Comparative study of pressures and measures in the major river basin management plans in the EU

Task 4 b: Costs & Benefits of WFD implementation

Task 4 b - Costs & Benefits of WFD implementation: Final report

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Note to the reader

This final report was prepared by ACTeon in the context of the EU project entitled ***Comparative study of pressures and measures in the major river basin management plans in the EU***. It benefited from input from Edi Interwies (InterSus – Sustainability Services, Germany) and Sarah Bogaert (Arcadis, Belgium).

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Content

1 Context

The Water Framework Directive (WFD) is promoting the application of sound economic principles, methods and instruments for supporting the achievement of its objectives (good ecological status) in Europe. However, at the start of adoption of the WFD, few countries had experience in the field of water economics. Despite initial efforts by many Member States and the specific guidance on water economics developed under the CIS process, the economic knowledge in the field of water has only been progressively built and in a very heterogeneous manner throughout Europe.

The more recent River Basin Management Plans (RBMP) reported to the EC further illustrate the emerging role of economics for supporting water management, very scattered and partial economic information being reported by EU member states (MS) with most often a lack of transparency on methods and assumptions. Furthermore, limited coherent cost and benefit information is reported. As a result, building a common economics knowledge base, making direct comparative assessments of costs and benefits in different River Basin or extrapolating available economic information to perform an EU wide assessment of the costs and benefits of the WFD remain a difficult and very challenging task.

At the same time, with the increasing competition on water resources and the current economic and financial crisis, there is a strong demand from all stakeholders and in particular from economic operators for more robust economic assessments to justify water management and policy decisions. As a result, the economic knowledge base for supporting policy decisions has been identified as one of the key problem areas that the forthcoming EU Water Blue Print will address.

2 Assessing WFD costs and benefits in the context of the EU Pressures and Measures project

2.1 Objectives of the assessment

To respond to the challenges outlined above, a specific task on costs & benefits was included in the *Comparative study of pressures and measures in the major river basin management plans in the EU* that is financed by the European Commission.

The overall objective of Task 4b is to develop a knowledge base on the economic dimensions of water management (i.e. costs, benefits & financing) that will contribute to:

- The overall assessment of the economic impact (costs & benefits) of the WFD (or its first cycle);
- The economic assessment of the policy options considered under the EU Water Blue Print.

In addition to these primary objectives, Task 4b will also provide recommendations on:

- How costs and benefits might best be assessed and reported under the WFD (and potentially other EU water-related directives that address economic issues);
- Enhancing the existing water economic knowledge base (through research, studies, etc.) so that it better supports European water management and water policy making in the medium and long-term.

2.2 Steps of the assessment

To achieve these objectives, a three-step methodology was developed, as illustrated below.

Step 1 – Review of existing information on the costs and benefits of the WFD

The existing information on the costs and benefits of the WFD in the selected countries was the basis of the current assessment at the EU level. In order to provide a complete and systematic review of such information, two databases 'one for cost information and one for benefit information- were created. This information base was created with the final purpose of allowing for the extrapolation of cost or benefit information for those river basin districts in which less or no information on costs or benefits is available: this implies, among other things, that information had to be collected and organized to allow comparisons among different river basin districts (RBDs).

In particular, costs and benefits were dealt with in the databases in two distinct ways:

- The **cost database** is aimed at collecting costs information per RBD, while allowing for the differentiation of costs per sector, main water management issues etc. The database has been designed in a way to make the methodologies used for cost calculation as well as the

different cost elements (in terms of type of measures but also regarding investment costs, operational and maintenance costs, etc.) as transparent as possible. This will be very useful for a later comparison or potential aggregation of cost data from different MS. Cost information is expected to be provided mainly in the RBMPs. Where this is not the case, accompanying studies and documents were reviewed.

- The **benefit database** is aimed at highlighting all possible relationships between changes in water status, Ecosystem Goods and Services (EGS), corresponding benefits and their monetary values, while linking this information to socio-economic information in RBDs and, whenever possible, also to water management objectives and type of measures adopted in the RBMPs. In view of the planned extrapolation exercise, benefit information was complemented with other indicators which can help understanding the relationship between measures and expected benefits, such as for example the total population, the main economic activities in the area, the number of water bodies in the basin etc. The relationships emerging from the database will be used to estimate benefits in other RBDs with similar characteristics but missing/inadequate benefit information. In the case of benefits, information could be found in the RBMPs only in one country, and more often accompanying studies and documents were reviewed.

As previously mentioned, this review of costs and benefits of the WFD implementation focused on countries for which cost and benefit information was more readily available, namely France (FR), Belgium (BE), Spain (ES), the Netherlands (NL), Luxembourg (LU), Latvia (LV), Lithuania (LT), Estonia (EE), Romania (RO) and the United Kingdom (UK)[1]. Other countries such as Germany (DE), Italy (IT), Cyprus (CY), Greece (EL) and Malta (MT) were also investigated, although less information could be found.

Step 2 – First extrapolation of available cost and benefit information to the European level

Based on the available cost and benefit information a first, simple extrapolation of the costs and benefits of the WFD at the EU level was performed. The aim was to provide a first indication on possible ranges of total costs and benefits for the EU 27 as a whole, to be compared with the results obtained through the application of the protocol for extrapolation which will be developed in the next and final step of the assessment.

To do this, simple average unitary cost and benefit values were calculated (costs/ha, costs/inhabitant, costs/WB, benefits/inhabitant), thus allowing for extrapolation of costs and benefits at the national level, then aggregated at the EU level; to account for differences in the data sources and uncertainties involved in such exercise, ranges of minimum, average and maximum possible costs and benefits are provided, rather than specific values.

Step 3 – Development of protocols for assessing costs and benefits at the river basin scale

In light of the limited information available, protocols that account for the salient features of river basins were then proposed for estimating costs and benefits at the river basin scale for river basins for which costs and benefits information is lacking or of insufficient quality. The assumption – to be tested – is that the application of such protocols will enhance the quality and soundness of general economic assessments of the WFD in particular, and of water policy in general.

[1] Kristine Pakalniete (AKTIIS, Latvia), Sandra Oisalu (BEF, Estonia) and Daiva Semeniene (CEP, Lithuania) provided support to obtain relevant information from Baltic States.

The assessment of costs and benefits of water policy in general, and of the WFD in particular, poses key challenges in absolute terms, but also in relative terms as compared to the assessment of other policy areas such as air quality. Indeed:

- Information on benefits, but also on costs, is often limited – and/or presented in formats that make its further use difficult;

- It is difficult to capture the spatial dimension of the water cycle, and the distribution of costs and/or benefits at scales that are "hydro-relevant" such as the river basin scale. Thus, assessments building on average cost or benefit figures applied at national scales rarely grasp adequately the actual costs and benefits of water policy and management.

In case information on costs and/or benefits is not readily available, transferring information and values from other countries, regions or river basins is a real challenge, requiring additional knowledge on the environmental and socio-economic context to which costs and/or benefits refer. In the literature, much attention is given to "benefit transfer", where economic values of ecosystem goods and services from a given (primary) site are applied in a different (secondary) site using additional information characterizing this site. Often, the transfer builds on econometric models developed for primary sites which are then applied with the characteristics of the secondary site. But parameters influencing values in a statistically significant manner are often difficult to obtain without surveys, in particular at aggregated (river basin) scales. And the performance of benefit transfer using these models as compared to applying simple transfers of averages is questionable.

Taking these challenges and limitations into account, a basic framework for designing a suitable protocol was developed. The basis for the establishment of the protocols is the integration between the DPSIR framework and the Ecosystem Goods & Services framework that further specifies the ecosystem services delivered by different states of the aquatic environment. Central to the assessment is the marginal change in water status in river basins that correspond to the policy implementation/goal (be it the overall goal of the WFD or the intermediary objective fixed at the end of the first river basin management planning period).

- It is expected that there is a relation between this change in water status and the total costs of measures required for this change to happen. This relation will depend on the types of measures to be implemented and their "dimensions" (number of hectares or population targeted), themselves depending on the drivers and pressures at the origin of the initial status level. In reality, this relation is multiple and not a one-to-one relationship: indeed, different sets of measures representing different philosophies can deliver the same outcome while having clearly very different costs[2]. For the assessment, the issue is to ensure cost-effectiveness sets of measures are considered so costs are not over-estimated.

- Ideally, this change in water status will lead to changes in ecosystem goods and services and thus to benefits. In some cases, the resulting changes in ecosystem services will remain as "potential" when no population benefit from the expected change in (potential) service. The challenge here is then to propose relationships that help capturing the factors that link

[2] This issue is often raised, e.g. when comparing strategies for restoring the quantitative balance of water resources in particular demand management versus supply-based strategies.

changes in water status to changes in ecosystem services effectively delivered (combining changes in the level of provision of the (potential) service with changes in the affected or beneficiary population – if any). More precisely, different relationships could be proposed for different water ecosystem types and socio-economic regions.

Thus, in an ideal world, the assessment of costs and benefits at a river basin scale could be performed using two relationships linking: a) the costs of (potential) measures with water status changes, drivers and pressures; and ; b) the benefits obtained from these measures with water status change and ecosystem services. Depending on the level of precision one might need, different relationships could be developed for different types of hydro-socio-economic conditions.

This basic framework is outlined in Figure 1.

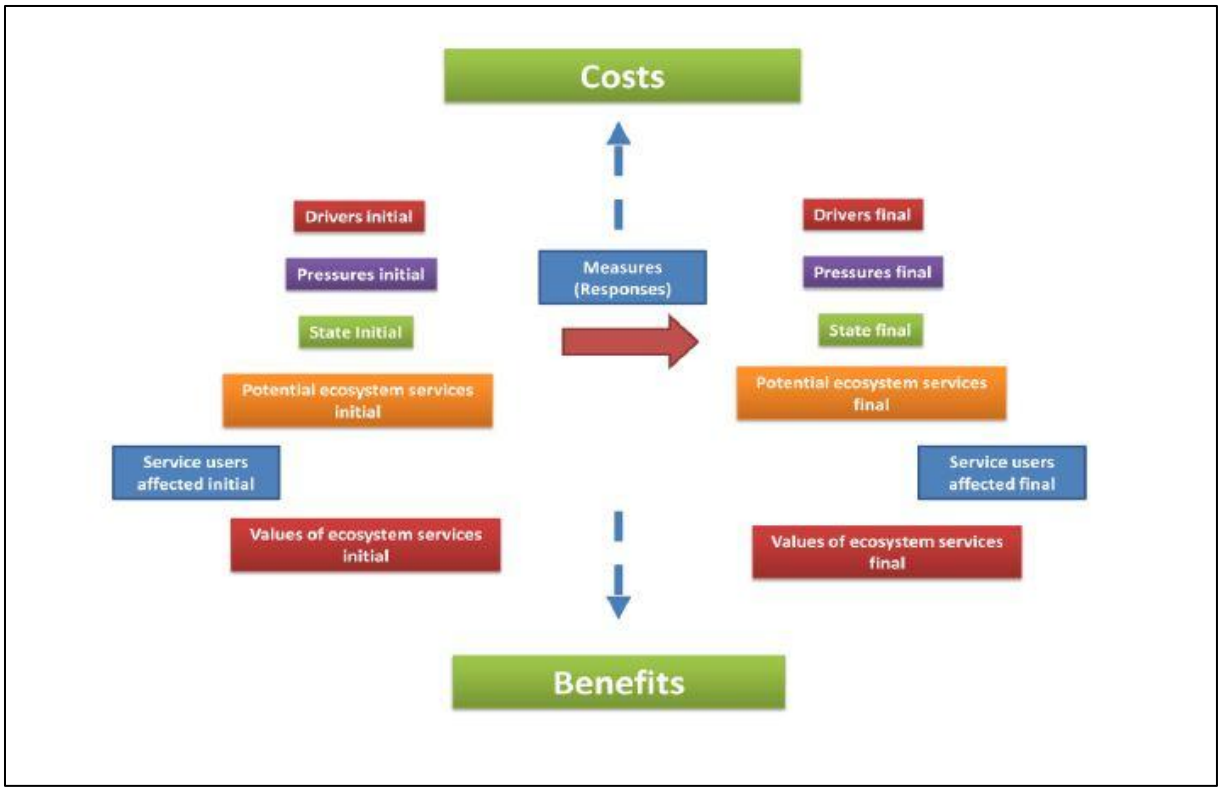


Figure 1 The basic framework adopted for developing extrapolation protocols

To identify possible relationships between costs and benefits on the one hand and changes in status and ecosystem services on the other (as well as other variables), a new river basin database was developed that aimed at structuring river basin information for conducting statistical analysis. The database included several variables at the river basin scale, which were deemed to reflect to various degrees the factors that might affect costs and/or benefits. The key variables considered, taking into account of readily available information[3], were partly derived from the database currently under

[3] At the start of the EU Pressures & Measures project, it was expected that river-basin scale information on changes in water status, drivers, pressures, impacts and unitary costs of a wide range of measures would be delivered by the work undertaken under Task 3. However, this did not materialize and only some data could be obtained from Task 3. Thus, other data (mainly proxies of the variables that were of interest) were then collected from publicly available sources.

development in the context of Task 3 of this project and partly from the databases made available by the EEA. These include:

- Total cost figures – whenever available;
- Total benefit figures - whenever available;
- The total area, the population and the population density of the river basin (expected to grasp part of the pressures on the river basin, but also influence total benefits[4]);
- The ecoregion(s) to which the river basin belongs (assuming that ecosystem services and thus benefits might differ from one eco-region to the other, but also that the type of eco-region might impact on the type and effectiveness of measures and thus on costs) ;
- Land-use information obtained from the Corinne Land Cover such as the percentage of the major land cover categories in individual river basins (expected to grasp partially the main drivers and pressures of individual river basins);
- Number of WBs, WBs in good status, artificial WBs, and expected changes in WB status obtained from Task 3 databases (as this is expected to influence the magnitude of benefits);
- The main pressures in each river basin, obtained also from the Task 3 databases.

As mentioned above, the statistical analysis focused on searching relationship between costs and benefit figures and the other variables through correlation and Kendall tests. In the case of benefit information, however, the number of RBDs for which benefit data were available proved to be insufficient for carrying out sound statistical analyses. In the case of costs, it was indeed possible to perform the correlation and Kendal tests, and the variables which showed to be significantly correlated with costs were used as independent variables to develop simple and multivariate regression functions with costs as the dependent variable. Such functions became thus the basis of the protocol, and were applied to all European RBDs to estimate total possible cost figures of WFD implementation at the EU level.

2.3 The objectives of the report

In this context, the objectives of this report are:

- To provide the overview of the available cost and benefit information for the countries reviewed in the context of the EU “Pressures & Measures” study;
- To identify the main differences in the information available for the different countries investigated;
- To present the first attempts to develop and apply statistically-based protocols for extrapolating costs information to river basins where such information is not readily available (or does not exist), stressing in particular the limitations of the proposed approach and the main challenges met when developing and applying the protocols;

[4] The assumption here is that total benefits will depend on the average economic value given by a single person multiplied by the number of persons in the river basin.

- To provide first estimates of what the overall costs and benefits of the WFD might be at the EU scale, building on the available information base.

3 Investigating the available knowledge on WFD costs: first results

3.1 Availability of cost information

Among the countries reviewed, the availability of information on the costs of the implementation of the WFD, in particular the Programme of Measures (PoM), is very different from one country to another – and partly even within the same country.

From the MS reviewed, it was not possible to find any indication on the costs of the WFD implementation for Greece only. In Germany, a single general cost figure is provided (reported in WISE) for the WFD implementation for the entire country – without any breakdown per river basin district (RBD) or indications on the type of cost information included (e.g. basic and / or supplementary measures). The same applies to Cyprus, with the difference that the island encompasses one RBD only. In Belgium, cost information is only given for the Flemish part of the Scheldt river basin. For Italy, cost information outside of the WISE reporting sheets could only be found for the Central Apennines District. In WISE, however, cost information is provided for all the Italian RBDs, except for Sardinia and Sicily. On the contrary, more detailed information could be found at the RBD scale for EE, FR, the UK, NL, LT, LU, RO and LV. These countries provide differentiated cost data in their RBMPs for groups of measures, for all measures of a given per sector, per main water management issue or grouped under other categories that are specifically chosen because of the issues encountered. The table below summarizes the availability of cost information in the RBMPs and in WISE.

Table 1 Availability of cost information

Countries reviewed	Cost information available in RBMPs	Cost information reported to WISE
BE	partly (only for the Scheldt - Flemish part)	partly (only for the Scheldt - Flemish part)
BG		yes (apart from the Danube RBD)
CY	No	yes
DE	no	yes, but only national
EE	yes	yes
EL	no	no
ES		partly
FR	yes	yes
IT	partly (only for the Central Appennines District)	yes (besides Sicily and Sardinia)
LT	yes	no
LU	yes	yes
LV	yes	yes
MT	yes	yes
NL	yes	yes
RO	yes	yes
UK	partly (for Scotland, costs for the draft RBMP, for Northern Ireland costs for the three RBDs together)	yes (besides Scotland)

3.2 Main differences between cost information provided by MS

As mentioned above, differences exist in the details and the amount of cost figures provided in the different MS. Furthermore, important differences have been identified with regards to the cost elements considered and the methods or assumptions used for obtaining cost estimates. Annex I of this report illustrates the differences among countries for three relevant aspects: the planning cycles taken into account for the calculation of cost figures; the handling of the different measure types (basic versus supplementary measures); and the inclusion of investment and operation and maintenance costs or any other cost information.

