Chapter 1: A Bird's Eye View of the Greek Water Situation: The Potential for the Implementation of the EU WFD.

[1]Koundouri, P., [2]Papandreou, N. [3]Remoundou, K., [4]Kountouris, Y.
[1]Athens University of Economics and Business, GREECE
[2]Andreas G. Papandreou Foundation, GREECE
[3]Aberystwyth University, UK
[4]Imperial College London, UK

The Water Framework Directive (WFD) was formulated for addressing the weaknesses of the previous water-related directives. The main steps that WFD involves could be summarised in the setting of ecological standards, the identification of anthropogenic pressures and the adoption of corrective measures. This introductory chapter describes the water situation in Greece and assesses the potential of the timely implementation of the European Union's (EU) WFD. In this context, the significance of Asopos River Basin (RB) is put into perspective. More analytically, the chapter presents: (a) the employed methodology that enables rapid assessment of the *status quo* of the water situation in each Greek catchment, as compared to the requirements and targets of the EU WFD, (b) the implementation of this methodology on each of the fourteen Greek River Basin Districts (RBDs) and (c) relevant empirical results. The main objective of the chapter is to present the rapid-appraisal methodology that was developed for the estimation of the cost-recovery level for water services in the fourteen Greek RBDs. Results from this 'quick appraisal' clearly highlight the need for reforms in the current pricing policy and preparation of a package of measures, as proposed in Chapters 9 and 10, in order for the water bodies to reach good ecological status and the water management to ensure full recovery of the cost of water services as required under article 11 of the WFD.

1. Introduction

General overview of the WFD

It is internationally recognised that water resources are necessary inputs to production in economic sectors such as agriculture (arable and non-arable land, aquaculture, commercial fishing, and forestry), industry (power generation) and tourism, as well as to household consumption (UNEP 2005).

Policy makers at European level have recognized the need to approach human activity and water resources in an integrated manner to achieve sustainable water resources management as laid down in the recently adopted EU-Water Framework Directive (WFD) (CEC 2000). The WFD (2000/60/EC) was adopted in October 2000, and it establishes a framework for European Community action in the field of water policy. The importance of water is crystallised in the first recital of the Directive. It states that "[W]ater is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such" (CEC 2000, p. I.327/1).

The aim of the WFD is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and ground waters. Whereas previously adopted water-related EU Directives addressed individual issues, the WFD aims to provide an integrated framework for water resources management, both in terms of quality and quantity, to achieve the objective of good water status for all EU waters. Figure 1 presents the integrated character of WFD.

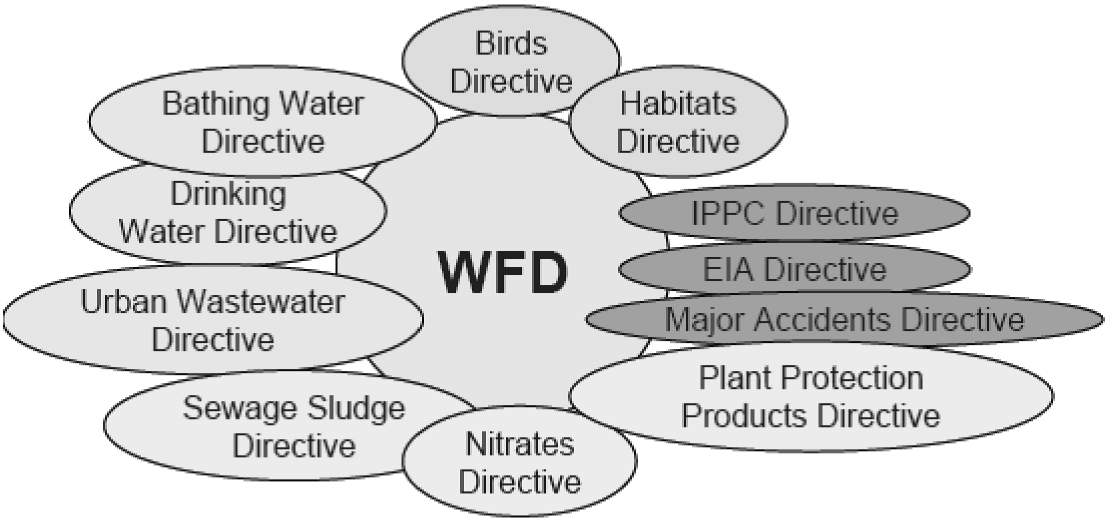


Figure 1: WFD, a truly integrated Directive

Hence, an examination of water policy through previous water directives, including the Nitrates Directive and the Bathing Water Quality Directive, demonstrates how current policy evolved from an emphasis on public health protection to environmental protection and finally, as formed today, to the notions of 'sustainable use' of water and an integrated ecosystem-based approach to water management. What is achieved from these changes is that although in the past EU legislation on water was focused on specific environmental problems related to water quality as far as for example drinking, bathing or freshwater fishing activities are concerned, emphasis is now placed on the improvement of the ecological quality of water and its eco-system functions, by using a broader and integrated approach involving both environmental quality objectives coupled with emission limit values.

The Directive calls for integrated catchment management plans to be prepared for all river basins in order to achieve Good Ecological Status (GES) in all EU waters by 2015. Particularly, according to Article 2 (18), '[G]ood surface water status' refers to the status achieved by a surface water body when both its ecological status and its chemical status are at least ‘good’. As such, the Directive aims at achieving a minimum standard of ‘good’ and ‘non-deteriorating’ status, and sets common approaches and goals for water management in the EU Member State countries adopting a broader measure of water quality.

The suggested means to achieve that goal is the planning at the natural hydrologic (river basin) level/unit instead of other administrative or political boundaries and the implementation of pollution-control measures in cases where existing legislation on water quality and pollution is proved inadequate. Hence, an important change in water management policy is that the measures to achieve WFD objectives will be co-ordinated at the level of River Basin District (RBD) that will correspond to large catchment basins incorporating the smaller sub basins. In the case that a basin crosses national boundaries, the responsibility should be shared between governments and one single vision should be created.

