costs and conducting the disproportionate costs analysis, as discussed in more detail in the next section.

3.9 Linking the cost-effectiveness analysis to further steps of the analysis

This sub-section examines what is suggested to link the cost-effectiveness analysis to further steps of the economic analysis for the Water Framework Directive such as the distributional analysis (an analysis of “who pays”) and the analysis of disproportionate costs.

Summary of approaches

Carrying out the cost-effectiveness analysis can allow gathering information which will be of use for subsequent steps of the analysis, including the assessment of the distributional impacts of measures and that of disproportionate costs. The distribution of costs is not relevant for defining the most cost-effective programme of measures but it is for evaluating disproportionate costs. While in theory CEA and the analysis of disproportionate costs are separate, in practice, they may be carried out together in order to avoid interaction or overlaps, as long as the distinctions between the two are set out in a transparent manner.

For example, as the Dutch handbook points out, the information gathered in the CEA will aid the formulation of what are essentially political decisions, such as the apportionment of costs between sectors and the potential transfers between sectors to compensate those that bear the majority of the costs. For that reason, the Dutch handbook recommends carrying out both analyses in parallel (by gathering information on distributional impacts for each measure) although it does not recommend a detailed methodology for doing so, since the focus of the handbook under review is on finding the least cost allocation of technical measures.

Cost-effectiveness analysis and further steps	
WFD	The WFD requires that other types of economic analysis be conducted. For example, Article 9 mentions that MS shall ensure by 2010 an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, based on the economic analysis conducted according to Annex III and taking account of the polluter pays principle. Economic analysis is also necessary for the analysis of disproportionate costs in all the conditions specified in Article 4.
United Kingdom	<p>The UK methodology recommends that information on costs be collected in a comprehensive manner during the CEA so as to facilitate the analysis of who pays (distributional analysis based on the financial costs) and the disproportionate cost analysis at a later stage. However, some key information will still need to be gathered for these later stages of the analysis, such as the costs (and benefits) of water-related environmental impacts for the disproportionate cost analysis or the distributional assessment indicating the incidence of costs and benefits or an estimation of the value of water-related benefits. Some of these issues can be flagged-up during the CEA, by conducting a rough analysis of cost-recovery and distributional impact for example, based on a comparison of the share of the costs that a stakeholder is bearing relative to their contribution to the pressure.</p> <p>As mentioned above, an evaluation of the uncertainty surrounding cost estimates should also help with taking decisions about whether it is preferable to wait for additional information to be available or to base a</p>

Cost-effectiveness analysis and further steps	
	decision on incomplete information through a “Value of Information” (VOI) analysis. This would help in supporting arguments for time derogations in the event of disproportionate costs (i.e. to defer a decision to the next planning period), provided that probabilities can be assigned to the different outcomes.
Germany	The links with the further steps of the analysis are not made explicit in the German handbook and are therefore not covered in details here.
Netherlands	<p>The derivation of an “optimal” programme of measures is presented as an iterative process, in which both cost-effectiveness and cost-analysis can be used to derive feasible and affordable objectives and their associated packages of measures. However, it is recommended that the assessment of disproportionate costs be carried out after the initial cost-effectiveness analysis is complete. This is also recommended for the evaluation of distributional impacts, referred to as the apportionment of costs (burden sharing).</p> <p>With respect to supporting time derogations, the methodology notes that some measures may have an impact in later periods, due to time lags. Therefore, it may be necessary to carry out the cost-effectiveness analysis for various time horizons and for objectives attained not only in 2015, but also 2021 or 2027.</p> <p>The handbook points out that it will be necessary to evaluate the distribution of costs of the programmes of measures between sectors: if it is more cost-effective for a given sector to take all the measures, it should not necessarily be the one that bears all the costs. This is defined as an implementation issue, which requires a political decision but the cost-effectiveness analysis can provide information for formulating such decisions (for example, on the issue of distribution of costs between upstream and downstream regions, as in the example in Box 1). The cost-effectiveness analysis should gather sufficient data to support the subsequent analysis of distributional impacts, particularly with information on feasibility and affordability, as well as indirect effects on employment and on the overall economy. If the benefits from implementing the measures can be estimated during the cost-effectiveness analysis, these should be recorded for the benefit of any subsequent cost-benefit analysis.</p>
France	<p>The Ministry of Ecology document recommends seeking the views of local stakeholders in order to identify any potential cause for requesting an exemption from the 2015 objectives. The reasons put forward by local stakeholders then need to be studied in more detail and may form the basis for conducting a cost-benefit analysis in order to justify a derogation. CBA should be used only if the local stakeholders say that, in their opinion, achieving the 2015 good status objective would be disproportionately costly. The results of such analysis would then need to be presented to local groups.</p> <p>The testing document in the Normandy bogs recommends allocating costs</p>