With regards to the planning cycle taken into account, the analysis shows relatively similar approaches taken by different MS. Apart from LU, all countries have published cost information for the implementation of the PoM of the first river basin management planning cycle (2010-2015). ES (partly), FR (partly), LU and NL gave in addition estimates of the costs for the entire WFD implementation period 2010-2027/ for reaching good ecological status in all water bodies. For RO and the Guadeloupe RBD in France, information on the costs of the second and third management cycle is also provided.

With regards to the handling of different measure types (basic vs. supplementary), and as illustrated in table 2 of Annex I, individual countries have treated this issue very differently. In many of the French RBDs and in Northern Ireland, for example, only cost figures for supplementary measures are estimated. In NL, the situation is similar, with a combination of supplementary and additional measures. In LU, on the other hand, only costs of two types of basic measures are provided. In all other countries, both cost data is given for basic and supplementary measures, but with different levels of disaggregation. In most of the RBDs of the UK, for example, costs of measures linked to the implementation of directives other than the WFD are given separately, but costs of basic measures of the WFD and supplementary measures for reaching goods status are provided together. Only in the case of the Italian Central Apennines District, costs for all four types of measures (including additional measures) are provided separately. Uncertainty on the type of measures considered is prevailing in the cases of Germany and Cyprus. It is worth mentioning that the UK – besides Northern Ireland and Scotland – which provides cost information in the context of their regulatory impact assessment, calculated cost data quite differently from the other MS. Whereas the remaining countries provide cost figures which seem to result mainly from adding foreseen expenses for the years 2010-2015 (without necessarily taking depreciation into account), the UK gives cost data in the form of a present value, which – for most of the measures – considers a period of 43 years.

Other differences exist between countries, and sometimes between river basins of a given country, with regards to the type of costs taken into account in the cost calculations, as illustrated in Table 3 of Annex I. Differences exist for example between RBDs in France, the Seine-Normandy RBD including only investment costs while all other RBDs present both investment and operational and maintenance costs[5]. Differences between RBDs can also be found in the Spanish case[6]. In general, transparency is often lacking regarding the type of costs taken into account. Only Latvian and

[5] For the French RBD of the Réunion and the Estonian RBDs, it is unclear whether other costs than investment costs have been taken into account.
[6] Only cost information provided in WISE has been considered.

Lithuanian RBDs clearly identify the different cost elements considered, which for LT for example comprises investment costs, operational and maintenance costs, VAT, administrative costs and environmental taxes and charges.

As mentioned above, several countries provide disaggregated cost information for different categories (sectors, pressures, or other groups of measures). However, the categories used are quite different from one country to another (see examples from the UK and Estonia below) and even within countries (e.g. in the case of France).

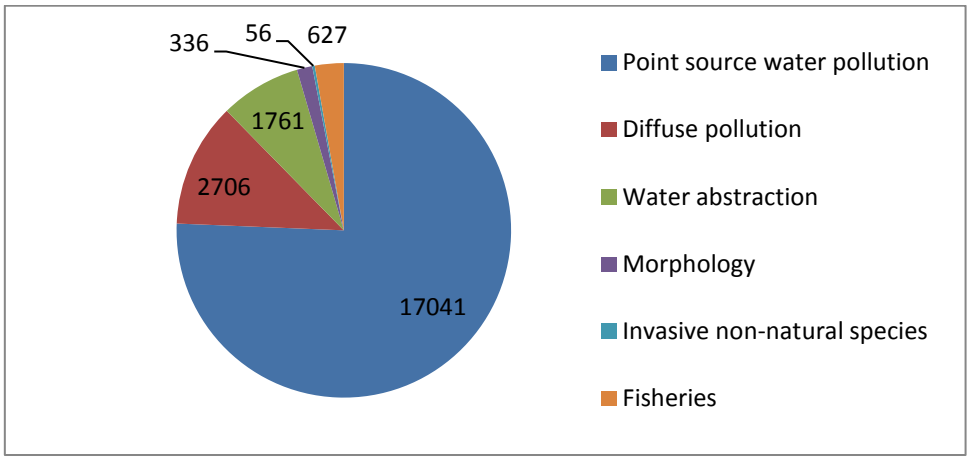


Figure 2 Distribution of the total costs of the first planning cycle of the Severn RBD in the UK (present value, in thousand Euros)

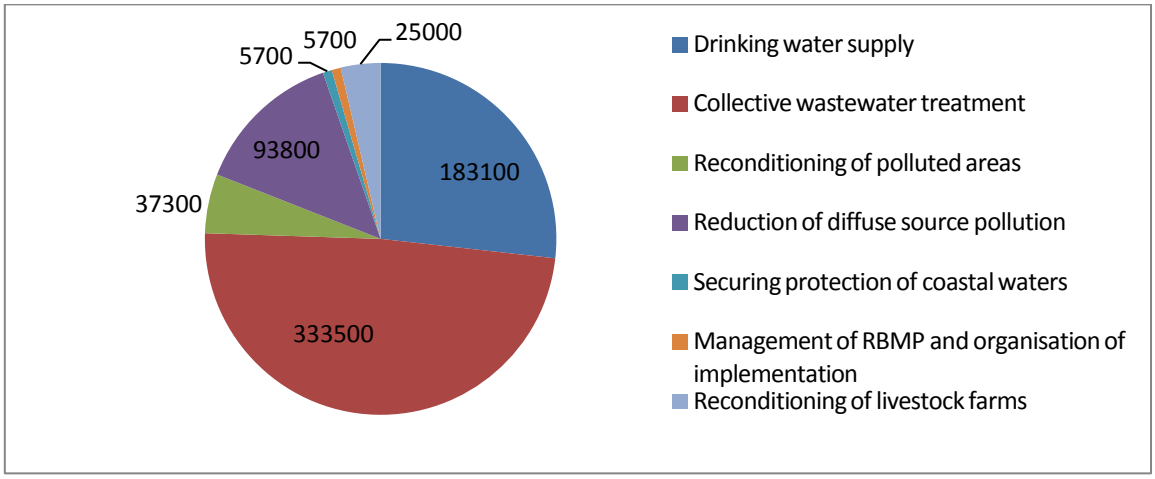


Figure 3 Distribution of the total costs of the first planning cycle of the West-Estonian RBD (in thousand Euros)

3.3 Are comparison and aggregation of cost figures possible? – Analysis of available cost information

Regarding the analysis and interpretation of the cost data collected, it is interesting to compare the costs of WFD implementation in different countries and to aggregate these costs to estimate total costs for several MS. However, the important differences in the parameters used for the cost calculation and the different methodologies applied impose significant limits to this task.

Based on the elements of the cost database, which is mainly referring to data from the RBMPs, the time span for which costs have been calculated (among the countries reviewed) only constrains comparison in the case of LU (which only calculated costs up to 2027). Difficulties result in particular with the differentiation of basic and supplementary measures. With the aim of indicating the (additional) costs of the WFD, it is in particular important to have the costs of basic measures linked to the implementation of other Directives listed separately from the basic measures linked to the WFD and from the supplementary measures. This is for example not the case for Malta and for the French RBDs Loire-Bretagne and Adour-Garonne. In other cases, where either the costs of supplementary measures and/or costs of basic measures linked to the WFD are provided, these figures could be summed up to provide an idea of a minimum cost of implementing the WFD. This is the case for BE (Flemish part of the Scheldt), most of the French RBDs, MT, NL and UK. The figures below are based on the cost data reported to the European Commission through WISE. They are in many cases better structured than figures from the RBMPs, but some information is missing, or seems incorrect.

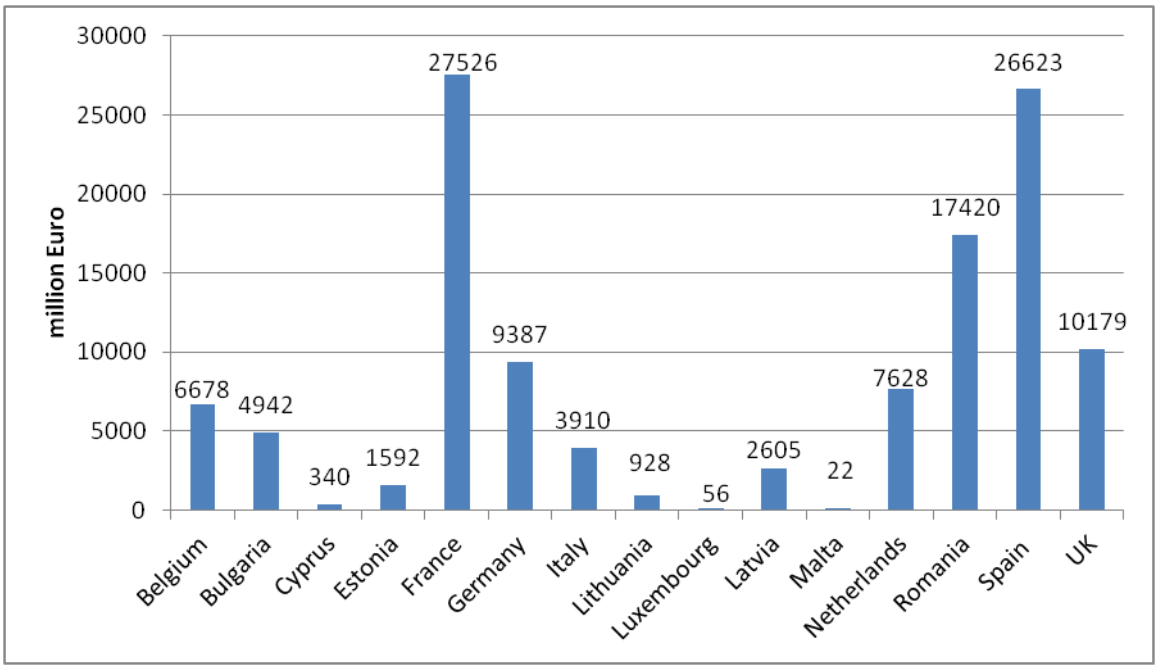


Figure 4 Cost figures of the first planning cycle reported to WISE, aggregated per country (in million Euro)

Note:
Total reported costs (all types of measures mixed).
The figure for Belgium only includes costs for the Flemish Scheldt RBD.
The figure for Bulgaria does not include costs for the Danube RBD.
The figure for France does not include Mayotte.
The figure for Italy does not include Sardinia and Sicily RBDs.
No figures are provided for Lithuania in WISE, the figure is stemming from the RBMP.
The figure for Spain includes the following RBDs: Galician Coast, Tagus, Guadiana, Guadalquivir, Segura, Ebro, Catalan RBD and Balearic Islands.
The figure for the UK does not include Scottish RBDs.

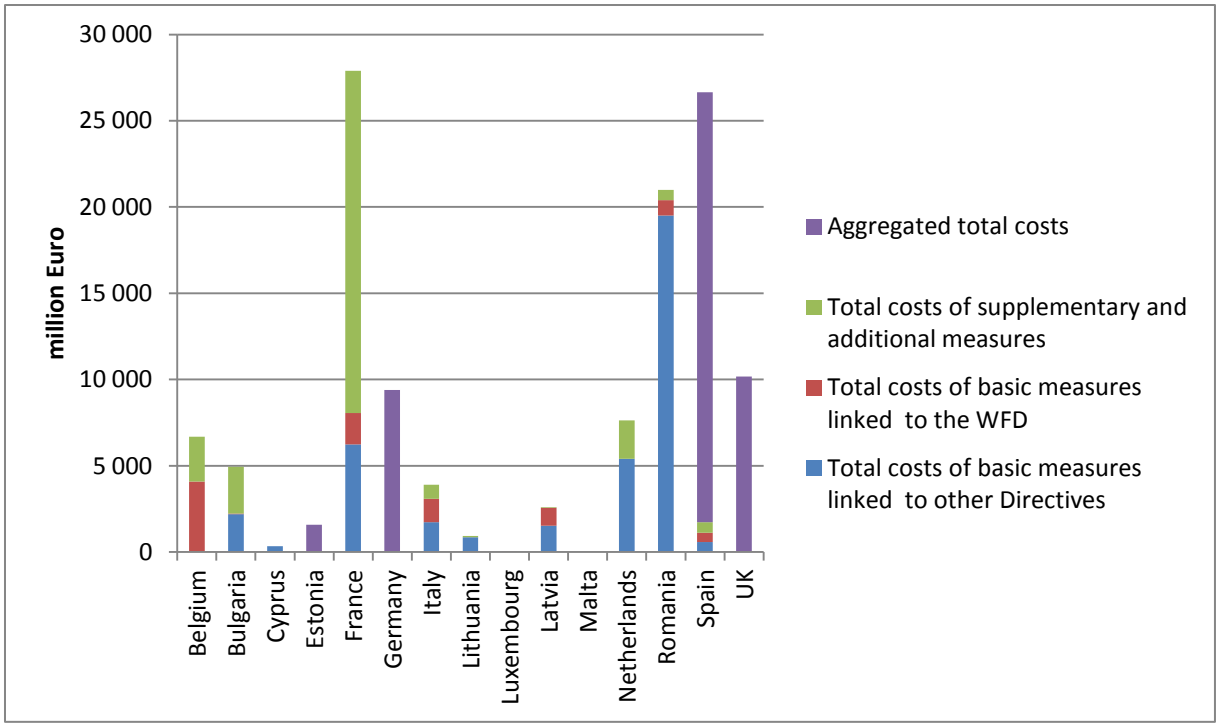


Figure 5 Total costs of the first planning cycle reported to WISE, taking the disaggregation per type of measure into account

Note:
Total reported costs in WISE (all types of measures mixed).
The figure for Belgium only includes costs for the Flemish Scheldt RBD.
The figure for Bulgaria does not include costs for the Danube RBD.
The figure for France does not include Mayotte.
The figure for Italy does not include Sardinia and Sicily RBDs. Furthermore, some figures have been excluded from the analysis, as they seem to represent mistakes (figures "9999").
No figures are provided for Lithuania in WISE, the figure is stemming from the RBMP.
For the Netherlands, the share of the basic measures is referring to both types of basic measures.
The figure for Spain includes the following RBDs: Galician Coast, Tagus, Guadiana, Guadalquivir, Segura, Ebro, Catalan RBD and Balearic Islands.
The figure for the UK does not include Scottish RBDs.

Based on the data provided in WISE, rough estimates can be made regarding the total costs of the WFD implementation for the first RBMP. Adding up the figures for the 15 countries investigated - without taking into account the differentiation in measure types - leads to a total cost of **119.8 billion Euros**. This corresponds to an average total cost of 609 Euro per inhabitant, ranging from 7 Euro per inhabitant in the Italian South Appennines District and the Lithuanian Dauguva RBD to 1704 Euro per inhabitant in the Bulgarian Black Sea river basin[7]. When looking only at the cost figures which can be clearly linked to the WFD implementation (excluding hence measures linked to the implementation of other EU Directives), an aggregation is only possible for BE (one RBD), BG, ES (3 RBDs), FR, IT, LT, LU, LV, MT, NL, RO and the UK. Summing up the cost figures for these 11 countries gives a total cost of **49.5 billion Euros** for the first WFD planning cycle. This represents an average

[7] Only those RBDs are taken into account for which information on the number of inhabitants could be made available.

cost of 222 Euro per inhabitant, with a range from 0.9 Euro per inhabitant in the Lithuanian Dauguva RBD to 973 in the Bulgarian Black Sea river basin[8].

As indicated above, some of the countries reviewed provide in their RBMPs also figures for the entire implementation period of the WFD and for reaching good status of all water bodies. The figure below illustrates the different cost figures for ES (Segura RBD), FR, LT, LU, NL and RO. The figure for FR is very high, compared to the other countries, although only six RBDs are considered. This might partly be explainable through the fact that costs of basic measures linked to the implementation of other directives are included in the figures at least for some of the RBDs. In the case of the Spanish Segura RBD, the figure also includes basic measures linked to other directives. The costs for this RBD without those basic measures amounts to 3324 million Euro. The total costs for RBDs for which information is given amount to **64.6 billion Euros**.