For the assessment of quality, three main characteristics are considered. The first is that of biological quality elements. The parameters to be measured for river, lake and transitional waters are composition and abundance of aquatic flora (macrophytes) and benthic fauna (invertebrates) as well as the composition, abundance and age of structure of fish. In the case of the marine environment, instead of the ‘fish’ parameter the composition, abundance and biomass of phytoplankton is considered. The other two quality characteristics refer to elements that support biological elements. One is the physico-chemical elements such as condition of thermal, oxygen, salinity, acid, nutrient and transparency, and the other is hydromorphological elements that can include in the case of a river for example, the quantity and dynamics of water flow, its continuity, depth and width variation, and structure of the riparian zone. The Directive's goal is diversified in the case of 'artificial/modified' waters serving economic activities where the GES turns to 'good ecological potential' and in the case of 'protected zones' (*i.e.*, areas designed for the protection of habitats or species) and nutrient sensitive areas where more stringent requirements may be applied.

For its implementation, the Directive calls for the authority of each RBD to prepare and put into action a six year River Basin Management Plan that will include a description of the district's characteristics, the identification of protected areas, the impact and pressures of human activity on water status (point source and diffuse pollution, abstraction and land-use patterns), an economic analysis of the cost of the water, an estimation of the effects of existing legislation to achieve the objectives, and information on measures taken to achieve goals. In implementing the measures, MS are asked to take account of the principle of full recovery of costs of water services that will provide incentives for the efficient use of water by different users. At this stage, according to Article 14, public participation of all interested parties should contribute to the identification of measures to be adopted.

It should be noted that in this context, monitoring is central to the Directive and according to Article 8 includes several monitoring requirements, not only to determine the classification of waters' status but also to continue assessing the necessity for additional measures or ensure that mitigation measures are implemented. Thus, the main steps that the WFD involves could be summarised in the setting of ecological standards, the identification of anthropogenic pressures, and the adoption of corrective measures. Furthermore, the main change and innovation that the

Directive brings is that it institutionalises the ecosystem objectives and has, to some extent, a binding character. Hence, “for the first time in the EU Environmental Policy a legal text proposes economic principles and measures as basic instruments for the achievement of specific environmental objectives” (MoEPPW, 2006, p.233). For each Member State there is a Common Implementation Strategy (CIS) and timetable as summarised in the following table (Table 1.1).

Table 1: WFD timetable

Year	Issue	Reference
2000	Directive entered into force	Art. 25
2003	Transposition in national legislation Identification of RBDs and Authorities	Art. 23 Art. 3
2004	Characterisation of river basin: pressures, impacts and economic analysis	Art. 5
2006	Establishment of monitoring network Start public consultation (at the latest)	Art. 8 Art. 14
2008	Present draft river basin management plan	Art. 13
2009	Finalise river basin management plan including programme of measures	Art. 13 & 11
2010	Introduce pricing policies	Art. 9
2012	Make operational programmes of measures	Art. 11
2015	Meet environmental objectives	Art. 4
2021	First management cycle ends	Art. 4 & 13
2027	Second management cycle ends, final deadline for meeting objectives	Art. 4 & 13

Source: http://ec.europa.eu/environment/water/water-framework/info/timetable_en.htm

2. The Socio-Economic Aspects of the EU WFD

From an economic perspective, water resources are not efficiently allocated and may be overexploited due, to some degree, to the existence of market and government failures at different levels (local, national, international). This phenomenon primarily occurs because of the public good nature of water resources and secondly because of the complexity that characterises water value (including use and non-use values), that does not allow it to be traded in markets as private goods. Brouwer *et al.* (2009, p.13) argue that the main problem when considering economic choices related to water is that a competitive, freely functioning market does not exist for many water related uses because "water is an essential commodity such that the value for a basic survival amount is infinite; water has natural monopoly characteristics; property rights for water resources are often absent and difficult to define; water is a 'bulky' commodity, thereby restricting the development of markets beyond the local area".

As economic efficiency occurs at the point where net social benefits of an economic activity are maximised, or equivalently, when the marginal benefits are equal to marginal costs, in order to implement the most efficient social and economic policies that prevent the excessive degradation and depletion of environmental resources it is necessary to establish their full value, and to incorporate this into private and public decision-making processes (Birol *et al.*, 2006). The WFD is one of the first European Directives to recognize explicitly the role of economics in reaching environmental and ecological objectives and it aims to correct for 'market or government failures' by managing water resources in a sustainable manner with the application of economic principles, approaches, tools and instruments at the RBD level.

In particular, the EU WFD is one of the policy initiatives that aim to ensure the sustainable management and conservation of this valuable resource, along with other international efforts such as the 1971 Ramsar Convention on Wetlands of International Importance (Ramsar 1996). In order to achieve this, the WFD promotes the concept of water as an economic commodity, while maintaining its focus on its broader and often intangible value. However, given the different characteristics of demand for different uses of this resource related to location, quality, quantity and timing, any consideration of water as an economic good needs to ensure its commensurability in terms of a common denominator of place, form and time (Brouwer *et al.*, 2009).

The procedure for the implementation of the economic analysis includes three steps (MoEPPW, 2006, p.233):

(i) Assessment of the current level of full cost recovery based on the economic analysis of water uses and long term forecasts of water supply and demand in each river basin district. The analysis aims at the development of the Baseline Scenario of the evolution of basic parameters affecting water demand and supply and necessary investments (Figure 2).

(ii) The Baseline Scenario is used for the assessment of the anticipated impacts on the quality of water bodies. Potential gaps in relation to the environmental objectives should be identified.

(iii) Assessment of the economic impacts from the application of program of measures.

