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Justifying exemptions through policy appraisal: ecological ambitions and water policy in France and the United Kingdom

For Water Policy

Abstract

The Water Framework Directive aims to achieve 'good status' for all water bodies in the European Union. However, exemption clauses enable member states to delay protective measures and to lower water quality objectives. The ambiguity of exemption clauses has lead to a plurality of approaches across the continent. They differ as to their political objectives, i.e. the overall ambition displayed in implementing the Directive, and to their methodological choices, i.e. the analytical tools used to justify exemptions. This article argues that those political and methodological dimensions influence each other. Relying on a framework of analysis that integrates key recommendations from the literature, we explore the usage and justification of exemptions in two countries, the United Kingdom and France. Our analysis suggests that analytical methods were often decided so as to reflect the ecological ambitions of a country, and some methodological choices seem to have had unintended consequences for water quality objectives. We conclude that economic methods should be adapted so that they take into account, rather than ignore, the political ambitions of a country in the field of water.

Keywords: Water Framework Directive, exemptions, disproportionate costs, cost-benefit analysis, affordability

1. Introduction

The Water Framework Directive (WFD, 2000/60/EC) represents a major shift in EU water policy from isolated attempts to reduce pollution from various *specific* sources

and clearly *defined* types of water usage towards a more *holistic* approach. The Directive recommends or makes compulsory water management principles such as river basin management, public participation and economic analysis, with a view to preventing any further deterioration and achieving 'good status' for all surface and groundwater bodies.

Specifically, the WFD obliges EU member states to draft River Basin Management Plans (RBMP), which specify water quality objectives for individual water bodies and justify exemptions. Programmes of Measures, published at the same time, identify the actions required to achieve these objectives. Water authorities operate within six-year management cycles; this includes the initial drafting, update and implementation of RBMPs and Programmes of Measures. The first cycle started in 2009 when the first RBMPs were published. The second cycle began in 2015 with the update of the plans. The third cycle will last from 2021 to 2027.

However, exemption clauses enable EU member states to delay protective measures for up to twelve years (Art 4.4 WFD) or to lower water quality objectives for individual water bodies, i.e. to reach "less stringent objectives" (Art 4.5 WFD). Member states may resort to these exemptions under three circumstances: if natural conditions are unfavourable, if the achievement of good status is technically infeasible, or if the associated costs are disproportionately high. They may also deteriorate water body quality to pursue projects of major general interest (Art 4.7 WFD).

This article focuses on exemptions related to deadline extensions and less stringent objectives based on disproportionate costs only. Exemption clauses were widely used across Europe: for instance, up until 2009, deadline extensions were granted for 40% of all surface water bodies and for 11% of all groundwater bodies (European Commission, 2012b). Obviously, the use of exemptions has a major impact on the degree to which the overall aim of the WFD will be achieved. At the time of writing, more than 15 years after the WFD entered into force, many EU countries are still a far cry away from achieving good water status. Back in 2012 the European Commission (2012b) had estimated that only 53% of all water bodies would reach a good status by 2015. More up-to-date data is not yet available, but we have little reason to assume that these estimates were wrong. There are many reasons for that, including technical (e.g. lack of knowledge), political

(e.g. lack of incentive pricing) and economic difficulties (e.g. financial restraints) (European Commission, 2012a; Stanley *et al.*, 2012; Levraut, 2013; Stanley *et al.*, 2012). Yet, exemptions certainly play a role here.

The term 'disproportionate costs' is somewhat ambiguous and the process of justifying exemptions not very well defined (Görlach & Pielen, 2007). This can be traced back to political disagreements during the negotiation phase of the Directive, almost 20 years ago. Even today, the legal status of the overall aim of 'good status', the extent to which exemptions should be relied on, and the economic tools used to justify disproportionality are still in dispute (Boeuf *et al.*, 2016). This has resulted in a plurality of approaches: on the one hand, member states differ greatly as to the overall ambition displayed in WFD implementation, i.e. the degree to which they would make use of exemption clauses (Bourblanc *et al.*, 2013). In other words, we observe diversity as to the *political* aspects of WFD implementation. On the other hand, EU member states rely on very different analytical tools to justify the presence of 'disproportionate costs', one of the conditions for an exemption clause (van der Veeren, 2010; Gómez-Limón & Martin-Ortega, 2013; Dehnhardt, 2014; Martin-Ortega *et al.*, 2014; Feuillette *et al.*, 2016). This suggests a high degree of diversity with regards to the *methodological* aspects of WFD implementation.