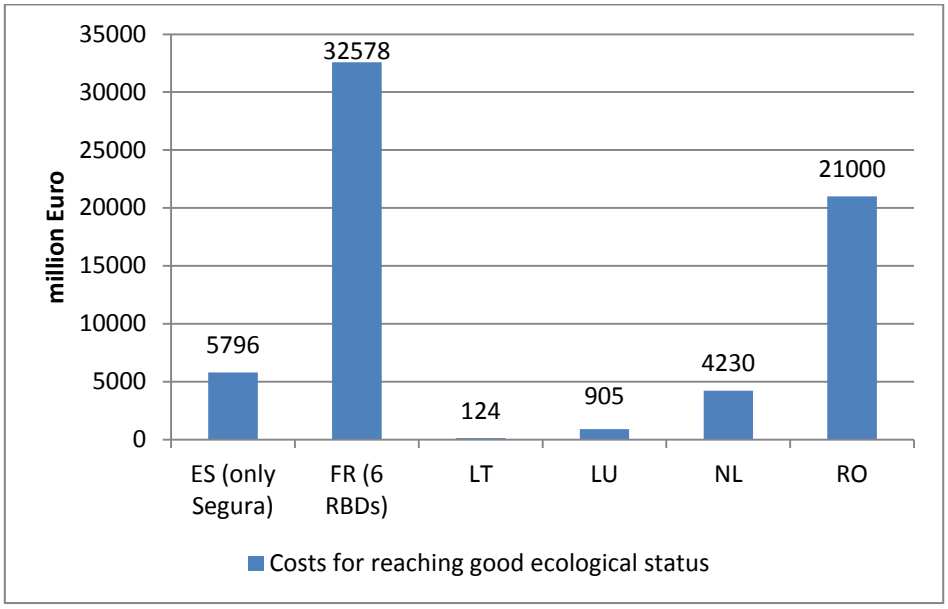


Figure 6 Costs for reaching good status in selected countries

Note:
Costs for the Spanish Segura RBDs include both types of basic measures and supplementary measures.
Costs for France include the following RBDs: Seine-Normandy, Artois-Picardie, Rhône-Méditerranée, Meuse and Sambre, Rhine, Guadeloupe
Seine-Normandy includes costs for implementation of basic measures linked to other directives.
Artois-Picardie: Total cost available including investment and operational costs. Basic measures make up for 10 % of the total costs (600 million Euros) and supplementary measures for 90 % (4 100 million Euros).
Guadeloupe: both types of basic measures included
Lithuania: Concerning the costs included for reaching good status: Costs for 2010-2015 only include supplementary measures. For the cost part for 2010-2027 it is unclear in how far basic measures are included.
Luxembourg: Costs include only basic measures linked to the WFD.
The Netherlands: The cost figure does not include any basic measures.

[8] Only those RBDs are taken into account for which information on the number of inhabitants could be made available.

4 Investigating the available knowledge on WFD benefits: first results

4.1 Availability of benefit information

In contrast to cost estimation, the identification and quantification of the benefits connected to the WFD implementation is generally not straightforward. And it often involves assumptions and uncertainties about the expected positive impacts of measures s.

In general, in the course of this exercise it was hardly possible to retrieve quantitative benefit information directly in the RBMPs. So the review that took place mobilized also accompanying studies and documents, either prepared by the river basin authorities themselves or by independent sources (e.g. research projects). The availability of benefit information, as well as the type of information available, varies considerably across the reviewed countries, as showed in the following table (additional detailed information is provided in Annex II).

Table 2 Review of available benefit information for selected Member States

Country	Information sources	Description
Belgium	Benefit information is not available within the RBMPs, so the assessment was based on external independent studies	Benefit information was found for the majority of RBDs, although in some cases the study was conducted at RBDs scale and in other at regional scale. All studies focused on some non-market benefits linked to the implementation of the WFD, and in all cases the contingent valuation method was applied. In two cases benefits were explicitly linked to the EGS framework, but more often this relationship was derived. The chosen time horizon was usually 30 years; when only yearly benefits were provided, total NPV of benefits over a 30-year period was calculated while filling the database.
Cyprus	No information on benefits linked to WFD implementation was found, neither in the RBMPs nor in accompanying/external studies.	An external study valuing the economic benefits of a wetland area was included in the database.
Germany	No benefit information could be found.	
Estonia	Benefit information is not available within the RBMPs, so the assessment was based on external independent studies	Benefit information was found for a specific water body (Valgejogi river) and for coastal waters (open Baltic Sea). In the first case, the benefits taken into account are not related to specific EGS, while in the Baltic Sea the benefits considered include more EGS at once. For the Valgejogi river benefits were valued using contingent valuation, but only the unitary value is provided (i.e. yearly benefits or aggregated benefits over a time period are not available); for the Baltic Sea, benefits were only quantified and not valued.
Greece	RBMPs have not been published yet, and there are	Benefit information was found for two specific sites (the island of Lesvos and one wetland), so no information was available at

Country	Information sources	Description
	no official documents available on benefits; some external, independent studies were used.	the river basin level. The three studies focusing on the island of Lesvos only focused on a general valuation of environmental and resource costs of water, estimated through contingent valuation; the last study, although not linked to the WFD implementation, considered all habitat and recreational services, which were valued one by one.
Spain	Benefit information could not be found in RBMPs, so the assessment was based on external independent studies.	Benefit information was found for 4 RBDs, although three studies were conducted at the RBD level (two in the Guadalquivir RBD and one in the Guadiana RBD), one at the sub-basin level (the Serpis sub-basin in the Jucar RBD) and one at the WB level (a lagoon in the Segura RBD). Two study valued the benefits linked to all cultural services (one study in the Guadalquivir RBD and the one in the Jucar), two studies took into account the provision of clean water (one study in the Guadalquivir and the one in the Guadiana RBD) whereas one study valued both the provision of clean water and cultural services (Segura). Choice experiment was used in two studies (Guadalquivir and Jucar RBDs), contingent valuation in two studies (Guadiana and Guadalquivir) whereas in the Segura RBDs both contingent valuation and opportunity cost method were applied.
France	Benefit information is not available within the RBMPs, but in many river basins the 'Agences de l'eau' developed accompanying studies on the benefits of the PoM in the whole basin or in specific sectors.	Benefit information was found for the majority of RBDs, but it is highly un-homogenous across different basins and studies with respect to: (i) scale of the study, as benefits were assessed for the whole river basin type of benefits, for specific water bodies or for particular areas, depending on the basin; (ii) type of benefits taken into account; (iii) valuation techniques; and (iv) time horizon for which benefits were estimated. In all studies, however, there was no reference to the EGS framework, and relationships were derived, when possible, while filling the database.
Italy	No benefit information could be found, and RBMPs, when available, are still going through the approval/implementation process. One study from the AquaMoney project was available.	Benefit information was found at the RBD level (Po river basin), focusing on cultural service (valued altogether). Contingent valuation was used, but only WTP/household/year values were provided.
Latvia	Benefit information is not available within the RBMPs, so the assessment was based on external independent studies	Benefit information was found for two specific water bodies (Lutza river and Riga' aquifer) and for coastal waters (open Baltic Sea). The three studies differ in the way EGS are considered: for Lutza river, three EGS are taken into account, while in the case of Riga's aquifer it was not possible to make the link between benefits and EGS; in the Baltic sea study, the benefits considered include more EGS at once. In all studies, however, benefits are not valued, and only for Riga's aquifer a quantification exercise was carried out.

Country	Information sources	Description
Luxembourg	No benefit information could be found.	
Lithuania	Benefit information is not available within the RBMPs, so the assessment was based on external independent studies	Benefit information was found for one river basin (two studies: one at the RBD scale, one at the sub-basin scale within the same RBD). In both studies, benefits were linked to some EGS, although in the valuation exercise the EGS taken into account were bundled together and valued through contingent valuation. At the river basin level, both unitary and yearly value of benefits were provided, while at the sub-basin level only unitary value was estimated.
Malta	Only some brief, qualitative information on benefits is provided in the RBMP.	
Netherlands	Benefit information is not available within the RBMPs, so the assessment was based on external independent studies	Benefit information was found for two RBDs, although in one case the study was conducted at RBDs scale and in the other at regional scale. The studies generally focused on some non-market benefits linked to the implementation of the WFD, but in one case e market benefit was also included. Both studies apply the contingent valuation method. Benefits are normally linked to the EGS framework, but in one case this relationship was derived. The chosen time horizon was 30 years in the first study; in the second study, only yearly benefits were provided, and total NPV of benefits over a 30-year period was calculated while filling the database.
Romania	Benefit informationis given at the national level to justify exemptions from reaching GES	Benefits were analyzed based on effect of specifically measures on 11 indicators; the changes in EGS are estimated in a qualitative way.
UK	For all RBDs in England and Wales benefit information is included in the RBMPs' Impact Assessment; for Northern Ireland, benefits are assessed at the regional level, thus including all Northern Irish RBDs (or part of them, for trans-boundary RBDs).	Benefits were estimated in all English and Welsh RBDs according to a standardized methodology: the same types of benefits linked to the WFD implementation were estimated at the national level within the National Water Environmental Survey through contingent valuation, which resulted in the estimation of unit benefit value at water body level; unit values were then aggregated at the RBD scale over a 43-year time horizon. Therefore, benefit information for England and Wales is highly standardized and comparable across RBDs. The EGS framework was not taken into account, but it was possible to derive the relationships while filing the database. No benefit information was found for Scotland. For Northern Ireland, benefits are assessed and valued using contingent valuation, over a shorter time horizon (15 years).

4.2 Main differences in available benefit information

The synthesis provided in the table above reveals the scattered and heterogeneous nature of available benefit information, both between and within reviewed countries. The main differences between existing benefit information include:

- The information source: benefits information is provided in the RBMPs only in one case (UK, with the exception of Scotland). In other countries it is presented in accompanying studies and documents developed either by the RBD authorities or by external research teams;

- Spatial scale: benefit information is provided at different spatial scales. Furthermore, in many countries, benefits are not assessed in the RBMPs, but rather in accompanying or external documents that estimate benefits at many different spatial scales even within the same country. Benefit information was estimated at the national scale (LU), at the river basin scale (UK, FR, BE, NL, LT), at the regional scale (BE, NL, UK), or even at the water body / site level (FR, GR, CY, ET, LV);

- Reference to the EGS framework: the relationship between the assessed benefits and the EGS framework is rarely made explicit (only in BE and NL). This information was derived while filling the database with available benefit information;

- Type of benefits considered: the definition of the type of benefits assessed in the different studies is probably the element presenting the greatest differences across countries and studies. Using the EGS framework as reference, the review shows very diverse disaggregation of the benefits obtained from different ecosystem good and services, with 'bundles' of EGS being valued sometimes as one unique benefit (this is true especially when contingent valuation is used, as it accounts for different goods and services depending on the questionnaire used). This implies that it is often impossible to understand the value of single ecosystem good and services. Furthermore, when single benefit values are used, it is unclear whether all EGS have been made explicit or not. In general, recreational services are taken into account in most of the studies, these services being however are often bundled with other services;

- Valuation techniques: different valuation techniques have been applied to estimate benefits, although contingent valuation appears to be the most common method used in many studies;

- Time horizon: depending on the study, benefits are estimated on a yearly basis or for a longer time-period. In the latter, a 30-year time horizon is usually applied. In the UK, however, a 43-year period was chosen (with the exception of Northern Ireland, where benefits are estimated over a 15 year time period).

4.3 Are comparison and aggregation of benefit figures possible? An analysis of available benefit information

Due to the many differences found in the various benefit information sources, the possibility to compare and especially aggregate benefit figures across countries was from the start seen as a clear challenge. As indicated above, this results from differences in terms of the spatial units at which benefits are estimated, the types and aggregation of benefits considered, valuation techniques, and temporal scales considered. The challenge is even greater when realizing that the basic knowledge base is scarce as RBD level benefit information is available in only a few river basins.

The first step in the analysis involved the identification of significant parameter at the RBD level (area, population, changes in water status) and the determination of one parameter which can ease in principle the comparison of benefit information in different RBDs, namely the value of yearly benefits per inhabitant, as shown in Table 3.

Table 3 Overview of available benefit information for countries and river basins kept for analysis and extrapolation

Country	RBD Name	Size RBD	Inhabitants	Density	Change in status (WB passing to good status)	Yearly benefits	Yearly benefits / inhabitant
		km^2	*Number if inhabitants*	*Inhabitants /km^2*	*%*	*M€/year*	*€/person/year*
BE	**Scheldt – Walloon part**	3770	1120000	297.08	n.a.	13.31	11.88
BE	**Meuse – Walloon part**	12283	2198000	178.95	n.a.	24.08	10.96
BE	**Scheldt – Brussels**	162	12996272	80223.90	n.a.	7.37	0.57
ES	**Guadiana**	55454	1783871	32.17	13.40%	39.34	22.39
ES	**Guadalquivir (1)**	57731	5000000	86.61	28.24%	365.00	73
ES	**Guadalquivir (2)**	57731	5000000	86.61	28.24%	50.51	10.1
ES	**Jucar (Serpis sub-basin)**	920	230000	2500	n.a.	3.69	16.04
FR	**Adour Garonne**	118683	1351102	61.94	11.26%	126.61	17.22
FR	**Seine - Normandie**	96418	18216002	188.93	29.34%	1757.08	96.46
LT	**Nemunas**	50048	2548786	50.93	6.83%	48.64	19.08
NL	**Scheldt – Dutch part**	4470	463000	103.58	4.92%	4.43	9.57
NL	**Country level**	49512	16730632	337.91	8.57%	186.70	11.16
UK	**Northumbria**	9036	2601938	287.95	5.25%	0.52	0.2
UK	**Humber**	26126	111261782	431.06	1.46%	0.98	0.09
UK	**Anglia**	27817	5518268	198.38	1.04%	0.42	0.08
UK	**Thames**	16182	14625666	903.82	2.11%	1.99	0.14
UK	**South East**	10199	3225424	316.25	3.64%	0.42	0.13
UK	**South West**	21206	2986073	140.81	8.51%	1.99	0.67
UK	**Severn**	21608	5544622	256.6	4.61%	1.36	0.25
UK	**Western Wales**	16653	1350681	81.11	6.02%	0.63	0.47
UK	**Dee**	2253	421350	187.02	8.70%	0.31	0.74
UK	**North West**	13149	6767609	514.69	3.20%	0.63	0.09
UK	**Northern Ireland (state)**	13576	1799392	132.54	36%	3.25	1.81

The table above stresses the large differences between benefits estimated for different RBDs. In particular, as illustrated in the graph below, three value ranges can be identified:

- Low range: 0 ÷ 1.81 €/inhabitant/year (including all UK RBDs for which benefit information is available and the Brussels area of the Scheldt RBD in Belgium);
- Mid range: 9.57 ÷ 22.39 €/inhabitant/year (including France, the Netherlands, Spain, Lithuania and Belgium);

- High range: 73 ÷ 96.46 €/inhabitant/year (including only two exceptional cases, namely the one of the two studies in the Guadalquivir and the Seine-Normandie river basins).

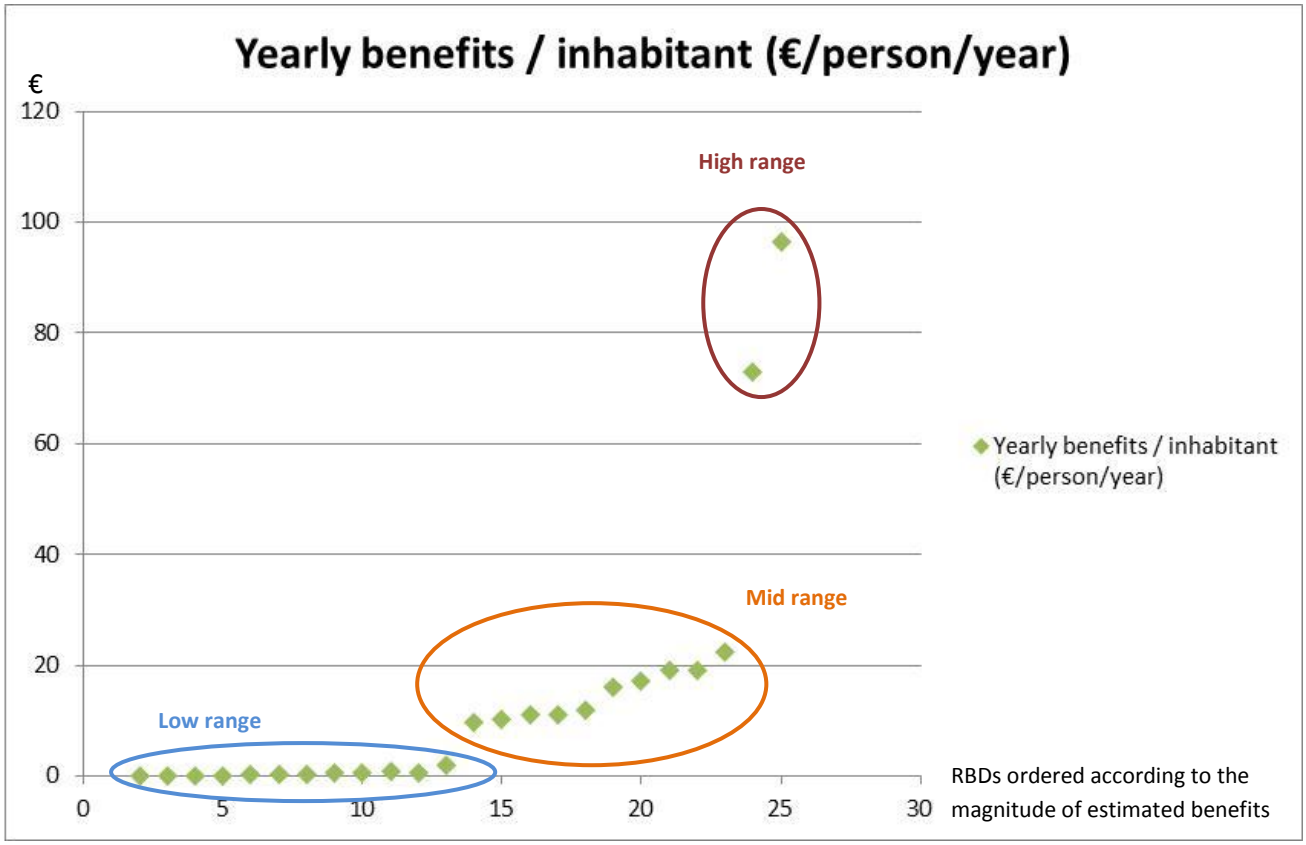


Figure 7 Yearly benefits per inhabitants ordered from the lowest to the highest.