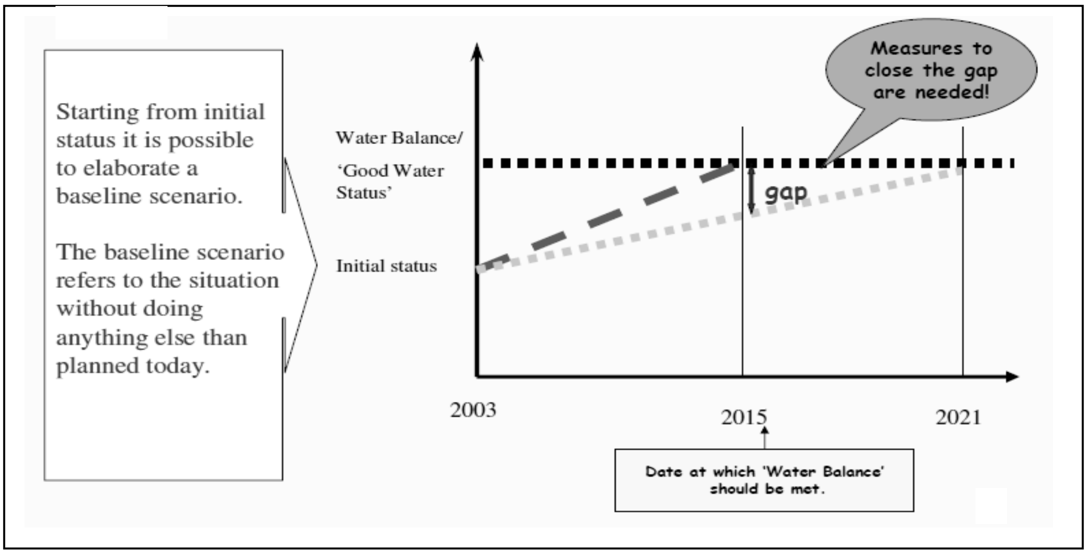


Figure 2: Diagrammatical implementation of WFD

Source: http://www.aueb.gr/users/resees/uploads/wfd.pdf

Economic issues are mainly dealt with in Article 5 (Characteristics of the river basin district, review of environmental impact of human activity and economic analysis of water use), Annex III (Economic analysis), Article 9 (Recovery of costs for water services) and Article 11 (Program of measures) of the Directive. These economic issues can be implemented (as indicated in the WATECO document, European Communities (2002)) by the use of the following river-basin specific three-step approach: (1) the economic characterization of water in the RBD, (2) the assessment of the recovery of the costs of water services, and (3) the economic assessment of potential measures for balancing water demand and supply. The first step involves the (i) estimation of the socio-economic significance of water uses using data concerning not only the water consumption, but also the production of pollution loads by the various activities and (ii) the investigation of the dynamics of key economic drivers that influence pressures and thus water status. As a result, the economic analysis must include the long term forecast of supply and demand, and estimates of volume, price and cost associated to water services where data is not available. An overview of the dynamics of the river basin should be provided, based on a top-down approach, forecasting changes in pressures based on the changes in key climatic and socio-economic drivers (e.g., population trends, trends for the major economic activities, land use changes, technological changes) in order to construct a baseline scenario.

The current level of recovery of costs of water services should then be assessed in a second stage to be used as a tool for appraising economic efficiency and equity and with a final aim of identification of least-cost measures to achieve sustainable water resources management in the final step. Therefore, the economic analysis reports should contain sufficient information on the significant drivers and pressures in each RBD and on the contribution of water uses in the recovery of costs in accordance with the polluter pays principle, to enable the selection of the programme of measures on a cost effectiveness basis in 2010 (Annex III). Overall, economic principles are to be applied in four main areas within a river basin context (Morris, 2004, p.4):

- The estimation of the demand for water and the valuation of water in its alternative uses (Article 5)
- The identification and recovery of costs, environmental and resource, associated with water services, having regard for the polluter pays principle and the efficient use of water (Article 9)
- The use of economic appraisal methods to guide water resource management decisions (Article 11)
- The use of economic instruments to achieve the objectives of the WFD, including the use of incentive pricing and market mechanisms (Article 11)

Specifically Article 5 introduces the principle of economic analysis in water management and the assessment of the most cost-effective combination of measures in respect of water uses to be included in the program of measures under Article 11, based on estimates of the potential costs of such measures. Furthermore, the economic analysis is also expected to provide room for derogations under the umbrella of disproportionate costs. With regard to the latter concept, Article 4 states that exemptions are possible if the cost of reaching the GES is disproportionate[1]. However, in order to evaluate the extent to which this is the case and to assess ‘disproportionality’, one also has to know the costs and benefits associated with reaching environmental objectives, in both qualitative and quantitative terms. In order to pass the test, costs should exceed benefits by a significant margin in a cost-benefit framework.

Article 9 stresses the need for users (that is industries, farmers, and households) to be charged a price that reflects the full cost of the water services they receive. Full cost pricing is a mandatory part of the river management plan and according to the Directive’s timetable Member States should have introduced water pricing policies by 2010. According also to Article 9.1 environmental and resource costs must be taken into account for water services, according to provisions of Annex III and particularly to the polluter pay-principle.

Another clear aim of the economic analysis is to provide a preliminary selection of appropriate instruments and measures. This selection should consider the significant water management issues, pressures and impacts identified, and the measures and investments foreseen or already implemented (MoEPPW, 2006). “Each measure should be assessed in terms of effect, cost and scale of application, in order to provide the basis for a more detailed assessment of costs and effects and ultimately for the selection of appropriate supplementary measures to be included in the River Basin Water Management Plan” (MoEPPW, 2006, p.235). As a result, considering that each measure and water policy is associated with each own costs and benefits and should

[1] Costs are considered as disproportionate if they exceed the monetised benefits of achieving ‘good status’ in a water body.

be judged in a long-run cost-effectiveness analysis basis to identify the optimal set of measures adequate to creative incentives for sustainable water resources use (Koundouri and Remoundou, 2009; Birol and Koundouri, 2008a; Koundouri, 2007).

Hence, the tool kit of economic analysis includes the estimation of both direct and indirect costs and benefits to be considered in each management plan (Hanley and Black, 2006). Regarding the nature of benefits, economic analysis will consider direct benefits such as reductions in the cost of drinking water treatment downstream when less pollution is discharged into a river and indirect benefits such as an increase in jobs if cleaner coastal waters lead to higher tourism levels. Furthermore, more difficult to quantify benefits, such as recreation and availability of healthy ecosystems, will also be included. It is regarded that the contribution of valuation methods can be useful in that respect. In general, this is an important but difficult task for river basin authorities, and it will involve them having to consider and evaluate costs and benefits - including environmental criteria. Hence, the concept of environmental and resource costs and benefits plays an important role in the economic analysis of the Directive and practical guidelines for their assessment have been developed (European Communities, 2002; Brouwer *et al.*, 2009). Furthermore, for supporting the coherent and harmonious implementation of the WFD, the Member States developed the CIS (2004).

Overall, economics and their subset of environmental economics are expected to play an important and supportive role in WFD implementation (through Articles 9, 11 and 4), and in particular in justifying spending on environmental protection where applicable. Particularly focusing on the contribution of the valuation of benefits, it is regarded that their inclusion will facilitate water-related decision-making in different ways. However, according to the Commission's compliance report COM (2007) 128 final), the economic assessment is one of the main shortcomings in the WFD implementation. In particular, although all Member States have submitted country reports on Article 5 of WFD, half of them have not supplied information at all on cost recovery. This highlights the difficulties (informational and methodological) that Member States face in implementing the economic aspects of the Directive. These difficulties will be exuberated by the requirements of Article 9 of the Directive, which indicates that by 2010 Member States should introduce pricing policies and economic instruments with the element of cost-recovery for the benefit of the environment.