Cost-effectiveness analysis and further steps	
	between the various stakeholders at a very early stage of the analysis in order to facilitate subsequent cost-recovery analysis. It also sets out how the subsequent disproportionate costs analysis can be carried out, which means that the two types of analysis are effectively combined. It recommends preparing alternative combinations of measures with different phasing-in scenarios, depending on costs and capacities.
Spain	The methodology, as developed for the Cidacos case study, recommends allocating costs between the various stakeholders in order to facilitate subsequent cost-recovery analysis and designing pricing proposals as a measure. The distributive impact over the different stakeholders must be the result of a social consensus in order to make the RBMP socially and politically acceptable; the convenience of some side payments and cross subsidies must be considered at this stage. Some important decisions must be taken as a result of the consultation and final decision process. The least economic cost programme of measures to reach the environmental objectives will need to be financially viable. For this reason, the effects of prices and other financial incentives need to be assessed in order to guarantee that people have the financial incentives to adapt their behaviour in the way expected by the RBMP.
Denmark (Odense)	The link with further stages of the analysis was not dealt with specifically in the Odense Pilot River Basin.

Evaluation and implications

In order to minimise the need for revisiting the same information at a later stage, several documents recommend that information on the distribution of costs on various sectors of each measure be recorded whilst conducting the CEA, even if it is only in broad qualitative terms. This is because a distributional impact analysis would almost always be required when considering how to implement the recommended programme of measures in practical terms.

The evaluation of disproportionate costs will only be needed for specific objectives so it would be too costly to gather all information (such as information on water-related environmental costs and benefits, which is required to estimate benefits) ahead of time. But it would be useful to report where this information may be available or suggested methodologies for compiling it based on available information or to identify existing gaps in information which would need to be filled out to allow such quantification. For the disproportionate costs, information coming from the CEA will be useful but it will also need to be combined with information coming from other types of analysis, such as the analysis of cost recovery, initial status, technical information on the feasibility of the measures and baseline scenario.

4. Conclusions of chapter III

The requirement for conducting a cost-effectiveness analysis was only defined in very broad terms in the text of the Directive, leaving much room for interpretation and adaptation to MS specific circumstances. The evaluation of national documents on conducting a cost-effectiveness analysis has allowed identifying areas of similarity and alternatives regarding the methodologies to be used.

We have summarised our findings and conclusions on the basis of five main points below:

MS have adopted a broad range of approaches depending on local circumstances (data, scale, methodologies,...)

MS that have already defined their proposed approach to CEA have all aimed to define a methodology to identify the most cost-effective programme of measures for a river basin district, which is the broad aim of the CEA according to the WFD. All MS propose to follow a similar set of logical steps, making the comparison of the methodology used for tackling each of those steps relatively easy (as done in the body of this report, where each Table shows the approach adopted by each country on a particular methodological point). Areas of similarity and key alternatives can be broadly summarised as follows:

- **Scale** - most national documents recommend carrying out the cost-effectiveness analysis first at the level where the environmental issue takes place. They also stress that integration between the analyses conducted at various scales should be verified at a later stage but few recommend a specific methodology for doing so;
- **Type of measures** – most available national documents would mention the difference between measures (which tend to be more technical in nature) and instruments (i.e. economic or policy instruments) but would include all of them in the CEA (except from the Dutch document, which focuses on technical measures in the first instance). The available national documents would reserve the CEA for the analysis of supplementary measures, or new or altered basic measures where there is some flexibility, even though basic measures would be included in the overall programme of measures. Some restrict the use of CEA to even more specific circumstances, i.e. in complex situations where the choice between measures is not obvious. CEA is usually considered to be a tool for selecting measures at the local level and national measures can be decided upon through more traditional policy-making methods. However, conducting a CEA at the local level may highlight the need for introducing a national measure, if a pressure common in several water bodies could be more effectively be addressed by a national measure rather than by local measures implemented in all the affected water bodies. Non-water measures are usually considered alongside water measures although there may be a slight bias towards focusing on water measures.
- **Pre-screening of measures** – all MS that have defined a CEA methodology have also prepared (or are in the process of preparing) a national catalogue of measures, with generic information on costs, effectiveness, mechanisms for implementation, uncertainties, etc... These catalogues have reached various levels of development but they can usually be used as a basis to perform the CEA at a local level. Based on such catalogues, the first phase of the local analysis would usually consist of carrying out a pre-screening of measures, either to eliminate measures that are not technically feasible (as

recommended in the Dutch guidance) or those which are clearly not cost-effective based on preliminary estimates (as in the UK guidance).