The graph makes very clear that, whereas the lower and middle range are relatively similar one from each other, significant differences exist between these two groups and the two high-range cases. To assess the main factors that might explain such differences, further analysis was carried out.

The parameter which could explain differences in overall benefit value could be the expected change in water status by 2015, information provided in the RBD database developed by the project's Task 3. In the case of Belgium and Spain, however, the data available in the database was insufficient (in particular in terms of the spatial scale at which benefits were estimated) to keep these two basins into the analysis. The results of the analysis are illustrated in Figure 8, which does not include Belgian RBDs and the Jucar for the reasons listed above.

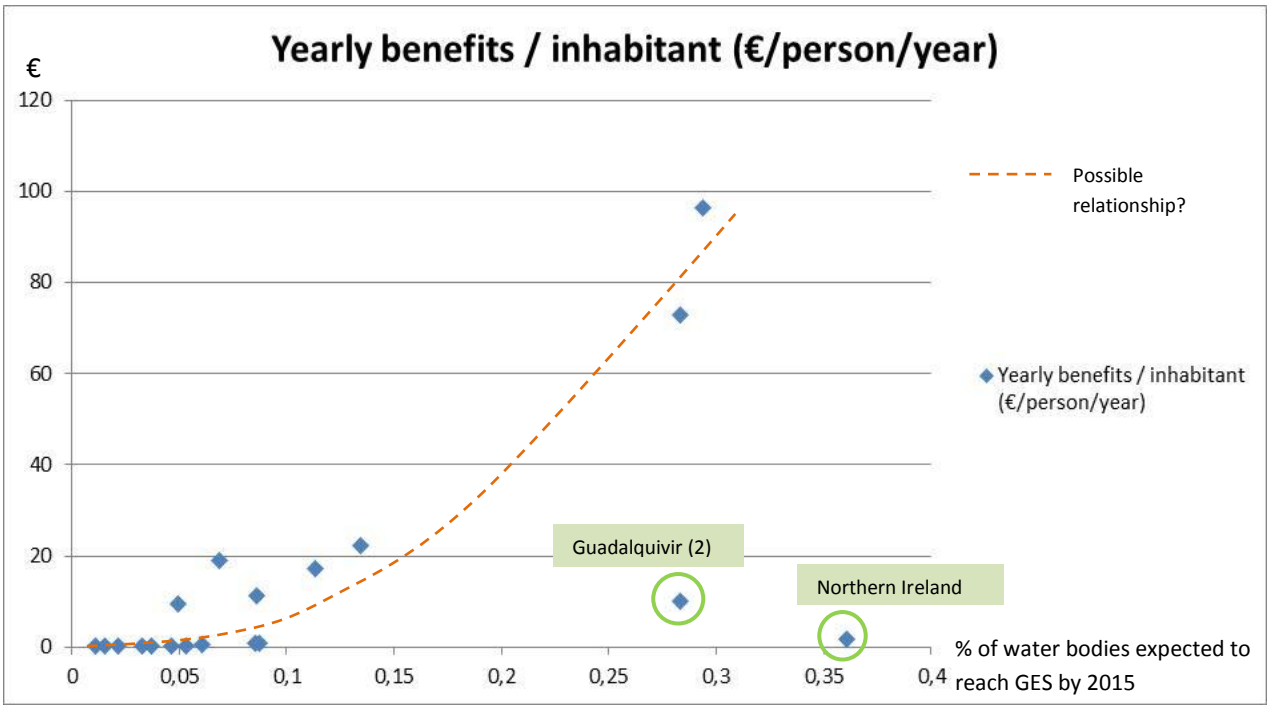


Figure 8 Relationships between the expected improvement in water status and the expected benefits.

As illustrated in the graph above, values for the Guadalquivir basin (two studies) and Northern Ireland do not follow the same general trend as other studies. In the case of Northern Ireland and the second study carried out in the Guadalquivir RBD, expected benefits are rather low as compared to the change in water status planned in the RBMP. However, this benefit value only consider the benefit attached to a single ecosystem service (the provision of clean water). In all other cases, however, although some variability exists between river basins, it seems that the benefit value does increase with a rising expected change in status. While looking at this graph, however, one should not forget the fact that benefits estimated in different countries follow different methodologies and take into account different bundles of benefits.

To overcome these issues, the analysis was limited to the values available for the UK river basins, where the same methodology was applied to all RBDs in England and Wales (thus not including Nothern Ireland, for which a different methodology was used). The results presented below suggest that, the valuation methodology being equal, expected benefits do in fact increase with the percentage of water bodies meant to achieve GES.

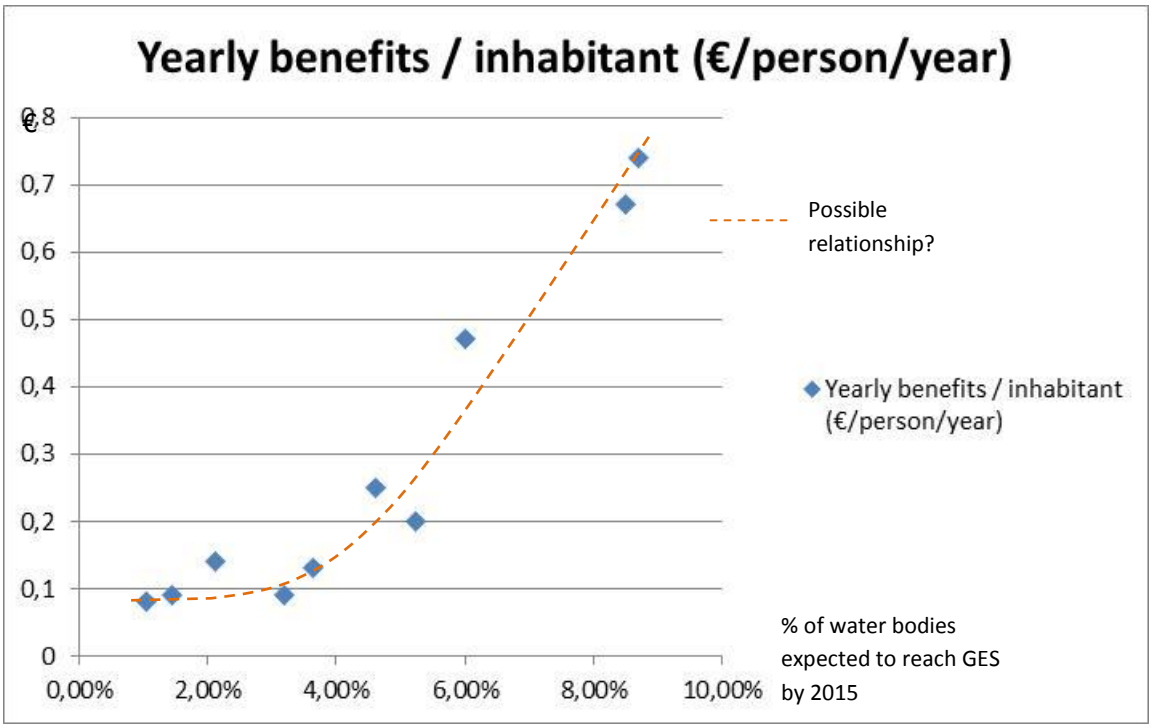


Figure 9 Relationships between the expected improvement in water status and the expected benefits in the UK (England and Wales).

The analysis conducted so far was based on the total yearly benefits per inhabitant. As mentioned earlier in this report, however, the different studies are hard to compare because they take into account different ecosystem goods and services (EGS), bundles of EGS valued altogether using contingent valuation or even benefits not linked to the EGS framework. It is thus interesting to compare the estimated values of single benefits or, when this is not possible, of different bundle of benefits (Figure 10).

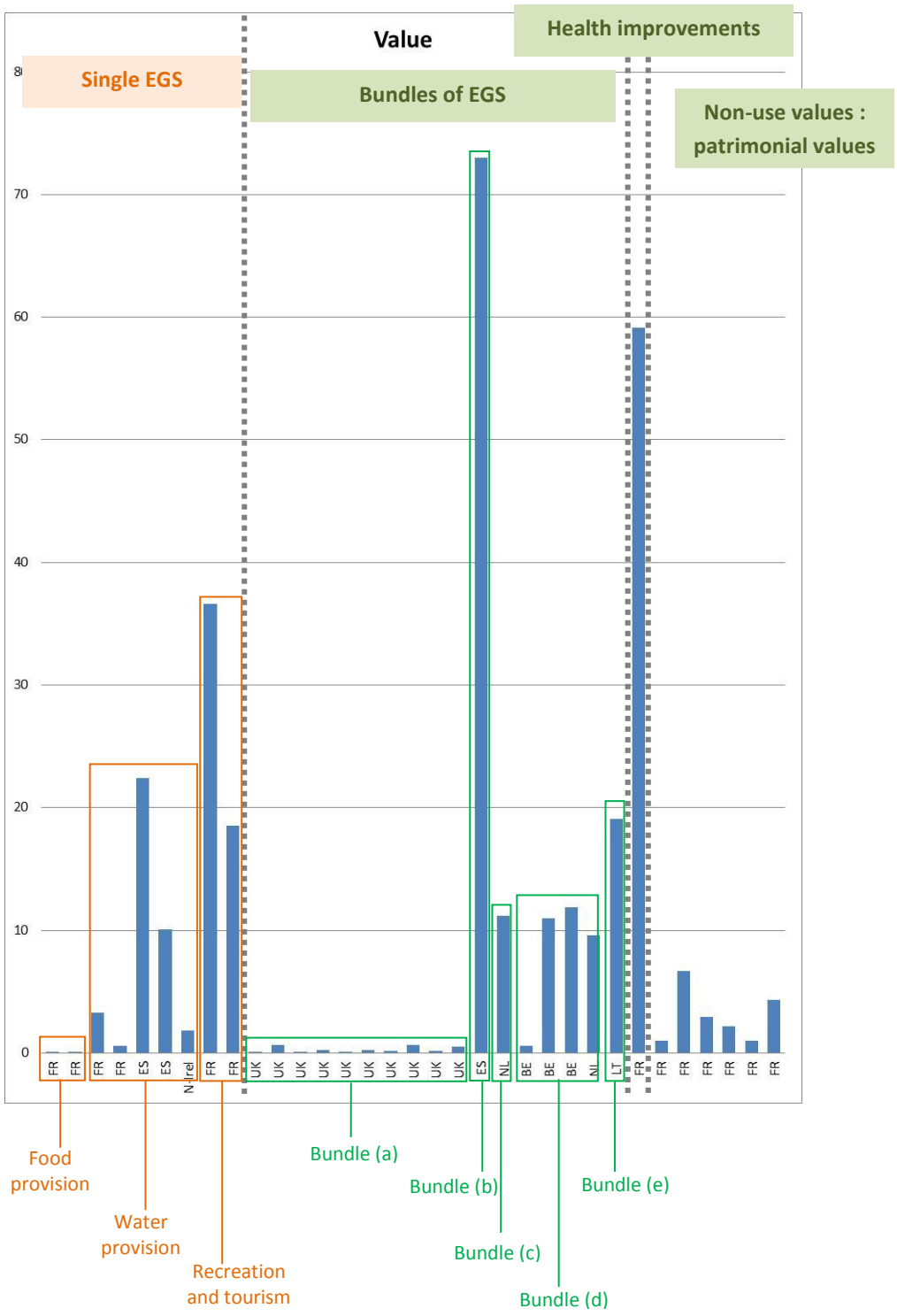


Figure 10 Estimated values of: single EGS; bundles of EGS; health improvements; non-use values or patrimonial values.

Bundle (a): maintenance of genetic diversity, aesthetic information, recreation and tourism, inspiration for culture, art and design;

Bundle (b): Aesthetic information, Recreation and tourism, Inspiration for culture, art and design , Spiritual experience, Information for cognitive development

Bundle (c): provision of clean water, provision of food, climate regulation, maintenance of genetic diversity;

Bundle (d): regulation of water flows, waste treatment, maintenance of life cycles + genetic diversity, aesthetic information, recreation and tourism;

Bundle (e): regulation of water flows, waste treatment, maintenance of life cycles and genetic diversity, recreation and tourism.

This exercise is interesting because it shows the high variability of estimations across RBDs and across different EGS and bundles of them. The most interesting figure of this graph is the value estimated for recreational services in the two French RBDs, which is not only much higher than the value of water and food provision, but it is often more important than the value of some bundles of EGS.

5 Extrapolating existing RBD/MS information to assess EU level costs & benefits

5.1 The costs of the WFD at the EU level: preliminary estimates

Extrapolating cost information to the European scale based on the countries reviewed above is a delicate issue, given the different uncertainties already highlighted. However, different rough calculations can be undertaken providing ranges which might give first hints of the order of magnitude of the total costs.

Extrapolation can be undertaken in different steps, and the cost information available (as described above) can be adapted in different ways when transferring it to the remaining EU member states. This will partly be done in the following parts of this sub-chapter, while two types of figures will always be provided:

- Costs of the measures specifically linked to the WFD: it refers to those measures included in the RBMPs as a result of direct implementation of the WFD. These costs will be referred to as the costs of "WFD dependent measures" in the tables and figures presented below;
- Costs of measures including costs linked to the implementation of other EU Directives: in accordance with the WFD, RBMPs must also incorporate the measures required by other water-related EU Directives, issued before the WFD. These costs will be referred to as the costs of "all WFD-related measures" in the tables and figures presented below;

Cost extrapolation for costs of the first WFD planning cycle

In the following tables and graphs, the extrapolation of costs to all over Europe is made using available cost figures as a basis. The costs estimates have been made using calculated cost values per inhabitant, per water body and per km². Next to the average values, the same calculation has been made with the smallest and the highest value given from the reviewed countries, to indicate potential ranges of total EU-wide costs.

Table 4 Extrapolated total costs of all WFD relevant measures for the first planning cycle for the EU 27 (in billion Euros)

	Based on costs per inhabitant	Based on costs per water body	Based on costs per km²
Lower value	3.5	8	6
Average value	305	824	230
Higher value	854	6 002	2 431

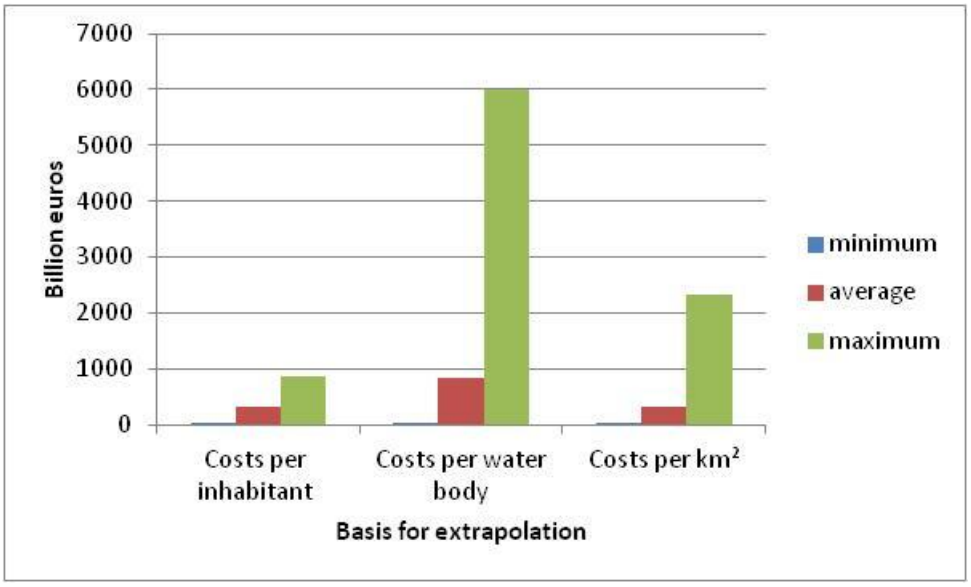


Figure 11 Extrapolated total costs of all WFD related measures for the first planning cycle for the EU

The total EU-wide costs for the implementation of **all WFD relevant measures** for the **first planning cycle** would then range (based on average cost figures per inhabitant, per water body and per km²) somewhere **between 230 billion Euros and 824 billion Euros**.