3. The need for a 'Quick Appraisal'

A rapid-appraisal approach was dictated by severe information deficiencies and limited time frame. At the time of the current study (November 2007) the European Commission had already initiated legal action of 'Non-Conformity' with the requirements under Article 5 against Greece (case A2005/2317). The time frame for this study was thus defined by the Ministry of Environment, Physical Planning and Public Works1[2] (MoEPPW), who financed and supervised the study, to two months. Meanwhile the significantly low level of available information posed a further constraint in the study. Preliminary analysis of water uses, pressures and impacts, under the first step of the implementation procedure, aiming to inform and guide the subsequent economic analysis was piecemeal. The only available source of information with regard to water uses in each River Basin District is a master plan

[2] Since 2009 the name of the ministry is changed to Ministry of Environment, Energy and Climate Change.

study conducted by the Ministry of Environment which only contained general socioeconomic information. More, financial data from the drinking and irrigation water companies were not always available since their legal status does not oblige them to report their economic elements. This was especially true for smaller companies operating in small towns. Finally the implementation of the Article 4 which defines the environmental objectives per RBD was not completed at the time of the study and thus the environmental quality assessment had to be based on approximations from existing studies. The agricultural census was not organized per RBD as well. Therefore information with respect to cultivations and water demand were approximated. The European Commission has taken Belgium, Denmark, Greece and Portugal to court over their failure to comply with EU water legislation and submit plans for managing their river basins. These plans should have been adopted by 22 December 2009 at the latest.

4. Total cost of water services

The most important economic concept that the Directive introduces, is that of water resources management based on the recovery of the total economic cost of water services such as freshwater provision to domestic uses and irrigation, urban wastewater collection and treatment by the Sewerage Services and recycled water supply to irrigation. According to Article 9 the total economic cost of water includes the financial cost of water companies (including costs of investments, operation and maintenance costs and administrative costs), but also the environmental and resource costs. The environmental cost reflects social welfare losses associated with water quality deterioration, caused by the water uses, while the resource cost represents additional costs that are, or will be, needed in order to cover water demand under water deficits due to the overexploitation of available water resources. In this respect Article 9 clearly states that 'Member States shall take account of the principle of recovery of the costs of water services, including environmental and resource costs, having regard to the economic analysis conducted according to Annex III, and in accordance in particular with the polluter pays principle'. Table 2 illustrates the disaggregation of the total cost of water services. Moreover, the WFD also states that the cost recovery of water services should be analysed for different water uses, which should be at least disaggregated into households, industry and agriculture.

Table 2: Total cost of water

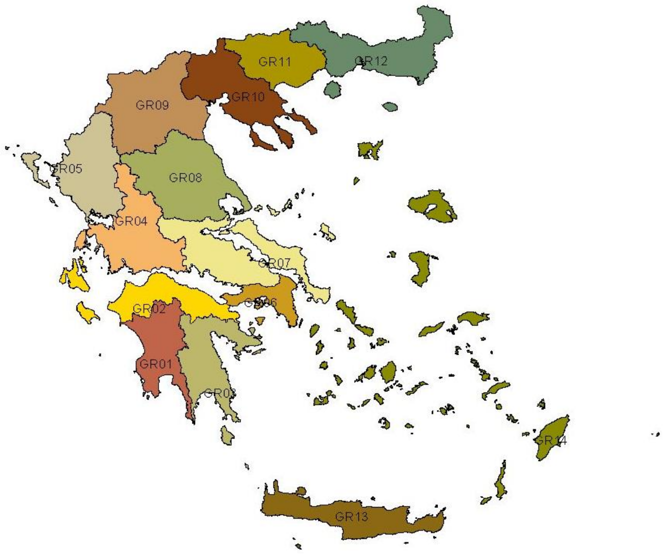
Total Economic Cost of Water Services	**Financial Cost**	Cost of providing and administering water services. Includes: Capital Cost, Operation Cost, Maintenance Cost, Administrative Cost
	Environmental Cost	Environmental cost represents the costs of damage that water uses impose on the environment and ecosystems and those who use the environment (e.g. a reduction in the ecological quality of aquatic ecosystems or the salinisation and degradation of productive soils.
	Resources Cost	Resource cost represents the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery (e.g. linked to the over-abstraction of groundwater)

Overall, with respect to the cost analysis of the water uses the following steps are recommended (MoEPPW, 2006, pp.233-234):

- The identification of significant pressures and impacts, which derives from the analysis of pressure and impacts
- Geographical and qualitative assessment of the various water uses (agricultural, industrial, domestic) in the regions of each RBD
- Estimation of socio-economic significance of water uses
- Identification of protected areas with species that present high economical value

5. The water situation in Greece and the potential of the timely implementation of the EU WFD

In Greece, the WFD has been transposed into the national legislation with Law 3199/2003 (MoEPPW, 2003). The country occupies a total area of 131.957 km^2 divided into 14 RBDs as presented in Figure 3, out of which 5 are international sharing water courses with Albania, FYROM and Bulgaria to the north and Turkey to the east. Furthermore the country is divided into 45 River Basins (Figure 4). At this point, since our case study for the chapters to follow is Asopos (RB), it should be noted that Asopos RB (GR25, Figure 4) is part of the Water District (GR 07) of East Sterea Ellada (Figure 3).