- **Evaluating the effectiveness of an individual measure** – there are large variations in the way that MS propose to evaluate the effectiveness of an individual measure, bearing in mind that some MS (such as France) do not spend much time on evaluating the effectiveness of a single measure but rather switch their attentions to evaluating the effectiveness of a group of measures. These variations are also due to the fact that there are several dimensions to good status and that a single measure may have an impact on several of those dimensions at once.
- **Estimating costs** – similarly, the proposed methodologies for estimating costs vary substantially from one MS to the next, depending on the stage at which they are recommending estimating environmental and wider economic costs. Some recommend valuing such costs only in qualitative terms at the CEA stage, with a more detailed analysis only at the CBA stage.
- **Assessing cost-effectiveness and evaluating combinations of measures** – as a result of the diverse methodologies for estimating effectiveness and costs, there is also considerable variation in terms of estimating cost-effectiveness. Some national documents, such as the Dutch and the Spanish ones, advocate relying on a single indicator on cost-effectiveness, estimated as the total costs divided by the total effects. However, given the difficulties in quantifying all effects and costs highlighted in other documents, the presentation of such a single indicator would often be difficult which is why other MS prefer the presentation of appraisal tables combining qualitative and quantitative information to support the consultation process and decisions by decision-makers.
- **Dealing with uncertainty** – uncertainty may affect cost and effectiveness estimates but also the definition of good status at this early stage, since the good status objectives have not yet been defined with precision. MS advocate several strategies for dealing with uncertainty, ranging from selecting the measures where uncertainty is less (as in the French document), to producing range estimates (as in the UK document) or seeking to obtain more information in order to reduce uncertainty (a method which is commonly advocated, although it would be necessary to review the full costs of obtaining such additional information -including delayed achievement of objectives- versus the benefits of doing so).
- **Consultation process and involving experts** – all national documents have identified specific circumstances where consultation of stakeholders and experts may be required. There are differences in such circumstances, which reflect different modes of involving the public in general and the availability of information at the local level.
- **Cost-effectiveness analysis and further steps** – All MS identify a link between the CEA and other stages of the economic analysis mainly through the information that is gathered. Given the link between cost-effectiveness and later stages of the analysis, the CEA exercise can be used to gather initial information for the distributional impact analysis, which means that such information should be noted as an aside when the CEA is being performed. Information gathered for the CEA can also help inform the analysis of disproportionate costs although additional information, such as on the environmental costs and wider economic effects, would need to be gathered at that stage.

All MS are going through a learning process and cost-effectiveness methodologies will need to be reviewed after 2009

Different MS are working to implement cost-effectiveness analysis with existing data and methodologies into the River Basin Planning. After 2009, this work will need to be revised as it is recognised that MS are in the process of learning how to carry out CEA for the WFD. This will allow making the most of MS experiences and may permit making the obtained results and policy conclusions more compatible with each other.

At this stage, none of the national documents have developed an integrated methodology for CEA allowing at the same time to define effectiveness simultaneously for different risk parameters (nitrogen, suspended solids, hydro-morphological changes) and to incorporate transboundary views.

This review has helped identify key areas where further learning would be required, especially on:

- **Scale issues** - how the programmes of measures built at the level of water bodies where there is a significant water management issue can be integrated with that in other water bodies, and in particular, how transboundary issues can be dealt with;
- **Combining qualitative and quantitative assessments** – the methodologies developed by MS have shown the need to combine qualitative and quantitative assessments of costs and effectiveness estimates and this for several parameters. At this stage, it seems that trying to deal with all of those assessments in a systematic manner would require developing a set of weights which may be difficult to attribute and too complex to administer. However, further methodological developments would be welcomed in order to deal with such an issue.

Variations between methodologies most likely reflect differences in circumstances, which means that harmonisation is not a worthwhile objective

Based on this analysis, it clearly appears that there is no common approach for integrated cost-effectiveness analysis in MS. The methodologies developed by MS reflect the type of pressures they are faced with, the relative importance of public participation and data availability. They may also reflect different priorities in different MS and the resources available to undertake the assessments. Water management capabilities may vary substantially, particularly given that CEA will need to be carried out by non-economists in most MS. Some methodological options are easier to adapt to the selection among ecosystem restoration options, others are most suited to choose among ways to reduce pollution loads and others are better suited to select the least cost options to save water in order to increase water flows and stocks in the natural environment. The information available, and the cost to obtain additional information, is also a reason that needs to be considered when explaining different choices taken with regard to CEA.

Notwithstanding this, in transboundary basins, it will clearly benefit all MS to engage in sharing of information to compare methods, definitions and data in order to improve consistency of the approaches.

The methodologies that have already been set out provide a very useful resource for MS that have yet to define their own methodology

All national documents are usually in agreement with respect to the main areas of difficulty with the cost-effectiveness analysis, but vary in their approaches for tackling them. Some national documents would go into more details than others for tackling certain issues (such as estimating costs for example, or combining measures into a cost-effective package of measures). Having access to all tools and instruments developed by the various national documents may be useful to the Member States which have yet to develop their own methodology for conducting a cost-effectiveness analysis, as it would provide them with a choice of approaches to fit local circumstances.

The adoption of cost-effectiveness methodologies should be seen as a key component of an improved way of carrying out water policy at the European level

CEA should be seen as a tool to help decision-making as well as an information system to improve transparency. It is not an end in itself. Apart from contributing to the design of a RBMP by 2009, the CEA must be a constituent part of a new institutional framework to design and assess water policies. In this sense, CEA information will need to be updated during the implementation process of the RBMP, cost estimations will also need to be changed with the new information available, the package of potential measures will need to be widened with new technological options and results from R&D, and so forth. Building a CEA framework is therefore not a once for all task but an ongoing tool to inform, assess and design the current water policy options and to monitor, audit and improve the quality of water policy decisions in future.