Table 5 Extrapolated total costs of only WFD dependent measures for the first planning cycle for the EU (in billion Euros)

	Based on costs per inhabitant	Based on costs per water body	Based on costs per km²
Lower value	0.5	2	2
Average value	111	444	230
Higher value	488	4 288	2 431

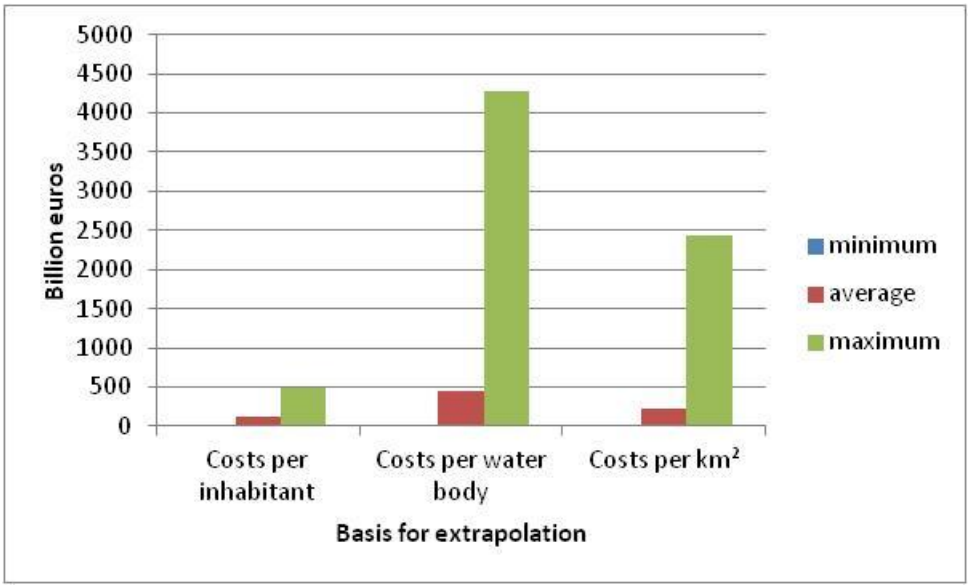


Figure 12 Extrapolated total costs of only WFD dependent measures for the first planning cycle for the EU

The total, European wide costs for the implementation of **only WFD dependent measures** for the **first planning cycle** are – based on average cost figures per inhabitant, per water body and per km² - lying **between 111 billion Euros and 444 billion Euros**.

These are only first rough estimates without any adaptation of the values available (values have been used for example without the consideration of the inclusion of investment or operation and maintenance costs nor any adaptation to account for differences in purchasing power between countries). Furthermore, when calculating costs per water body, the number of water bodies already in good status would need to be abstracted for making cost extrapolation to the EU scale.

Estimation of yearly costs

To be able to compare those estimated costs to the GDP of a country or average revenues, the total costs need to be estimated as costs per year. A rough approximation of yearly costs can be made through simply dividing cost figures by 6 (as the planning cycle is from 2009 to 2015 six years long). Whereas this is acceptable for the part of the costs corresponding to operation and maintenance (O & M) costs, it does not correctly account for the part of the costs corresponding to investments. For the latter, costs need to be divided by the lifetime of the equipment to correspond to yearly costs[9]. As described above and shown in table 3 of the Annex, it is often unclear whether both investment and O & M costs have been taken into account or not in the cost figures provided. However, in most of the cases where the type of costs included is indicated, both types of costs are included. For the purpose of the rough extrapolation of the available cost figures which is undertaken here, it will be assumed that both types of costs have been considered in all cost figures provided by MS.

Applying a uniform share of O & M equal to 10 % to the extrapolated figures presented just before results in yearly total costs per inhabitant as presented in Table 6 and Table 7.

Table 6 Yearly costs of all WFD relevant measures of the first planning cycle (in Euro)

	Costs of all WFD relevant measures per inhabitant	**Costs of all WFD relevant measures per inhabitant**		**Yearly costs of all WFD relevant measures per inhabitant**	
		Calculated share of investment costs	Calculated share of O&M	Assumed investment lifetime of 30 years	Assumed investment lifetime of 40 years
Lower value	7	6	1	0.33	0.27
Average value	609	548	61	28	24
Higher value	1704	1534	170	79	67

[9] Depreciation will not be looked at at this stage.

Table 7 Yearly costs of all WFD dependent measures of the first planning cycle (in Euro)

	WFD dependent costs per inhabitant	WFD dependent costs per inhabitant		Yearly WFD dependent costs per inhabitant	
		Calculated share investment costs	Calculated share O&M	Assumed investment lifetime of 30 years	Assumed investment lifetime of 40 years
Lower value	1	0.90	0.10	0.05	0.04
Average value	222	200	22	10	9
Higher value	973	876	97	45	38

As shown in the two tables above, the estimated yearly costs for **all WFD related measures** lie between 0.33 Euros per inhabitant and 79 Euros per inhabitant per year for an assumed investment lifetime of 30 years; with an **average of 28 Euros per inhabitant per year**. In the case of measures which are **exclusively linked to the WFD implementation**, their calculated costs vary between 0.05 Euros per inhabitant per year and 45 Euros per inhabitant per year for an assumed investment lifetime of 30 years; with an **average of 10 Euros per inhabitant per year**.

When comparing these figures to the average income per person in the EU 27 of 17 213 Euro (figure for 2008, Eurostat 2012[10]), the average cost values correspond to only 0.16 % and 0.06 % of this income for all WFD relevant measures and those only linked only to the WFD implementation, respectively. The highest theoretical share based on these figures could occur for Romania, which had the lowest average yearly income of 4 022 Euro per year in 2008. In this case, yearly costs of all WFD relevant measures (including both types of basic measures) would represent at the utmost 1.38 % of yearly income, and 0.39 % only for all measures linked exclusively to the WFD implementation. Based on these figures, extrapolated EU-wide costs have been estimated and are presented in the Table 8 and Table 9. Again, calculations have been made considering lifetimes of investments of both 30 and 40 years.

[10] http://appsso.eurostat.ec.europa.eu/nui/setupDownloads.do

Table 8 Extrapolated total yearly EU-wide costs of all WFD relevant measures based on the first planning cycle (in billion Euro)

	Based on costs per inhabitant		Based on costs per water body		Based on costs per km²	
	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)
Lower value	0.2	0.1	0.4	0.3	0.3	0.2
Average value	15	12	38	32	11	9
Higher value	43	33	280	235	113	95

Table 9 Extrapolated total yearly EU-wide costs of only WFD dependent measures based on the first planning cycle (in Billion Euro)

	Based on costs per inhabitant		Based on costs per water body		Based on costs per km²	
	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)	(assumed investment lifetime of 30 years)	(assumed investment lifetime of 40 years)
minimum	0.02	0.02	0.1	0.1	0.1	0.1
average	5	4	21	17	11	9
maximum	23	23	200	168	113	95

With an EU-wide GDP of 12 629 000 million Euro (2011, in current prices), the average yearly values of all WFD relevant measures of the first WFD planning cycle correspond to 0.08 % to 0.30 % of the GDP for a lifetime of investments of 30 years and to 0.07 % to 0.26 % of the GDP for a lifetime of investments of 40 years. And the average yearly values of all WFD dependent measures of the first WFD planning cycle correspond to 0.04 % to 0.16 % of the GDP for a lifetime of investments of 30 years and to 0.03 % to 0.14 % of the GDP for a lifetime of investments of 40 years.

5.2 The benefits of the WFD at the EU level: preliminary estimates

As seen in the previous sections, the extreme variability of the few, scattered available benefit information does not allow for sound statistical analysis and proper benefit transfer operations. It is possible, however, to use this information to build some first, indicative estimates of the total benefits of WFD implementation at the EU level.

The first step of this exercise involved the creation of a simple relationship between changes in water status or, more precisely, the increase in the percentage of water bodies reaching GES in 2015 after the implementation of the PoMs, and the expected benefits per person per year, by assuming a linear correlation between these two variables. More precisely, two linear correlations were assumed:

- Linear correlation between the changes in status and the corresponding benefits per person per year, calculated taking into account benefits values in the UK (England and Wales) and considered as the lower threshold;

- Linear correlation between the changes in status and the corresponding benefits per person per year taking into account all the other values, and excluding: Belgium (no available information on change in status), Northern Ireland and Guadalquivir (2 studies) (exceptional value, not responding to the relationship change in status – benefit magnitude) and the two high-range values (Guadalquivir (1) and Seine-Normandie).

The linear relationships are illustrated in Figure 13.

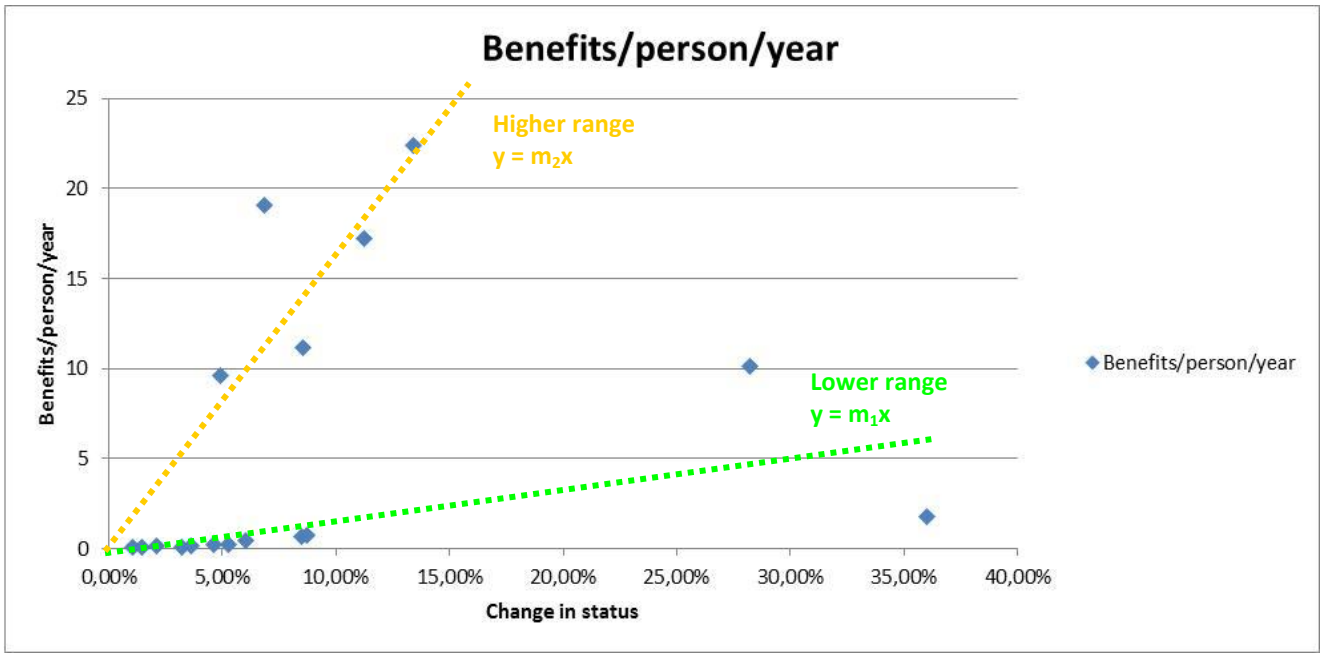


Figure 13 Linear relations between water status (in % of total water bodies at Ecological Status) and estimated benefits per person per year

The coefficients m_1 and m_2 were then calculated as the relationship coefficient to be used in the estimation of a range of benefits (lower and higher range) starting from the known values of the change in water status. Although it can be argued that the selected methodology is not correct from a strictly statistical point of view, it is believed that it can be sufficiently robust and simple to get a first rough estimate of the range of expected benefits when only the change in status is known.

As a second step, it was necessary to collect information on the percentage of water bodies in good ecological state in each MS, which is summarized in the table below[11].

[11] Sources: Kristensen, P., Lyche Solheim, A., 2010. "The Water Framework Directive and state of European waters". EEA, Presentation.

Table 10 Percentage of water bodies in good ecological status in individual Member States

Country	WB in GES in 2010 (%)	Group
Belgium	0	Group 1 WB in GES <10%
Netherlands	0	
Luxembourg	8	
Germany	9	
Poland	10	Group 2 WB in GES <20%
Hungary	12	
Czech Republic	17	
UK	32	Group 3 WB in GES <40%
Cyprus	40*	Group 4 WB in GES <50%
Lithuania	40	
Austria	41	
France	42	
Bulgaria	43	
Greece	44	
Italy	52	Group 5 WB in GES <60%
Sweden	54	
Ireland	54	
Finland	55	
Latvia	57	
Spain	58	
Denmark	60*	Group 6 WB in GES <70%
Slovakia	62	
Romania	62	
Malta	70*	Group 7 WB in GES <80%
Portugal	70*	
Estonia	78	

*Estimate drawn from Ecologic, 2012. "3rd European Water Conference – Background documents. Annex A: Preliminary Assessment River Basin Management Plans". Bruxelles, 2012.

Once the starting point for each country was known, it was possible to estimate the expected benefits for reaching GES in all countries: using the two m coefficients previously calculated, the lower and higher ranges of yearly benefits was calculated in each country for different intervals of GES improvement, starting from the percentage of water bodies in GES in 2010. An example of how this calculation was made is given below for Belgium (0% of water bodies in GES in 2010) and Italy (52% of water bodies in GES in 2010); the complete calculation is provided in Annex III.

Table 11 Assessing WFD benefits for different percentages of water bodies in good ecological status

Country	WB in GES in 2010 (%)	Extrapolation Conv. Min.	Extrapolation Conv. Max	Percentage of WB in GES in 2015 and corresponding expected benefits/person/year																	
				10		20		30		40		50		60		70		80		90		100	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Belgium	0	0,08651	1,141175	0,865093	11,41175	1,730186	22,82351	2,595297	2,595297	3,460396	45,64702	4,325495	57,05877	5,190594	68,47052	6,055693	79,88228	6,920792	91,29403	7,785891	102,7058	8,65099	114,1175
Italy	52	0,08651	1,141175	No impr.	No impr.	No impr.	No impr.	No impr.	No impr.	No impr.	No impr.	No impr.	No impr.	0,692078	9,129403	1,557178	20,54116	2,422277	31,95291	3,287376	43,36467	4,152475	54,77642

These two examples were chosen to show how the percentage of water bodies in GES in 2010 (starting point) was taken into account in the calculation. In the case of Belgium, the starting point was 0%, so we calculated the benefits per person per year (lower and higher range) of reaching GES as 10%, 20%, 30% and so on of water bodies in the country. In Italy, in contrast, the starting point was 52%, so the benefits per person per year (lower and higher range) were estimated for reaching GES in 60%, 70%, 80%, 90% and 100% of water bodies. The same procedure was followed in all countries based on the actual percentage of water bodies in GES in 2010 for each country

All the values obtained in each country were then multiplied for the total population in order to obtain the total yearly benefits for the entire country (the complete calculation is shown in Annex IV). These estimates were then aggregated at the EU level, as follows:

- Supposing that the countries in Group 1 (WB in GES < 10%) can achieve 10% of WB in GES by 2015, the total yearly benefits (lower and higher range) were estimated;
- Supposing that all countries in Group 1 and 2 (WB in GES < 20%) can achieve 20% of WB in GES by 2015, the total yearly benefits (lower and higher range) were estimated;
- Supposing that all countries in Group 1 and 2 (WB in GES < 20%) can achieve 30% of WB in GES by 2015, the total yearly benefits (lower and higher range) were estimated;
- Supposing that all countries in Groups 1, 2 and 3 (WB in GES < 40%) can achieve 40% of WB in GES, the total yearly benefits (lower and higher range) were estimated;
- And so on, until the yearly benefits (lower and higher range) of achieving GES in 100% of WB of all European countries were estimated.

On the basis of the lower- and higher-range benefit values, average values were then calculated. The results are summarized in the table below.

Table 12 Expected annual benefits for different levels of water status improvements in groups of Member Sates

Groups of Countries	Percentage of WB in GES in 2010 in the concerned countries	Percentage of WB in the concerned countries reaching GES in 2015	Expected yearly benefits for the EU (B€)		
			Expected benefits: Lower range	Expected benefits: medium range	Expected benefits: Higher range
Group 1	<10	10	0,03	0,22	0,41
Group 1 + Group 2	<20	20	0,17	1,2	2,23
Group 1 + Group 2	<30	30	0,31	1,8	3,28
Group 1 + Group 2 + Group 3	<40	40	0,5	3,57	6,64
Group 1 + Group 2 + Group 3 + Group 4	<50	50	0,77	5,46	10,14
Group 1 + Group 2 + Group 3 + Group 4 + Group 5	<60	60	1,11	7,89	14,67
Group 1 + Group 2 + Group 3 + Group 4 + Group 5 + Group 6	<70	70	1,53	10,86	20,18
All EU countries	<80	80	1,96	13,92	25,88
All EU countries	<90	90	2,39	16,99	31,59
All EU countries	<100	100	2,83	20,06	37,3

So, for example, supposing that all countries in which less than 70% of water bodies reached GES in 2010 manage to achieve 70% of water bodies in GES at the end of the first planning cycle, the expected yearly benefits at the EU level would range between 1 526.82 and 20 180.26 million Euros, with an average of 10855.04; in the same way, **if all water bodies in the EU will be in GES by 2015 the expected yearly benefits would range between 2.8 and 37.3 billion €/year with an average value of 20 billion €/year .**

As mentioned earlier, these results must be considered as rough and indicative estimates of the possible range of benefit that might be obtained through the implementation of the WFD. The main weaknesses of the approach applied here include:

- The available benefit information used as a data source in this exercise is extremely diverse, and comparison of the different information sources is debatable;
- The rapid benefit assessment does not take into account the environmental, social and economic differences between European RBDs, as this would have implied a much accurate analysis which was out of the scope of this study;
- The number of basins for which complete benefit information could be found, and which was used as the reference data in this exercise, is very limited;
- The linear relationships (lower and higher range) between changes in status and yearly benefits per person were intended as a simplifying assumption, allowing to obtain some estimates from the incomplete and diverse available data source.

It follows that the benefit ranges provided here are to be considered as simple indications of possible benefits which could be expected from the implementation of the WFD. More precise estimates could be obtained after more thorough analysis, maybe collecting additional data to integrate the existing benefit information base; due to the time and resource constraints of the present study, however, a more precise assessment has not been possible.