01: West Peloponnese	06: Attica	11: East Macedonia
02: North Peloponnese	07: East Sterea Ellada	12: Thrace
03: East Peloponnese	08: Thessaly	13: Crete
04: West Sterea Ellada	09: West Macedonia	14: Aegean Islands
05: Epirus	10: Central Macedonia	

Figure 3: Greek River Basin Districts
Source: http://www.minenv.gr/nera/ (WFD Article 3 report - Greek maps)

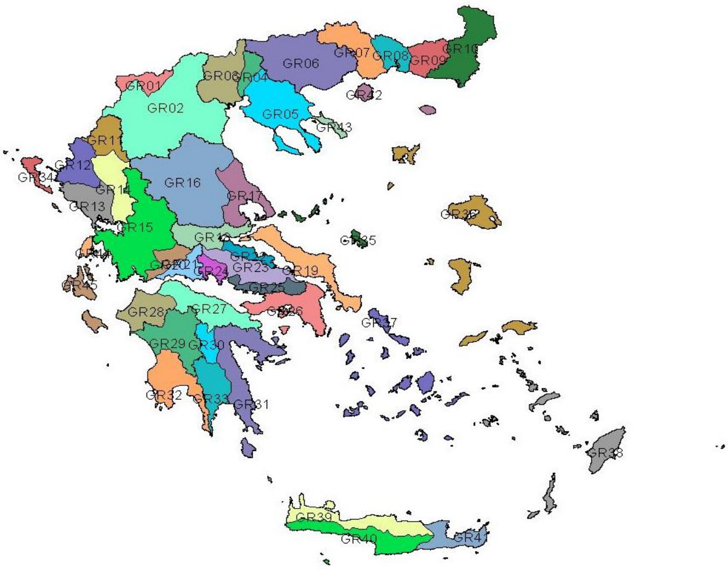


Figure 4: Greek River Basins
Source: http://www.minenv.gr/nera/ (WFD Article 3 report - Greek maps)

In Greece water supply is viewed as public service and it is mainly the municipalities which are responsible for water supply, waste water collection, treatment and disposal. In the largest cities of the country, Athens and Thessaloniki, owned companies (non profit making corporations), controlled by the Ministry of Environment Physical Planning and Public Works, own and operate the treatment plants. In the other cities of more than 10,000 inhabitants water supply is managed by municipal companies – operating as private enterprises DEYA (Municipal Enterprise for Water Supply and Sewerage) but owned by the municipalities. The pricing policy is determined by each DEYA on the basis of their cost and is approved by the Municipal Council. Based on the economic elements on DEYA the mean price per cubic meter of water in Greece is estimated at €1.27.

As far as the agricultural sector is concerned the 40% of Greece's irrigation needs are covered by the 404 operating Local Irrigation Companies, which are responsible for the abstraction and distribution of water. The construction of major irrigation plants is undertaken by the General Irrigation Companies operating in 10 river basin districts. Prices are set by irrigation companies based on private cost criteria. The mean price per irrigated thousand square meters in Greece is €13.73.

Table 3 presents the overall socio-economic characterization of the RBDs. In particular, for each river basin it is reported the percentage of participation of each sector of economy (primary, processing, and services) to the formation of the total GDP of the river basin. Table 4[3] presents the most important water uses in each RBD. From these tables it is apparent that East Sterea which includes Asopos RB presents a

[3] Report on the implementation of Article 5 of the WFD (2008)

considerable contribution of the secondary sector in GDP and a considerable demand of water use for irrigation and industry.

Table 3: Socio-economic identity of the RBDs

River Basin District	Primary Sector (% GDP)	Secondary Sector (% GDP) (processing)	Tertiary Sector (% GDP)
1. West	42.2	17.7	40.1
2: North	18.6	34.3	47.1
3: East	33.7	24.7	41.6
4: West Sterea	34.8	18.8	46.4
5: Epirus	26.3	19.5	54.2
6: Attica	2.1	26.5	71.4
7: East Sterea	24.1	43.0	32.9
8: Thessaly	33.5	26.1	40.3
9: West	25.9	37.0	37.1
10: Central	14.9	30.5	54.6
11: East	27.6	32.5	39.8
12: Thrace	34.7	29.4	35.9
13: Crete	28.7	16.3	55.0
14: Aegean	15.2	20.2	64.6

Table 4:Economic analysis of the most important water uses and pressures in each RBD

River Basin District	**Population (2001)**	**Area (km^2)**	**Demand for supply (hm^3/year)**	**Demand for irrigation (hm^3/ year)**	**Demand for industry (hm^3/ year)**
1. West Peloponnese	331 180	7 301	23	201	3
2: North Peloponnese	615 288	7 310	36.7	395.3	3
3: East Peloponnese	288 285	8 477	22.1	324.9	0.03
4: West Sterea Ellada	312 516	10 199	22.4	366.5	0.35
5: Epirus	464 093	10 026	33.9	127.4	1
6: Attica	3 737 959	3 207	400	99	1.5
7: East Sterea Ellada	577 955	12 341	41.6	773.7	12.6
8: Thessaly	750 445	13 377	69	1,550	0.054
9: West	596 891	13 440	43.7	609.4	30

Macedonia					
10: Central Macedonia	1 362 190	10 389	99.8	527.6	80
11: East Macedonia	412 732	7 280	32	627	0.321
12: Thrace	404 182	11 177	27.9	825.2	11
13: Crete	601 131	8 335	42.33	320	4.1
14: Aegean Islands	508 807	9 103	37.19	80.20	1.24

According to the information/data provided by the National Management Program of water inventory of the Hellenic Ministry of the Environment, Physical Planning and Public Works, the river basins are distinguished according to the conditions of water quality to:

1. Good
2. Moderate
3. Bad

This distinction has been done following the measurements in each river basin regarding the concentrations of NO_3, P and NH_4. The concentration for each pollutant is characterized as Low, Moderate or High according to the levels of the pollutant factor[4]. The water quality in a river basin is characterized as Good if the majority of the measurements for all pollutants indicate Low Concentration, Moderate if the majority of measurements indicate Moderate Concentration and finally water quality is characterized as Bad if the majority of the measurements for all the considered pollutants indicate High Concentration. Table 5[5] presents the total number of the available measurements per pollutant and concentrations as well as the final condition

[4] Low Concentration: P<0.17mg/l, NO_3-N<5 mg/l, NH_4-N<0.04 mg/l
Moderate Concentration : 0.17 mg/l <P<0.31 mg/l, 5 mg/l <NO_3-N<11 mg/l, 0.04 mg/l <NH_4-N<1
High Concentration: P>0.31 mg/l, NO_3-N>11, NH_4-N>1

[5] Report on the implementation of Article 5 of the WFD (2008)

of the river basin. Regarding the East Sterea Ellada RBD it demonstrates an overall "moderate" condition of river quality considering the specific examined parameters. It should be also reminded that Asopos RB is only part of East Sterea Ellada RBD and its specific condition will be presented in the following two chapters which focus more on this particular basin characterization.