6 Proposed protocols for assessing costs and benefits at the river basin scale

6.1 Confronting the framework to information reality

The review of the available information on costs and benefits in RBMPs and accompanying documents/studies stresses the diversity of information that is available in these documents.

- Full estimates of all costs & all benefits of the WFD, or of the program of measures proposed in the first RBMP are provided for a limited number of river basins only;

- Partial estimates of the costs and/or benefits are provided in some river basin. In some RBMPs, it is unclear whether all benefits are considered in benefit values reported, or whether all costs are considered (or only investment costs). The challenge draws from the combination of completeness and transparency issues.

- In other basins, there is no cost information for the proposed program of measures. In some river basins, the program of measures is described and quantified (dimensioned), while other river basins only list proposed measures. In a few cases, the program of measures is not provided.

- With regards to benefits, the knowledge provided is of poorer quality as compared to costs. Benefits are often very partial, linked to a given site, environmental issues or type of service provided by aquatic ecosystems. In addition, benefit information at the RBD level could be found for a very limited number of RBDs (22), which makes statistical analysis of available data not significant;

- The change in water status for which costs and benefits are assessed can also vary among river basins. For some river basins, costs and benefits refer to the improvements in water status expected at the end of the 2009-2015 time period (implementation period of the first RBMP). In other basins, costs and benefits refer to the achievement of good water status for all water bodies.

- The time horizon along which costs and benefits are assessed is also an issue. Some basins present total investment costs, while other assess annualized costs. Benefits are sometimes estimated per year, or aggregated for a given time period (the duration of the first RBMP, a period equivalent to the life period of given equipment or a period set for performing the cost-benefit assessment) using or not some discounting factor.

In addition to providing basic information for building the knowledge base on costs and benefits, this review has stressed the importance of methods for “creating costs and benefits information” so knowledge gaps can be filled and better assessments carried out.

6.2 A protocol for transferring cost information

As previously mentioned, the first step for developing a protocol was the search of correlations between the available cost figures extracted from the cost database and various factors and variables (included in the ad-hoc database built as a basis for testing protocols) expected to influence positively or negatively total costs.

Similarly to the extrapolation exercise presented in chapter 5, two cost figures were taken into account here: the total costs of all WFD-related measures (thus including all costs linked to the implementation of the WFD and other water-related EU directives) and the total costs of the measures specific to the WFD implementation only. Correlations and Kendall tests were performed for identifying possible links between a series of river basin characteristics and cost figures for the RBD where cost information is available. Table 13 presents the first results including the correlations coefficients[12] obtained with the two tests.

Table 13 Variables showing some relationship with cost figures and correlation coefficients emerging from the correlation and Kendal statistical tests

Dependent variable	**Total costs of all WFD-related measures**		**Total costs of WFD-dependent measures only**	
Independent variable	**Correlation** *coefficient*	**Kendall test** *coefficient*	**Correlation** *coefficient*	**Kendall test** *coefficient*
RBD size	0,5	0,5	0,4	0,4
Inhabitants	0,22	0,5	0,37	0,6
Land Cover type 1	No corr.	0,23	0,14	0,21
Land Cover type 2	0,17	No corr.	0,21	0,22
Land Cover type 5	No corr.	No corr.	0,13	No corr.
No. Surface WBs	0,15	0,39	No corr.	0,39
No. Ground WBs	No corr.	0,5	No corr.	0,41
No. WBs	0,14	0,41	No corr.	0,4
No. Natural WBs	No corr.	0,26	No corr.	No corr.
No. Artificial WBs	No corr.	0,27	No corr.	0,5
Ground WB in good status	0,14	0,23	No corr.	0,34
Surface WBs chem.exempt.	No corr.	No corr.	No corr.	0,28
Ground WBs exemptions	0,16	0,23	0,27	0,35
Pressure type 1	No corr.	No corr.	0,39	No corr.
Pressure type 3	No corr.	No corr.	0,54	No corr.
Pressure type 5	No corr.	No corr.	0,36	No corr.

The table shows that the existing correlations between variable and cost figures are generally weak when statistically significant. Only two variables show significant correlation with both the total costs

[12] Meaning of correlations coefficients:
0<c<1 the two variables are positively correlated (the significance of the correlation increases with increasing coefficient)
c=0 the two variables are not correlated
0>c>1 the two variables are inversely correlated (the significance of the negative correlation increases with decreasing coefficient)

of all WFD-related measures and the total costs of WFD-dependent measures only, namely the RBD size and the number of inhabitants. Thus, this statistical analysis refutes the initial assumption of a positive relationship between expected changes in water status and total costs of measures required for this change to happen[13].

Different statistical models (simple functions using the two variables most correlated to costs) were developed and applied. In addition, a multivariate regression function was also developed, with the aim of including the highest possible number of independent variables in the statistical model. The construction of the multivariate model, however, revealed that only two independent variables – the RBD size and the percentage of artificial WBs in the total surface WBs - are significantly related to cost figures. The table below presents the main statistical results obtained for the 5 statistical models tested.

Table 14 Regression coefficients of the regression functions created for the extrapolation of costs at the RBD level

Statistical linear model - Coefficients					
Regression exercise	**Dependent variable**	**Independent var.**	**c**	**Const.**	**R^2**
Statistical model 1	Total costs of all WFD-related measures	RBD size	0,03	0	0,5
Statistical model 2	Total costs of all WFD-related measures	inhabitants	0,00012	0	0,22
Statistical model 3	Total costs of WFD-dependent measures only	RBD size	0,0007	0	0,4
Statistical model 4	Total costs of WFD-dependent measures only	inhabitants	0,000009	0	0,37
Statistical model 5	Total costs of WFD-dependent measures only	RBD size	0,0170002	-86,19377	0,5
		Artificial WBs	21079,97		

Extrapolation of the total costs of the WFD first planning cycle

The five statistical models were then applied to all European RBDs for assessing RBD costs for each and every individual river basin as basis to calculating an aggregated cost figure at the EU level. The functions tested, as well as the total costs for the EU as calculated with each function, are summarized in Table 15.

[13] A variable measuring the change in status was indeed included in the database prepared for the statistical analysis, but none of the two tests showed any correlation between this variable and the costs. In contrast, the size of the basin and the population targeted or, in other word, the "dimensions" of the measures to be implemented, appear in fact to be directly related with costs, and these variables will therefore be used in testing the different protocols.

Table 15 Total EU level cost figures estimated with different statistical models

Statistical model	Dependent variable (y)	Regression function	Total costs for the EU (Billion €)
Statistical model 1	Total costs of all WFD-related measures	y = 0,03*(RBDsize)	**209**
Statistical model 2	Total costs of all WFD-related measures	y = 0,00012*(inhabitants)	**134**
Statistical model 3	Total costs of WFD-dependent measures only	y = 0,0007*(RBDsize)	**39**
Statistical model 4	Total costs of WFD-dependent measures only	y = 0,000009*(inhabitants)	**40**
Statistical model 5	Total costs of WFD-dependent measures only	y = 0,0170002*(RBDsize) + 21079,97*(artificialWB) – 86,19377	**221**

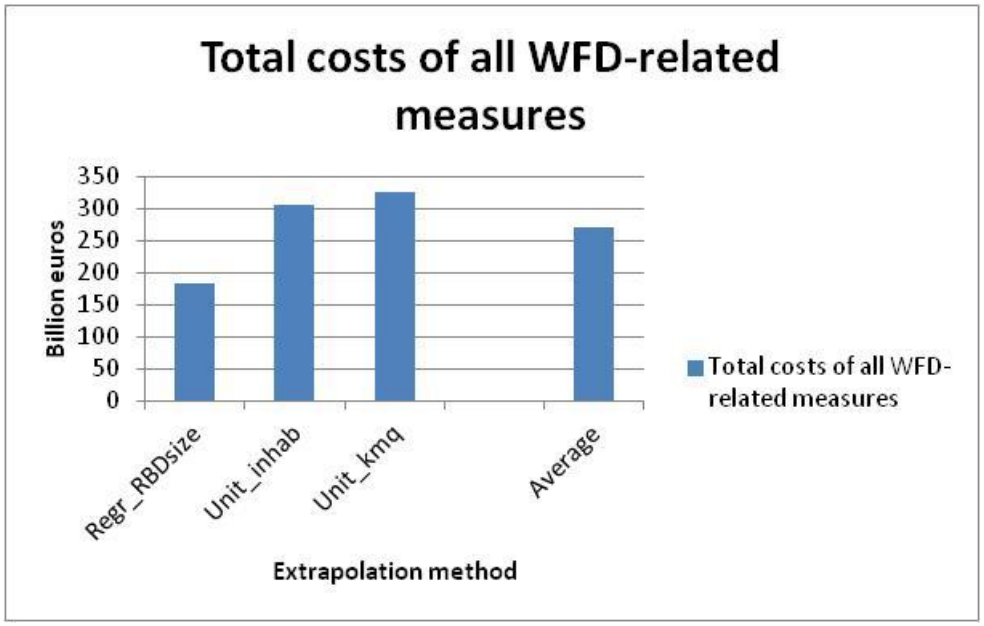
The table stresses that the statistical models produce very different cost EU-level estimates results, ranging from 40 billion Euros to 221 billion Euros.

These results were then compared with the first results presented in section 5.1 and illustrated in Figure 11 & Figure 12 (page 28), where unitary costs were used as a basis for extrapolation. Before illustrating the results of the comparison, two observations are necessary:

- Statistical model: the total costs obtained using "inhabitants" as an independent variable are likely to be an underestimation. In the source data base used for extrapolation, data on total inhabitants were not available for 71 RBDs: therefore, the extrapolated cost value obtained using inhabitants as an independent variable does not include these RBDs;
- Extrapolation based on unitary costs: observing the figures obtained with this extrapolation method, it is very likely that the extrapolation exercise using unitary costs per water body over estimates the final results. The the total costs (both of all WFD-related measures and WFD-dependent measures only) obtained using unitary costs per water body, in fact, are significantly higher than the total cost figures obtained using unitary costs per inhabitant and per kmq.

For this reason, the total cost figures obtained as outlined above were excluded from the comparison between the two extrapolation methods. Such comparison of cost figures is presented in Figure 14 and Figure 15, which include also average cost figures taking into account the results of both extrapolation methods; in the case of the extrapolation using unitary costs, average values are used.

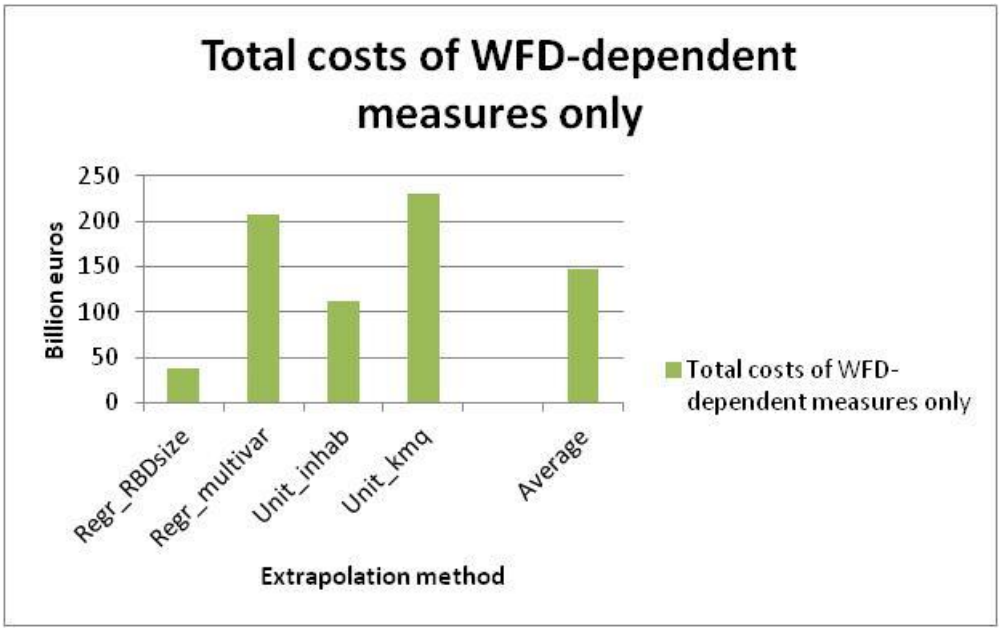
Figure 14 Extrapolation of the total costs of all WFD-related measures: comparison between the cost figures obtained with the proposed protocol 1 and the unitary cost method



Note: in the case of figures obtained with the unitary cost method, only average figures are retrieved here. As a reminder, cost ranges provided in chapter 5.1 were as follows:

- *Total costs of all WFD related measures using unitary value per inhabitant: average value 305 B€; lower value 3,4 B€, higher value 853 B€;*
- *Total costs of all WFD related measures using unitary value per km^2: average value 326 B€; lower value 6 B€, higher value 2314 B€.*

Figure 15 Extrapolation of the total costs of WFD-dependent measures : comparison between the cost figures obtained with the proposed protocol 1 and the unitary cost method



Note: in the case of figures obtained with the unitary cost method, only average figures are retrieved here. As a reminder, cost ranges provided in chapter 5.1 were as follows:

- *Total costs of all WFD related measures using unitary value per inhabitant: average value 111 B€; lower value 0,4 B€, higher value 488 B€;*
- *Total costs of all WFD related measures using unitary value per km^2: average value 230 B€; lower value 2,2 B€, higher value 2431 B€.*

The comparison between total cost figures obtained with the different methods stressed also the large differences between total costs figures obtained.

- In the case of the **total costs of all WFD-related measures**, the approaches applied yield cost estimates **ranging from 209 to 326 billion €, with an average value between methods of 280**
- In the case of the **total costs of WFD-dependent measures only**, ranges are wider **between 39 and 230 billion €, with an average value of 150 billion €**.

The main reasons explaining such differences might include the initial limited sample of cost figures (43 RBDs only) that limits the scope for statistical models and the significance of the analysis, and the relative low explanatory power of the statistical models developed.

Further research on the topic would then be needed to obtain realistic cost figures at the EU level. In addition, it would be essential to enhance the quality of cost data reported by MS under the WFD[14].

Yearly costs of the first WFD planning cycle

Similarly to what has been done in section 5.1, it is also useful to translate these total cost figures in yearly cost figures. Also in this case, a distinction must be made between investment and O&M costs, as the time horizon of these two types of costs is different. To get an yearly estimate of O&M costs, it is enough to divide total O&M costs by 6 (as the planning cycle is from 2009 to 2015 six years long). In the case of yearly investment costs, in contrast, total investment costs must be divided by the lifetime of the equipment: in this extrapolation exercise, yearly investment costs were calculated assuming a lifetime of 30 and 40 years. As previously mentioned, although it is often unclear whether both investment and O & M costs have been taken into account or not in the cost figures provided by MS, for the purpose of extrapolation it was assumed here that both types of costs were considered in all cost figures provided by MS, and a uniform share of O&M costs equal to 10% was applied to the extrapolated figures.

Table 16 and Table 17 below summarize the yearly cost figures derived from the total cost figures obtained with both the statistical models and the unitary cost method –the latter are retrieved from section 5.1[15] to allow for comparison with the figures resulting from the statistical models.

Table 16 Extrapolated total yearly EU-wide costs of all WFD relevant measures based on the first planning cycle (in billion Euro)

[14] On the basis of the experiences gained while attempting to complete Task 4b, a "Guidance note for future reporting and assessment of costs and benefits" at the MS level was also produced as a part of Task 4b.
[15] Also in this case, only average cost figures are retained –see chapter 5.1 and Figure 14-15 for complete cost ranges.

		Total costs of all WFD-related measures	Total costs of all WFD-related measures		Yearly costs of all WFD-related measures	
			Share of investment costs	Share of O&M costs	Assumed investment time of 30 years	Assumed investment time of 40 years
		Billion €	Billion €	Billion €	Billion €	Billion €
Proposed statistical models	Statistical model 1 Independent variable: RBD size	209	188	21	10	8
Extrapolation using unitary costs	Unitary costs per inhabitant	305	275	31	14	12
	Unitary costs per km^2	326	293	33	15	13
Average total WFD-related costs		280	252	28	13	11

Table 17 Extrapolated total yearly EU-wide costs of WFD-related measures based on the first planning cycle (in billion Euro)

		Total costs of WFD-dependent measures only	Total costs of all WFD-related measures		Yearly costs of all WFD-related measures	
			Share of investment costs	Share of O&M costs	Assumed investment time of 30 years	Assumed investment time of 40 years
		Billion €	Billion €	Billion €	Billion €	Billion €
Proposed protocol - statistical regression	Protocol 3 Independent variable: RBD size	39	35	4	2	2
	Protocol 5 Independent variables: RBD size, %artificial WBs	221	199	22	10	9
Extrapolation using unitary costs	Unitary costs per inhabitant	111	100	11	5	4
	Untary costs per km^2	230	207	23	11	9
Average total WFD-related costs		150,25	135	15	7	6

In short, yearly cost figures can be summarized as follows:

- **Yearly costs of all WFD-related measures**: assuming an investment lifetime of 30 years, the approaches applied yield cost estimates **ranging from 10 to 15 billion €/year, with an average value between methods of 13 billion €/year;** assuming an investment lifetime of 40 years, yearly cost estimates **range between 8 and 13 billion €/year, with an average between methods of 11 billion €/year.**
- **Yearly costs of WFD-dependent measures:** value ranges obtained with the approaches applied are slightly wider. Assuming an investment lifetime of 30 years, cost estimates **range from 2 to 11 billion €/year, with an average value between methods of 7 billion €/year;** assuming an investment lifetime of 40 years, yearly cost estimates **range between 2 and 9 billion €/year, with an average between methods of 6 billion €/year.**

6.3 A protocol for assessing benefit information

As previously mentioned, the diversity of benefit information and the limited number of studies at the RBD level posed severe limitations to data analysis and to the development of a transfer protocol.