Table 5: Overall condition of river quality

River Basin	Concentration									Total Condition
	NO_3			P			NH_4			
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	
1. West Peloponnese	2	0	1	2	0	0	0	0	0	Good
2: North Peloponnese	1	0	0	1	0	0	0	1	0	Good
3: East Peloponnese	1	1	0	2	0	0	1	0	0	Good
4: West Sterea Ellada	11	0	0	10	2	1	0	9	0	Good
5: Epirus	7	0	0	8	0	1	3	4	0	Good
6: Attica	1	0	0	2	0	0	1	0	0	Good
7: East Sterea Ellada	3	0	2	1	2	0	0	3	0	Moderate
8: Thessaly	3	1	0	2	2	0	0	4	0	Moderate
9: West Macedonia	12	1	1	10	3	10	0	11	5	Bad
10: Central Macedonia	7	0	0	2	1	7	0	7	0	Moderate
11: East Macedonia	7	0	0	3	3	3	0	7	0	Moderate
12: Thrace	8	9	1	0	5	12	0	13	4	Bad
13: Crete	4	0	0	4	0	0	4	0	0	Good
14: Aegean Islands	-	-	-	-	-	-	-	-	-	Good

The following section analyzes the calculation of the financial, environmental and resources cost that determine the total cost of water services that should be taken into account in the design of future pricing policies to ensure sustainable water resources management in line with the provisions of the Directive.

6. Methodologies for the calculation Total Economic Cost in Greece

6.1 Financial Cost

The financial cost of water services includes operational, administrative, maintenance costs of existing infrastructure and investment cost for the enterprises of drinking water supply and sewerage and the irrigation water companies. The relevant data, for the calculations under this study, were collected from the enterprises' annual published financial reports of the most recent five years. For the RBDs where financial data were not available for all enterprises, the total financial cost was approximated assuming for the remaining enterprises the Greek mean financial cost per enterprise and aggregating over all operating enterprises. Financial costs for domestic and agricultural water supply in each RBD are presented in Table 6.

Table 6: Financial cost per RBD

	Financial Cost (€)	
River Basin District	**Domestic (€/hm^3)**	**Irrigation (€/ha)**
1. West Peloponnesos	4 108 662	27.3
2. North Peloponnesos	4 612 819	14.6
3. East Peloponnesos	6 895 954	253
4. West Sterea Ellada	4 762 739	334.4
5. Epirus	5 684 518	319.2
6. Attica	833 711	13
7. East Sterea Ellada	3 378 763	10.07
8. Thessaly	6 850 916	63.9
9. West Macedonia	3 934 249	33.5

10. Central Mecedonia	2 091 853	53
11. East Macedonia	5 193 781	95.7
12. Thrace	2 746 149	28.6
13. Crete	5 258 926	33.8
14. Aegean Islands	9 530 520	10.3

6.2 Environmental cost

The environmental cost refers to the cost associated with water quality depletion and thus the subsequent limitation of water resources' capacity to provide goods and services which can be translated to value for people. Values from water resources include both values associated with the direct use of water for drinking, irrigation for agriculture and recreation, but also non-use values relating to nutrient retention, flood control and protection, biodiversity and bequest and aesthetic purposes among others (Birol *et al.*, 2006) To calculate the environmental damage arising from water supply or discharge, a variety of valuation techniques developed by economists can be applied which are generally classified as revealed preference techniques (see for example Braden and Kolstad, 1991) and stated preference techniques (see for example Adamowicz *et al.*, 1998). The first take into account observable market information which can be adjusted and used for revealing the individual's preferences while in Stated Preference approaches the market for the good is 'constructed' through the use of questionnaires and respondents are asked to state their willingness to pay for an improvement.

In the present study, in order to calculate the environmental cost a Benefits Transfer approach (Kirchhoff *et al.*, 1997; Desvousges *et al.*, 1992) is implemented. This approach allows values from existing studies to be transferred to policy sites of interest after correcting for certain parameters. The mean value from an extensive literature of valuation studies which apply stated preference methods to elicit individual valuations for water quality amelioration was thus adopted under this study after proper adjustment to reflect Greek-specific socioeconomic characteristics[6]. A single value transfer was judged as inappropriate under this study due to the great heterogeneity between the different RBD with regards to both environmental and socioeconomics conditions. We argue that a mean value from studies conducted in different areas with different cultural, environmental and socioeconomic backgrounds can isolate case-study specific characteristics and thus can better approximate the value to be adopted for this study. Monetary estimates from the considered studies capture both values associated with the direct use of water but also non-use values relating to the existence of water ecosystems.

RBDs were initially classified according to the pollution loads identified. The evaluation of surface and groundwater quality characteristics for the classification was based on monitoring data under existing studies (MoEPPW, 2007). Accordingly, the environmental cost was approximated with the welfare loss due to resources depletion and degradation as elicited in existing valuation studies after proper adjustment. Welfare estimates in the considered studies are reported as WTP per individual and they were then aggregated over the population of each RBD. The environmental cost was then disaggregated into different uses based on the pollution loads that are attributed to each use. The contribution percentage of the use in the total pollution loads identified in the RBD ($x = \frac{\text{pollution load attributed to a use}}{\text{total pollution load in the RBD}}$) was then used to approximate the environmental cost for this use (environmental cost of a use= x*total

[6] Ahmad et al., 2005; Basili et al., 2006; Bateman et al., 2004; Birol and Koundouri, 2008b; Birol et al., 2006; Brouwer and Bateman, 2005; Crandall 1991; Crutchfield et al., 1997; Day and Mourato, 2002; Farber and Griner 2000; Forster 1985; Georgiou et al., 2000; Green et al., 1993; Green and Tunstall,1991; Hanley 1991; Jordan et al., 1993; Lindhjem, 1998; Miliadou 1998; Mitchell and Carson, 1984; Ozdemiroglu et al., 2004; Poe and Bishop, 1992; Whitehead and Groothuis, 1992, Koundouri, 2010, 2007.

environmental cost in the RBD). An ideal approach to calculate the environmental cost would involve original valuation studies to be carried out in each water body of each river basin district addressing the particular environmental problem in the area to allow for accurate welfare loss estimations. These valuation studies could either follow the states preference paradigm or implement revealed methods to derive the social value of water quality. However such an approach would require large financial resources and a more extended time horizon. Nevertheless, the benefit transfer approach presented above is widely accepted for providing, if properly adjusted, reliable costs and benefits estimates. The results of the environmental cost calculations are reported in the Table 7 below.

Table 7: Environmental Cost per RBD

River Basin District	Environmental Cost (€)
1. West Peloponnesos	0
2. North Peloponnesos	0
3. East Peloponnesos	0
4. West Sterea Ellada	0
5. Epirus	0
6. Attica	0
7. East Sterea Ellada	7 037 232
8. Thessaly	9 137 486
9. West Macedonia	14 535 598
10. Central Mecedonia	16 586 149
11. East Macedonia	5 025 462
12. Thrace	9 842 713
13. Crete	0
14. Aegean Islands	0

As expected the largest environmental cost is in northern Greece and specifically in Macedonia. Water quality in these regions is under severe stress since they concentrate the bulk of the remaining industrial activity in the country. On the other hand, island regions and the Peloponnese that have not developed industrial sectors have smaller environmental costs.

6.3 Resource cost

The resource cost is a cost associated with current or future scarcity arising due to overexploitation of water resources beyond their rate of replenishment implying that resource cost is present when water demand for all uses is not covered adequately and is zero otherwise. The resource cost was calculated for the water districts of Aegean Islands, East Sterea Ellada, Thessaly and East Peloponnesos, where water demand surpasses supply as indicated by their water balance. In the literature (Koundouri 2004) resource cost is approximated by the cost of backstop technology to cover excess demand. Desalination plants are set up in many Aegean islands and thus the price of this backstop technology was used for the resource cost approximation in the relevant water district. The exploitation of other non-conventional water sources such as recycled water was the backstop technology relevant for the water districts of East Peloponnesos and East Sterea Ellada, whereas the diversion of the river Acheloos is meant cover excessive water demand in the water district of Thessaly. Resource cost was thus the product of the excess demand times the backstop technology cost per cubic meter of water which is €1.5m^3 for the desalination (WDD, 2005), €0.5/m^3 for the recycled water (WDD, 2005) and €0.818m^3 for the Acheloos diversion (personal communication MoEPPW). Water shortages are attributed to the agricultural sector because (a) agriculture uses 80% of the available water resources (b) agriculture has been identified as the most inefficient water using sector and (c) there exist a policy priority to cover water needs of the residential sector, which constitutes 17% of total water consumption. Accordingly, no resource cost was attributed to domestic water use. Table 8 reports the resource cost in each RBD.

Table 8: Resource Cost per RBD

River Basin District	**Resource Cost (€)**

1. West Peloponnesos	0
2. North Peloponnesos	0
3. East Peloponnesos	3 510 184
4. West Sterea Ellada	0
5. Epirus	0
6. Attica	0
7. East Sterea Ellada	20 515 680
8. Thessaly	89 356 467
9. West Macedonia	0
10. Central Mecedonia	0
11. East Macedonia	0
12. Thrace	0
13. Crete	0
14. Aegean Islands	26 792 100

The largest resource cost is in Thessaly. This is the primary agricultural region of Greece that faces threats on water availability. Further resource cost is also high in the Aegean Islands which experience severe water shortages due to limited rainfall especially during the summer months.

7. Assessment of cost –recovery level

7.1 Recovery from charges to users

Once the total cost of water services is determined and the revenues of water companies are calculated an assessment of the cost- recovery level is possible. Hence we now turn to the calculation of the current level of cost recovery, based on the present pricing structure in each of the considered economic sectors. As far as the domestic sector is concerned, the water companies cost recovery derives from both potable water pricing and sewerage connection and wastewater treatment pricing. The later, is calculated as a surcharge of 80% to the value of water consumption, with small fluctuations from region to region. Revenues from water consumption were calculated by multiplying the consumed cubic meters of water with the mean water price in each RBD whereas the sewerage expenses were inferred given the number of households in each RBD and the relevant fees set by the water companies. With respect to irrigation companies, cost recovery was calculated by multiplying the irrigation needs with the mean irrigation water price per RBD.

7.2 Estimating the Cost- Recovery Level

When both the total economic cost and the revenues from charges to users were identified for each use in every RBD the cost recovery level was calculated as:

$$Cost\ Recovery\ Level = \frac{Recovery}{Total\ Economic\ Cost}$$

The mean cost recovery level per RBD in Greece was found 59.18%. In general, the revenues of water and sewerage services providers are not even sufficient for financial cost recovery. It is worth noting that the recovery level in agriculture is even lower compared to domestic water use, stressing the need for policy measures to address sustainable and efficient water resources management in this sector. The problem is particularly prominent in the district of Aegean Islands where irrigation cost recovery level is 1.78%. The results of the economic analysis regarding the cost recovery level are summarized in Table 9.

Table 9: Cost Recovery Level in each RBD

	Cost Recovery Level (%)		
River Basin District	**Domestic**	**Irrigation**	**Total**
1. West Peloponnesos	62.21	11.44	50.54
2. North Peloponnesos	77.31	19.41	68.22
3. East Peloponnesos	37.89	15.66	34.18
4. West Sterea Ellada	61.29	14.28	46.19
5. Epirus	71	22.44	68.11
6. Attica	108.14	21.30	106.13
7. East Sterea Ellada	75.1	15.98	57.61
8. Thessaly	33.66	6.38	29.82
9. West Macedonia	53.55	41.05	51.71
10. Central Mecedonia	86.58	12.04	78.27
11. East Macedonia	79.39	27.38	70.74

12. Thrace	103.29	11.05	78.28
13. Crete	49.67	56.25	50.91
14. Aegean Islands	42.94	1.78	37.84

The above estimates should be regarded as broad estimates of the true recovery level, the calculation of which would be expensive and extremely difficult to conduct in the short term. The second best approach pursued based on benefit transfers and reasonable assumptions, however allows for valuable conclusions to be reached regarding the limitations of the pricing policies which fail to reflect the true value of the resource and efficiently allocate it to competing demands. Given that most Member States according to the commission (COM (2007) 128 final) provided incomplete reports for the economic analysis regarding the recovery level, the methodology followed in this study can assist future attempts to fully comply with the EU reporting requirements. Besides, only five Member States having supplied information on cost recovery have taken into consideration in the analysis environmental and resource costs (see Figure 3). In this respect, the Greek case study can provide useful guidance.

Because of the lack of information, it is also not possible to give an average on the percentage of cost recovery across the EU. When available, cost-recovery levels vary significantly (WWF, 2006). Member States that have provided information on households have indicated a cost recovery rate of services for households between 70 and 100%. For industry, the Member States providing information reported a cost recovery rate between 40 and 100%. For agriculture the cost recovery rate is reported to vary between 1 and 100%.