The limited number of studies (22), in particular, made it impossible to perform statistical analysis, as the results would not have been significant. Clearly, such statistical analysis would have been the first step in the developing functions for transferring benefit information to RBD where such information is not readily available.

As an alternative, a qualitative analysis was attempted, aimed at establishing qualitative relationships between the reported benefit values, the expected changes in status and several variables which were considered to be possibly related with EGS provision and, as a result, with benefit provision; the final aim of this analysis was to establish some benefit ranges which could be applied to RBDs where benefit information is not available. The selected variables were as follows:

- **Ecoregions**: the relative importance of benefits related to improvement in water status is related to the specific environmental conditions of the RBD. For example, in the Mediterranean area the benefits linked to a higher water security are likely to be more relevant than the benefits linked to improved recreational services, whereas this is not expected to be the case in water-rich RBDs such as, for example, several RBDs in the UK and NL. The sub-division of the EU territory in 25 "Ecoregions for rivers and lakes" developed by the EEA (first published: 2002; last update: 2011; http://www.eea.europa.eu/data-and-maps/figures/ecoregions-for-rivers-and-lakes) is expected to capture this differences across basins.

- **Protected areas**: the percentage of protected areas on the whole RBD surface (source: Natura 2000) is expected to be linked to the extent to which EGS are provided and, as a consequence, to the magnitude of benefits provided by improvements in water status.

- **Number of water bodies**: this parameter is also expected to be linked to the amount of benefits delivered by improvements in water status (source of information: Task 3 database).
- **Importance of agricultural land**: agricultural activities are strongly linked with water management and water status, both in terms of water availability (agriculture is the main water user worldwide) and in terms of water quality, as such activities can be an important non-point source of pollution. Therefore, the benefits delivered by the PoM might be related to the percentage of agricultural land on the total RBD's area, especially in the case of measures aimed at improving irrigation efficiency and reducing agricultural pollution.

- **Valuation technique**: although the valuation technique is an external variable, not connected with the RBD's characteristics and/or to the expected changes in status, the previous analysis suggested that the chosen technique might indeed have a great influence on the final benefit value estimated in each study.

Overall, the results of such qualitative analysis stress the absence of specific relations between these factors and benefits. For example, the same percentage increase in water bodies with good water status is associated with very diverse benefit values. The qualitative assessment, however, stressed the following issues

- As a general feature, benefit values estimated in England and Wales are significantly lower than the values estimated elsewhere, regardless of the change in water status and the values for other variables;

- With a few exceptions, an increase in change in status appear to match an increase in benefits, although no specific relation seems to exist with other selected variables;

- The valuation technique, in particular, seems to be determinant for explaining the magnitude of the estimated benefit values. This might in itself explain the large gap between benefit values estimated in England and Wales and all the other available benefit values.

Overall, based on the information currently available, it was then not been possible to develop a protocol for benefit transfer as envisaged in the planning phase of Task 4b. Therefore, only rough estimates of WFD benefits at the EU level presented in section 5.2 could be provided. As it was the case for the determination of WFD costs, the issues for estimating the WFD benefits at the EU level could also be overcome through better reporting at the MS level. To ensure the comparability of figures calculated in each RBD or country, guidelines for benefit assessment and reporting at the MS level could be developed[16].

[16] Based on the experience built within Task 4b, specific recommendation will be therefore provided in the "Guidance note on the assessment and reporting of costs and benefits" delivered together with this final report.

7 Conclusions

This report presented the results obtained under Task 4b, part of the *Comparative study of pressures and measures in the major river basin management plans in the EU* that is financed by the European Commission. Activities carried out in the context of this Task were aimed at developing a knowledge base on the economic dimension of water management and, more precisely, of the WFD implementation.

The review of existing cost and benefit information revealed that limited information on cost and benefit is currently available. This is true in particular with respect to the benefits of WFD implementation: such information is rarely included in the RBMPs (with the UK as a noteworthy exception), and it is normally provided by independent studies and assessments which use different methodologies, definitions of benefits, geographical scales and so on, in such a way that comparison and aggregation of results is often difficult, if not impossible. In total, benefit information could only be found for 22 RBDs. In the case of costs, some figures were provided in almost all countries (with the exception of Greece), although the type of costs considered and the geographical scale (RBD or national) vary across countries.

This variety of information types posed some significant issues for comparison and aggregation of figures across countries, and posed challenges for the extrapolation exercises undertaken in this study. Extrapolation of existing cost and benefit information to the EU level was done at two distinct levels:

- Extrapolation based on unitary costs (per km^2, inhabitant and WB) and unitary benefits (per inhabitant), carried out at the national and then EU level;

- Development of statistical models for the transfer of costs and benefits information to RBDs in which cost and/or benefit information is not available – as starting point for assessing total costs and benefits at the EU level.

The development of possible transfer protocols, in particular, was a crucial point of investigation of this study. The proposals built on the central idea that a relationship might exist between:

- The costs of implemented measures –including both the total costs of all WFD-related measures (WFD and related directives) on the one hand, and the total costs of WFD-dependent measures only- and the expected change in status, as well as specific characteristics of the RBD where measures are implemented (RBD size, population impacted, number of WBs impacted by the measures, etc.);

- The benefits of WFD implementation and the expected change in status: changes in status are expected to bring about a change in the provision of ecosystem services which, in turn, result in benefits. Additionally, other RBD characteristics were expected to impact on benefits, e.g. the total population or the importance of nature protected areas.

To find these possible relationships, a specific RBD database was built, combining cost and benefit information at the RBD level with information on key characteristics of RBD (e.g. RBD size, inhabitants, type of land cover, protected areas, number of WBs, change in status, pressures etc). Statistical analysis was then performed to identify statistical relationships between these variables and total costs. Similar statistical analysis could not be carried out with benefits as such benefit information is found in 22 RBDs only.

The costs of WFD implementation

The type of costs considered in the transfer and aggregation exercises are the total costs of all WFD related measures (including the costs of all relevant measures implemented as part of other water directives) and the total costs of the measures specific to the WFD.

The application of the different transfer and aggregation methods led to **total costs of all WFD-related measures** ranging from **209 and 326 billion €**, and **total costs of measures specific to the WFD** ranging from **40 to 230 billion €**. These total cost figures correspond to yearly costs of all WFD-related measures ranging from 8 to 15 billion €/year and yearly costs of only WFD-related measures ranging from 2 to 11 billion €/year.

The large differences obtained with different approaches were linked to the incoherent and limited initial cost information, lack of factors and variables statistically related to costs and weak level of significance of statistical models developed.

The benefits of WFD implementation

In the case of benefit, the extremely small size of the statistical sample (22 RBDs) did not allow to perform any statistical analysis aimed at finding correlations between a series of RBD characteristics and total benefits. The qualitative analysis that was performed did not identified specific links between total benefits and selected RBD variables (expected change in status, ecoregions, protected areas, number of WBs, extension agricultural land). The valuation method applied, however, appears as influencing the total benefit values.

Thus, only very rough benefit estimates could be provided in the context of this study by using average unitary benefit per inhabitant multiplied by MS and then the EU population, assuming that a fixed percentage of WBs in good status would be achieved at the EU27 as a whole. Overall:

- If 70% of European WBs would be in GES by 2015, the expected total yearly benefits might range between 1.5 Billion € and 20 Billion € per year, with an average value of 10.9 billion € per year;

- If all European WBs would reach GES by 2015, the expected total yearly benefits might range between 2.82 billion € and 37.3 billion € per year, with an average value of 20 billion € per year.

Similarly to costs, such benefit ranges are extremely wide and must be taken with caution keeping in mind the initial knowledge base mobilized for developing such estimates!

Using the existing knowledge base for the EU-wide integrated modeling for supporting water policy

In parallel to the present Task 4b efforts, the JRC has embarked into an EU wide modeling effort aimed at supporting the development of scenarios for the protection of water resources in Europe[17]. The question arises whether the Task 4b work could directly feed into the modeling effort carried out and strengthen its economic component.

Because of the available cost & benefit knowledge, the information mobilized in the context of the present study is of limited use for the integrated modeling.

- The overall aggregated costs of the WFD measures estimated could be used as yardstick to compare the costs of scenarios estimated from the optimization/modeling. Clearly, both costs are not directly comparable as: a) some of actions proposed in the scenarios tested with the integrated model might already be part of the proposed WFD measures for which costs are reported by MS; b) the modeling effort mainly focus on water quantity issues (and to a lesser extend quality) but does not provide room for assessing measures/scenarios addressing hydro-morphological and part of the ecological issues; and c) the costs reported under the WFD only cover the first planning cycle, and not the full achievement of GES/the environmental objectives of the WFD – which could then be used as reference (baseline) costs;

- The benefit information cannot not easily be used for assessing the overall benefits expected from the different scenarios investigated by the JRC. At present, there is not (monetary) benefits (including environmental benefits) explicitly assessed in the JRC modeling framework for individual scenarios[18]. The "total benefit" information reported in the context of the WFD relate however to the achievement of GES (or some improvements in ecological status) that is not the improvements in water status assessed in the JRC modeling effort (that focuses so far on improvements in the water balance at different spatial scales). For some river basins, benefit information is available on the values of individual ecosystem services that are relevant to the JRC modeling effort (in particular values of services linked to the provision of water and environmental flow regulation). However, the information is too scanty and not always disaggregated[19] to the ecosystem services that are relevant to KRC current modeling.

With the structure of the integrated model developed by JRC, some attempts could be made to better express some benefits and improvements in ecosystem services that are delivered under different scenarios.

[17] Reference : de Roo A. et al. 2012 (forthcoming). A multi-criteria optimisation of scenarios for the protection of water resources in Europe – Support to the EU Blue Print to Safeguard Europe's Waters. European Commission, Joint Research Center, Institute for Environment and Sustainability

[18] Total benefits are estimated when comparing a given scenario to the baseline scenario, differences in economic losses estimated under the baseline and the scenario investigating yielding possible benefits.

[19] As indicated in the earlier parts of the report, different services are bundled in economic values provided, without the possibility to estimate the relative share of economic values provided that link to a given service.

- Changes in average NO3 & PO4 concentrations in rivers could be used for estimating changes in treatment costs for achieving drinking water potable threshold values (using relevant functions linking NO3 & PO4 river concentrations to N/P regulatory threshold values). This would require, however, that the share of surface water abstracted for drinking water purpose out of the total drinking water abstracted is known to some extend. And this does not seem to be the case in the current modeling platform structure;

- The LISQUAL calculations could be used, for example, to extract an "N-removal" and "P-removal" indicators for individual cells of the modeling grid, or for "water regions" considered for assessing the Water Exploitation Index (WEI) for example. These indicators could express the self-purification capacity of surface water systems that could be multiplied by basic unitary costs of reducing nitrate at source (e.g. unitary costs per kg of N/P removed via changes in farming practices or wastewater treatments) for estimating very roughly the value of the "self-purification service" provided by (surface) aquatic ecosystems;

- Additional knowledge could be brought into the modeling structure for linking river flows (average flows, flood return periods, etc.) to the quality of wetlands connected to aquatic ecosystems. Clearly, this would require additional knowledge and expertise than what is currently integrated in the model. Furthermore, while some wetlands are directly connected to surface waters, others are linked to groundwater levels, a variable that is not available in the current model;

- It seems very difficult to link the integrated model's output describing surface water systems to any type of overall benefit (including non-use values), in particular linked to improvements in the ecological status of surface water systems. The combination of chemical quality (NO3 and PO4) and river flow (environmental flow) parameters could be used as a proxy for "ecological status" (with probably very different rules and assumptions for making such estimates in different eco-regions, an issue that would nee solid expertise in ecology) to which (total) economic values reported under the WFD for GES changes could be applied. However, the WFD (aggregated) benefit values do not usually relate to changes in chemical quality and in river flows only, but also include wider ecological and morphological improvements not accounted for in the JRC modeling;

With its present structure, integrating environmental benefits and improvements in the values of services provided by aquatic ecosystems appears as challenging. Clearly, an explicit integration of links between the "State[20]" variables obtained from the model (chemical quality & river flows only in its present version) and the (expected) ecosystem services that are expected under different States would be required in the first place. Then values for the individual services related to the State variables considered could be included into the modeling framework. Additional thoughts would however be required for ensuring more general values linked to aesthetic, use for sight-seeing/general tourism and non-use values can be integrated into the modeling framework – both in

[20] State from the aquatic ecosystem

terms of linking changes in surface water status to these uses and in the population that might benefit from improvements in general water status[21].

Enhancing the available cost & benefit knowledge base: way forward

From the results summarized above, it is clear that the major limitation encountered in the course of this study remains the scarce and incoherent information on cost and benefit reported at the RBD and national levels, a situation that is extreme for benefits but that applies also to costs. Based on the experience built in the course of Task 4b, two main recommendations for further work is urgently required, an issue that has been well considered in the forthcoming EU Water Blue Print:

- Guidelines for reporting cost and benefit at the MS and RBD level are required. The scarcity of available data, as well as significant heterogeneity in data reported, strongly support the need of specific reporting guidance that could be developed at the EU level for supporting national and RBD authorities. To this end, preliminary recommendations for future reporting of WFD costs and benefits WFD were developed in the course of this study and are provided in a separate document;

- In the context of Task 4b, information, time and resource constraints did not allow further research on the factors impacting WFD costs and benefits. Additional research on this topic would then be required so robust protocols are developed for transferring costs and/or benefit information to RBD where it does not exist. A separate note on possible actions that would enhance the water-related cost & benefit knowledge base has been developed in the context of the present study.

[21] E.g. the population of the water region where improvements in water status take place, a share of this population as inhabitants living nearby rivers are mostly concerned, or a larger population as changes in the status of specific aquatic ecosystems might have a value (in particular when emblematic sites or species are concerned) for inhabitants from other water regions or countries.

ANNEXES

Annex I – Type of cost information available by country

Table 1: For which planning cycles has cost information been provided?

Country		BE	CY	DE	EE	ES		EL	FR			IT	LT	LU	LV	MT	NL	RO	UK
River basin district		Scheldt (Flemish part)	CY	only one national figure	all RBDs	Galician Coast, Tagus, Guadiana, Guadalquivir, Ebro, Catalan RBD, Balearic Islands	Segura	no cost information provided	Seine-Normandy, Artois-Picardie, Rhône-Méditerranée, Meuse and Sambre, Rhine	Adour-Garonne, Corse, Loire-Bretagne, Martinique, La Réunion, Guyane	Guadeloupe	only Central Apennines District	all RBDs	Rhine and Meuse	all RBDs	MT	all RBDs	RO	all RBDs (except for Scottish)
Planning cycles	2010-2015	yes	yes	yes	yes	yes	yes		yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
	2016-2021	no	no	no	no	no	no		no	no	yes	no	no	no	no	no	no	yes	no
	2022-2027	no	no	no	no	no	no		no	no	yes	no	no	no	no	no	no	yes	no
	2010-2027 / Costs for reaching GES	no	?	no	no	no	yes		yes	no	yes	no	yes	yes	no	no	yes	yes	no

Note: in the case of Cyprus, it is not clear whether the costs for reaching GES is referred to the entire the period 2010-2027; for this reason, the symbol "?" was used.

Table 2: Which type of measure is taken into account or differentiated in the cost figures given?

Country		BE	CY	DE	EE	ES			EL	FR				IT	LT	LU	LV	MT	NL	RO	UK	UK
River basin district		Scheldt (Flemish part)	CY	only one national figure	all RBDs	Galician Coast, Tagus, Catalan RBD, Balearic Islands	Guadiana, Guadalquivir	Segura, Ebro	no cost information provided	Seine-Normandy, Artois-Picardie, Rhône-Méditerranée, Meuse and Sambre, Rhine	Adour-Garonne, Martinique, Guyane	Corse	Loire-Bretagne, Guadeloupe, La Réunion	only Central Appennines District	all RBDs	Rhine and Meuse	all RBDs	MT	all RBDs	RO	English RBDs	Northern Ireland as a whole
Type of measure considered	Basic measures linked to other Directives (Art.11(3)(a)) [1]	no	no	no	no	no	yes	no		no	no	yes	no	yes	yes	yes	yes	no	no	no	yes	no
	Basic measures of the WFD (Art.11(3)(b-l)) [2]	yes	no	no	no	no	yes	no		no	no	no	no	yes	yes	yes	yes	no	no	no	no	no
	Supplementary measures (Art.11(4)) [3]	no	no	no	yes	no	yes	yes		yes	yes	yes	no	yes	yes	no	no	yes	no	no	no	yes
	Additional measures (Art.11(5)) [4]	no	no	no	no	no	no	no		no	no	no	no	yes	no	no	no	no	no	no	no	no
Combinations of measure types	[1] + [2]	no	no	no	yes	no	no	?		no	yes	no	no	no	no	no	no	yes	no	yes	no	no
	[1 partly] + [2 partly] + [3]	no	no	no	no	no	no	no		no	no	no	yes	no	no	no	no	no	no	no	no	no
	[2] + [3]	no	no	no	no	no	no	no		no	no	?	no	no	no	no	no	no	no	no	yes	no
	[3] + [4]	yes	no	no	no	no	no	no		no	no	no	no	no	no	no	yes	no	yes	yes	no	no
Other		no	no	no	no	no	no	no		no	no	no	no	no	no	no	no	no	no	no	no	no
Unclear what has been taken into account in the cost figure		no	yes	yes	no	yes	no	no		no	no	yes	no	no	no	no	no	no	no	yes	no	no

Note: when it was not clear whether a specific type or combination of measures was taken into account in the reported cost figures, the symbol "?" was used

Table 3: Type of costs included

Country		BE	CY	DE	EE	ES				FR					IT	LT	LU	LV	MT	NL	RO	UK	UK
River basin district		Scheldt (Flemish part)	CY	only one national figure	all RBDs	Galician Coast, Tagus, Catalan RBD, Balearic islands	Guadiana, Segura	Guadalquivir	Ebro	Seine-Normandie,	Adour-Garonne, Artois-Picardie, Guadeloupe	Rhône-Méditerranée	Meuse and Sambre, Rhine, Corse, Loire-Bretagne, Martinique, Guyane	La Réunion	only Central Appennines District	all RBDs	Rhine and Meuse	all RBDs	MT	all RBDs	RO	English RBDs	Northern Ireland as a whole
Type of cost taken into account	Investment costs	yes	?	?	yes	?	yes	yes	yes	yes	?	yes	yes	yes	?	yes	yes	yes	yes	?	yes	yes	?
	Operational and maintenance costs	yes	?	?	?	?	no	yes	?	no	?	yes	yes	?	?	yes	yes	yes	yes	?	yes	yes	?
	VAT	?	?	?	?	?	?	?	?	?	?	?	?	?	?	yes	no	yes	?	?	no	?	?
	Administrative costs	yes	?	?	?	?	?	?	?	?	?	?	?	?	?	yes	?	no	?	?	?	yes	yes
	Environmental charges / taxes	no	?	?	?	?	?	?	?	?	?	?	?	?	?	yes	?	no	?	?	yes	?	?
	Other	no	?	?	?	?	?	?	?	?	?	yes	?	?	?	no	?	no	yes	?	?	yes	?
	Specify											Costs of carrying out studies							also indirect costs and benefits included			Monitoring costs	

Note: when it was not clear whether a specific cost category was taken into account in the reported cost figures, the symbol "?" was use. As noted in paragraph 3.2, in fact, transparency is often lacking regarding the type of costs taken into account.

Annex II - Type of benefit information available by country

	BE	EE	EL	ES	FR	IT	LT	LU	LV	MT	NL	RO	UK
RBDs for which "some" info is available	2 Scheldt, Meuse	1 West-Estonian (+ open water Baltic Sea)*	2 Aegean Islands, Western Macedonia	4 Guadalquivir, Jucar, Guadiana, Segura	4 Seine-Normandie, Rhone-Méditerranée-Corse, Adour-Garonne, Loire-Bretagne	1 Po RBD	1 Nemunas	None	1 Daugava (+ open water Baltic Sea)*	None	2 Scheldt, Meuse	National level	11 (only Scottish RBDs are missing)
RBDs for which some benefits are valued (at all scales)	2	1	2	4	4	1	1		None		2	None: changes in EGS estimated in a qualitative way	11
RBDs for which some benefits are valued for the entire RBD	None (all studies are about an area within the RBD)	None	None (three studies at the island level, one at the WB level)	2 Guadalquivir, Guadiana	2 Seine-Normandie, Adour-Garonne	1	1		None		None (all studies are about an area within the RBD)	None	11
RBDs for which benefit valuation is linked to RBMPs objectives	1 Scheldt	1	None	3 Guadalquivir (2), Guadiana, Jucar (others no specific link)	1 Adour-Garonne (others: often to justify derogations)	Not clear	Not clear		1 (2 WB in Daugava RBD, but no valuation of benefits)		1 Meuse	None: estimation to justify derogations from reaching GES	11
EGS considered at RBD level	N.a.	None	N.a.	Water provision Cultural services (all)	Food Water Recreation and tourism	Cultural services (all of them)	Regulation of water flows Waste treatment Maintenance of life cycles + genetic diversity Recreation and tourism		None		N.a.	At national level: Moderation of extreme events Regulation of water flows Waste treatment Biological control Maintenance of life cycles Recreation and tourism	EN and WA: Maintenance of genetic diversity Aesthetic information Recreation and tourism Inspiration for culture, art and design NI: provision of clean water (some aspects)
EGS considered at WB level	EGS at area level: Regulation of water flows Waste tratement Maintenance of life cycles+genetic diversity Aesthetic information Recreation and tourism	None	Maintenance of life cycles maintenance of genetic diversity Recreation and tourism Spiritual experience and cognitive development	Water provision	Recreation and tourism	None	Sub-basin level: Water Wastewater treatment Maintenance of life cycles + genetic diversity Aesthetic information Recreation and tourism Inspiration for culture, art and design Information for cognitive development		Maintenance of genetic diversity Aesthetic information Recreation and tourism		EGS at area level: Regulation of water flows Waste tratement Maintenance of life cycles+genetic diversity Aesthetic information Recreation and tourism	N.a.	N.a.
Additional benefits which cannot be linked to specific EGS	No	Benefits of improved and sustainable fishing of protected species Possibility to use dams for hydropower production Possibility to swim	WTP for reaching moderate and good status Others???	No	Health improvements due to a less polluted environment Increase of patrimonial value for non-users Patrimonial value of GW, for recreational users, of wetlands patrimonial value: non-use value assigned to ecological capital Value assigned to reaching GES by locals	No	No		Benefits Benefits from improving water quality Benefits for connected ecosystems Benefits from improved soil quality		No	No	No
RBDs for which the yearly value of benefits is provided at the RBD level	None	None	None	2 Guadalquivir, Guadiana	2 Seine-Normandie, Adour-Garonne	None	1		None		None	None	10
RBDs for which the total value of benefits is provided at the RBD level	None	None	None	None	1 Seine-Normandie	None	None		None		None	None	11
RBDs for which the yearly value of benefits is provided at the WB level	2 (Yearly benefits provided at area level)	None	2 both island and WB level	1 Segura	2 Rhône-Méditerranée-Corse, Loire-Bretagne	None	None		None		2 (Yearly benefits provided at area level)	None	None
RBDs for which the total value of benefits is provided at the WB level	2 (Total benefits provided at area level)	None	1 (island)	None	1 Rhône-Méditerranée-Corse	None	None		None		2 (Total benefits provided at area level)	None	None

Annex III - Lower and higher ranges of yearly benefits per person per year in each EU country

Country	WB in GES in 2010 (%)	Extrapolation		Percentage of WB in GES in 2015 and corresponding expected benefits/person/year																	
		Conv. Min.	Conv: Max	10		20		30		40		50		60		70		80		90		100	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Belgium	0	0,08651	1,14118	0,8651	11,412	1,7302	22,82	2,5953	2,5953	3,4604	45,65	4,325	57,059	5,191	68,471	6,0557	79,882	6,9208	91,294	7,7859	102,71	8,651	114,12
Bulgaria	43	0,08651	1,14118									0,606	7,9882	1,471	19,4	2,3358	30,812	3,2009	42,223	4,066	53,635	4,9311	65,047
Czech Republic	17	0,08651	1,14118			0,2595	3,424	1,1246	14,835	1,9897	26,25	2,855	37,659	3,72	49,071	4,585	60,482	5,4501	71,894	6,3152	83,306	7,1803	94,718
Denmark	60	0,08651	1,14118													0,8651	11,412	1,7302	22,824	2,5953	34,235	3,4604	45,647
Germany	9	0,08651	1,14118	0,0865	1,1412	0,9516	12,55	1,8167	23,965	2,6818	35,38	3,547	46,788	4,412	58,2	5,2771	69,612	6,1422	81,023	7,0073	92,435	7,8724	103,85
Estonia	78	0,08651	1,14118															0,173	2,2824	1,0381	13,694	1,9032	25,106
Ireland	54	0,08651	1,14118											0,519	6,8471	1,3842	18,259	2,2493	29,671	3,1144	41,082	3,9795	52,494
Greece	44	0,08651	1,14118									0,519	6,8471	1,384	18,259	2,2493	29,671	3,1144	41,082	3,9795	52,494	4,8446	63,906
Spain	58	0,08651	1,14118											0,173	2,2824	1,0381	13,694	1,9032	25,106	2,7683	36,518	3,6334	47,929
France	42	0,08651	1,14118									0,692	9,1294	1,557	20,541	2,4223	31,953	3,2874	43,365	4,1525	54,776	5,0176	66,188
Italy	52	0,08651	1,14118											0,692	9,1294	1,5572	20,541	2,4223	31,953	3,2874	43,365	4,1525	54,776
Cyprus	40	0,08651	1,14118									0,865	11,412	1,73	22,824	2,5953	34,235	3,4604	45,647	4,3255	57,059	5,1906	68,471
Latvia	57	0,08651	1,14118											0,26	3,4235	1,1246	14,835	1,9897	26,247	2,8548	37,659	3,7199	49,071
Lithuania	40	0,08651	1,14118									0,865	11,412	1,73	22,824	2,5953	34,235	3,4604	45,647	4,3255	57,059	5,1906	68,471
Luxembourg	8	0,08651	1,14118	0,173	2,2824	1,0381	13,69	1,9032	25,106	2,7683	36,52	3,633	47,929	4,499	59,341	5,3636	70,753	6,2287	82,165	7,0938	93,576	7,9589	104,99
Hungary	12	0,08651	1,14118			0,6921	9,129	1,5572	20,541	2,4223	31,95	3,287	43,365	4,152	54,776	5,0176	66,188	5,8827	77,6	6,7478	89,012	7,6129	100,42
Malta	70	0,08651	1,14118															0,8651	11,412	1,7302	22,824	2,5953	34,235
Netherlands	0	0,08651	1,14118	0,8651	11,412	1,7302	22,82	2,5953	2,5953	3,4604	45,65	4,325	57,059	5,191	68,471	6,0557	79,882	6,9208	91,294	7,7859	102,71	8,651	114,12
Austria	41	0,08651	1,14118									0,779	10,271	1,644	21,682	2,5088	33,094	3,3739	44,506	4,239	55,918	5,1041	67,329
Poland	10	0,08651	1,14118			0,8651	11,41	1,7302	22,824	2,5953	34,24	3,46	45,647	4,325	57,059	5,1906	68,471	6,0557	79,882	6,9208	91,294	7,7859	102,71
Portugal	70	0,08651	1,14118															0,8651	11,412	1,7302	22,824	2,5953	34,235
Romania	62	0,08651	1,14118													0,6921	9,1294	1,5572	20,541	2,4223	31,953	3,2874	43,365
Slovenia	n.a.	0,08651	1,14118																				
Slovakia	62	0,08651	1,14118													0,6921	9,1294	1,5572	20,541	2,4223	31,953	3,2874	43,365
Finland	55	0,08651	1,14118											0,433	5,7059	1,2976	17,118	2,1627	28,529	3,0278	39,941	3,8929	51,353
Sweden	54	0,08651	1,14118											0,519	6,8471	1,3842	18,259	2,2493	29,671	3,1144	41,082	3,9795	52,494
UK	32	0,08651	1,14118							0,6921	9,129	1,557	20,541	2,422	31,953	3,2874	43,365	4,1525	54,776	5,0176	66,188	5,8827	77,6

Note: No data on changes in status were found for Slovenia

Annex IV - Lower and higher ranges of total yearly benefit in each EU country

Country	WB in GES in 2010 (%)	Percentage of WB in GES in 2015 and corresponding expected benefits/country/year																			
		10		20		30		40		50		60		70		80		90		100	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Belgium	0	3473929,3	1,25E+08	18947859	249346307	28421788	28421788	37895717	499382614	47369646	624865768	56843576	749838922	66317505	874812075	75791434	999785229	85265363	1,125E+09	94739293	1,25E+09
Bulgaria	43	0	0	0	0	0	0	0	0	4544717,7	59350595	11037171	145594303	17529625	231238010	24022079	316881717	30514533	402525425	37006987	488163132
Czech Republic	17	0	0	2733566,6	36059214	11845455	156256594	20957344	276453974	30069233	396651355	39181122	516848735	48293011	637046115	57404899	757243495	66516788	877440875	75628677	997638256
Denmark	60	0	0	0	0	0	0	0	0	0	0	0	0	4810493,7	63456519	9620987,4	126913038	14431481	190369557	19241975	253826075
Germany	9	7072322,9	93292917	77795552	1,026E+09	148518781	1,959E+09	219242010	2,892E+09	289965240	3,825E+09	360688469	4,758E+09	431411698	5,691E+09	502134927	6,624E+09	572858156	7,557E+09	643581385	8,49E+09
Estonia	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	231880,1	3058732,8	1391280,6	18352757	2550681,1	33646721
Ireland	54	0	0	0	0	0	0	0	0	0	0	2325831,5	30680670	6202217,2	81815119	10078603	132949568	13954389	184084017	17831375	235218466
Greece	44	0	0	0	0	0	0	0	0	5870502,1	77439375	15654672	206505001	25438843	335570626	35223013	464636251	45007183	593701877	54791353	722767502
Spain	58	0	0	0	0	0	0	0	0	0	0	7385370	105337168	47912220	632023006	87839070	1,159E+09	127765920	1,685E+09	167692771	2,212E+09
France	42	0	0	0	0	0	0	0	0	45018653	593853181	101291969	1,336E+09	157565285	2,078E+09	213838602	2,821E+09	270111918	3,563E+09	326385234	4,305E+09
Italy	52	0	0	0	0	0	0	0	0	0	0	41958293	553483234	94406174	1,245E+09	146854048	1,937E+09	199301923	2,629E+09	251749797	3,321E+09
Cyprus	40	0	0	0	0	0	0	0	0	695315,91	9180014,3	1391831,8	18360029	2087747,7	27540043	2783663,7	36720057	3479579,6	45900072	4175495,5	55080086
Latvia	57	0	0	0	0	0	0	0	0	0	0	578658,06	7633234,4	2507518,3	33077349	4436378,5	58521464	6365238,7	83965578	8294098,9	109409693
Lithuania	40	0	0	0	0	0	0	0	0	2806301,1	37026588	5613802,2	74053177	8420703,2	111079765	11227604	148106354	14034505	185132942	16841406	222159531
Luxembourg	8	88558,454	1168198	531350,73	7009190,6	974143	12850183	1416935,3	18691175	1859727,5	24532167	2302519,8	30373159	2745312,1	36214151	3188104,4	42055144	3630896,6	47896136	4073688,9	53737128
Hungary	12	0	0	6310310,5	91163682	15549549	205118285	24188187	319072888	32826825	433027431	41465463	546982094	50104101	660936697	58742739	774891300	67381377	888845903	76020015	1,003E+09
Malta	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	361280,05	4765742,5	722560,1	9531484,9	1083840,1	14297227
Netherlands	0	14408315	1,9E+08	28817830	380143762	43226745	43226745	57635660	760287523	72044575	950353404	86453490	1,14E+09	100862405	1,331E+09	115271321	1,521E+09	129680236	1,711E+09	144089151	1,901E+09
Austria	41	0	0	0	0	0	0	0	0	6543459	86316531	13813969	182223787	21084479	278131044	28354989	374038300	35625499	469945556	42896009	565852813
Poland	10	0	0	33046814	435923425	66093628	871858850	99140441	1,308E+09	132187255	1,744E+09	165234069	2,18E+09	198280883	2,616E+09	231327697	3,052E+09	264374511	3,487E+09	297421324	3,923E+09
Portugal	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3202033,9	121386588	18404080	242773175	27606120	364159763
Romania	62	0	0	0	0	0	0	0	0	0	0	0	0	14820056	195495351	33345126	439864540	51870196	684233729	70395266	928602918
Slovenia	n.a.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovakia	62	0	0	0	0	0	0	0	0	0	0	0	0	3761633,4	49620799	8463688,6	111646797	13165738	173672796	17867787	235698794
Finland	55	0	0	0	0	0	0	0	0	0	0	2325072,9	30670664	6375218,8	92011991	11625365	153353319	16275511	214634646	20925657	276035973
Sweden	54	0	0	0	0	0	0	0	0	0	0	4887240,1	64468901	13032640	171917070	21178041	279365238	29323441	386813407	37468841	494261576
UK	32	0	0	0	0	0	0	43210456	570000762	97223525	1,283E+09	151236594	1,995E+09	205249664	2,708E+09	259262733	3,42E+09	313275803	4,133E+09	367288872	4,845E+09
Total EU MI		**31,0437**	**409,506**	**168,784**	**2226,47**	**314,63**	**3276,88**	**503,687**	**6644,27**	**769,026**	**10144,43**	**1112,269**	**14672,2**	**1529,819**	**20180,26**	**1961,81**	**25878,8**	**2394,73**	**31589,5**	**2827,65**	**37300,3**