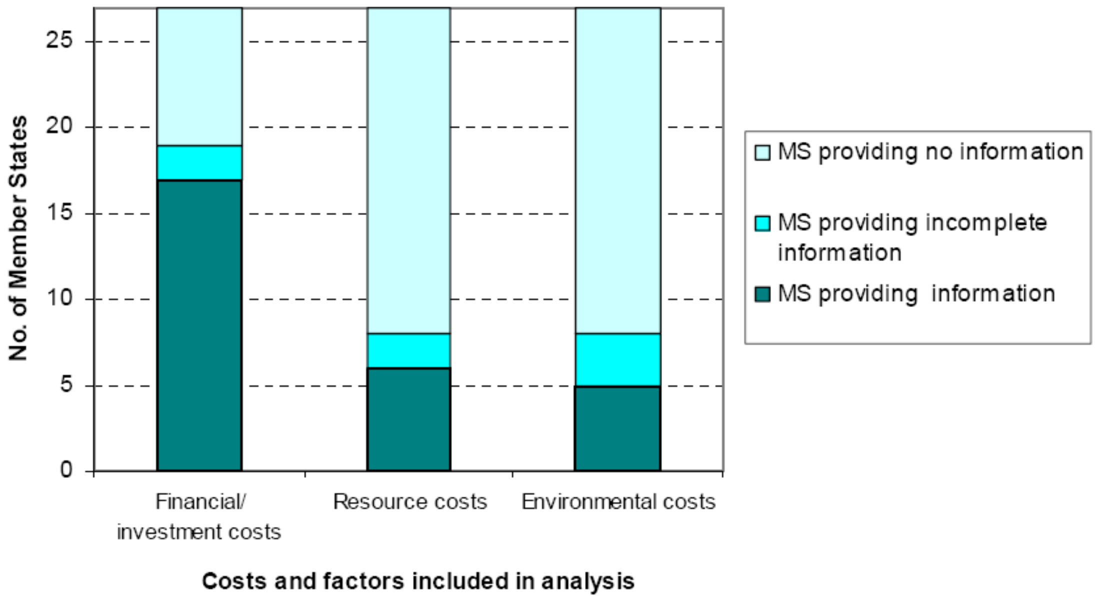


Figure 3: Member States providing information on costs of water services

Source: (COM (2007) 128 final)

8. Discussion and conclusions

The WFD was formulated to address the weaknesses of previous water-related directives by adopting an integrated water management approach. Given the increasing pressures on the quality and quantity of water resources, the EU has established an effective legislative instrument in the form of the WFD. The innovation of the WFD is that, for the first time a directive proposes economic principles and measures as basic instruments for the achievement of specific environmental objectives. According to Kallis and Butler (2001) the main strengths of the Directive apart from the broader and integrated ecosystem approach is that it introduces changes with respect to institutions, planning and information processes, and the 'user-pays' approach, but importantly sets a concrete standard of no further deterioration for any water. However, the economic analyses of most Member States are incomplete and this is one of the major shortcomings in the WFD implementation so far. This concerns in particular the calculation of water services cost recovery accounting for environmental and resource costs (COM (2007) 128 final).

At the same time, serious concerns about the success of the Directive have been expressed. For example, the WFD requires that charges for water services should adopt the principle of full cost recovery in accordance with the polluter pays principle in order to provide incentives for water use efficiency. However, it is expected to be quite challenging in a number of MS that water in the domestic and agricultural sectors is subsidised (Spain, Greece, and Portugal) or water pricing is completely absent (Ireland). In the latter case, the political cost of asking households to pay for environmental improvements when sources of diffuse pollution are not fully checked is expected to be high. Furthermore, pricing mechanisms imply ‘benefit pricing’ based on willingness to pay and there is a fear of discriminatory practices from the side of profit seeking suppliers (Morris, 2004).

Regarding assessment of “disproportionality”, it has been argued that whether or not costs are considered disproportionate is highly arbitrary and subjective (European Communities, 2002; Brouwer, 2008) as it remains to be answered (i) what is an acceptable cost level in relation to the expected environmental benefits for example, being a maximum of two, three or four times the expected (monetary) benefits; and (ii) what is the acceptability of this decision to those who bear the financial burden (Brouwer, 2008). It has been also noted that it is highly questionable whether policy makers and society as a whole are willing to pay the relevant investment sums without any further justification as to their socio-economic benefits (Brouwer, 2008), while Brouwer and Pearce (2005) argue that European legislation such as the WFD introduces ‘asymmetric property rights’ assigning higher weights to environmental benefits compared to the social costs involved.

Kallis and Butler (2001) express a fear that ambiguity of terms especially related to derogations coupled with the high costs involved and the lack of a clear-cut legal mandate to achieve the status objectives may undermine the effectiveness of the policy as unwilling MS may exploit legislative loopholes to avoid implementation. Finally, Carter and Howe (2006) argue that the WFD is an ambitious piece of legislation and its key objective to achieve good water status in most of Europe’s waters is not expected to be achieved in the short term (by 2015).

In this chapter we present a rapid-appraisal approach we followed in Greece for the estimation of the cost-recovery level in its 14 RBDs including the RBD of Asopos (East Sterea Ellada). The approach seeks to provide guidance and assist policymakers and researchers in other RBD to proceed with the assessment of the cost-recovery level. Results reveal that the recovery level in Greece is extremely low in all water sectors. In the majority of cases not even the financial cost of water companies in both domestic and irrigation water sectors is covered. Environmental and resource costs associated with water uses are not taken into consideration in the determination of the pricing policies resulting in very low pricing of water for households and industry and almost free of charge water provision in agriculture, particularly in the presence of many illegal boreholes, as is apparent from the very low recovery level.

Authors, however, acknowledge the limitations of this study. A comprehensive and complete analysis of all pressures and impacts and a detailed assessment of the cost recovery in each river basin as required by the Directive were not possible in this study due to the severe lack of data and very limited time frame. Scale and time inconsistencies of the available data have also been identified and approximations were thus used. Detailed and site specific data were rare and consequently results and policy recommendations should be considered conditional on these limitations. However, results under this 'quick appraisal' clearly highlight the need for reforms in the current pricing policy to adequately address full cost recovery of water services according to the polluter pays principle as required by the WFD. To address this challenge, reforms in the institutional framework covering water resources management are also clearly needed. Overlapping responsibilities between competent authorities pose a serious constraint in efficient and sustainable water resources management. All these considerations should be taken into account in the preparation of the package of measures to reach good water status and ensure full recovery of the cost of water services as required under Article 11 of the WFD.

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