This article argues that *political* and *methodological* aspects are interrelated and cannot be separated from each other. Political ambitions may influence which analytical tools are used - and how; and tools, far from being purely technical and neutral, may have intended and unintended consequences for the political ambitions on the ground (Lascoumes & Le Gales, 2007). We will show that the ambitions of EU member states related to WFD implementation have shaped the analytical tools used and that these choices have influenced the protection standards of individual water bodies. Based on original data and extensive fieldwork in two EU member states, the United Kingdom (UK) and France, this article explores a widely understudied phenomenon: the politics of exemptions in WFD implementation and the role of 'disproportionate costs' therein.

This way we introduce a novel argument to the literature on WFD implementation. So far, in-depth studies on the actual use and justification of exemptions and their

relationship to the political ambitions displayed by a country remain scarce (Boeuf & Fritsch, 2016). Existing research tends to provide broad overviews across Europe (e.g. Görlach & Pielen, 2007; Klauer *et al.*, 2007; Martin-Ortega *et al.*, 2014; Maia, 2017). Some of them are already outdated. WFD management activities are organised in six-year cycles, and works such as Gómez-Limón and Martin-Ortega (2013) explored the first management cycle from 2009 to 2015 only (and even here mainly the first two or three years). We know little about the second cycle and how water managers took into account feedback from the first management cycle. In fact, we are not aware of any study that has already looked into the second WFD cycle (i.e. 2015 to 2021). Other works offer recommendations based on academic experiments (e.g. Del Saz-Salazar *et al.*, 2009; Vinten *et al.*, 2012; Galioto *et al.*, 2013; Perni & Martínez-Paz, 2013; Martin-Ortega *et al.*, 2015; Klauer *et al.*, 2016; Machac & Slavikova, 2016; Klauer *et al.*, 2017). Obviously, these works may provide great benefits to practitioners and researchers, but they say little about what is happening on the ground.

2. Analytical framework

The WFD does not properly define what 'disproportionate costs' are and how disproportionality should be established. Two methods - and thus two interpretations of this term - emerged from discussions at EU level. The costs of protective measures could be compared to the benefits provided to society through the improvement in water quality: disproportionality as a result of a cost-benefit analysis (CBA). Alternatively, costs could be compared to the ability of stakeholders to pay for protective measures: disproportionality as the inability of various sectors or polluters to afford the measures (Boeuf *et al.*, 2016).

There is a rich academic literature making recommendations on how to undertake disproportionality analyses (Brouwer, 2008; Del Saz-Salazar et al., 2009; Martin-Ortega, 2012; Galioto et al., 2013; Gómez-Limón & Martin-Ortega, 2013; Martin-Ortega *et al.*, 2014; Feuillette *et al.*, 2016; Klauer *et al.*, 2016; Klauer *et al.*, 2017). While these studies differ in important ways, they have one thing in common: they acknowledge that CBA and affordability tests are multi-dimensional. Essentially, the comparison of benefits and

costs lies at the heart of every CBA, and so does the juxtaposition of costs and available resources in affordability tests. In order to carry out those tests, however, environmental economists are required to consider a range of decisions which govern how precisely the method shall be put into practice (Pearce *et al.*, 2006; Davidson, 2014). Our argument is that these decisions not only define the operationalisation of the method, but may also influence analytical outcomes. The contents of these decisions form what we call here the 'dimensions' of CBA and affordability tests.

We select five dimensions from the literature: scale, screening, costs and benefits data, uncertainty, and additional parameters. They were selected for three reasons: First, they are comprehensive, i.e. taken together, they cover all the technical aspects related to CBA, to affordability tests, or to both. Second, they may be applied globally and enable cross-country comparisons. Third, they all depend on the degree of ambition displayed by an EU member state for implementing the WFD, and their precise operationalisation may influence the process of setting objectives.

The overall function of these dimensions in this research therefore is to *unpack* two complex analytical tools – CBA and affordability tests – and to provide the signposts needed to understand the application of these tools in diverse empirical settings. The above dimensions have no normative meaning here, i.e. we use them to anatomise, dissect and examine rather than to assess and evaluate. In doing so, these dimensions provide a structure for our case study analysis and lay the foundation for the argument that we wish to make: First, we compare the choices that water managers in England and France have made with regards to each dimension. Second, we explore the relationship between these choices and the political ambition displayed by each country. We describe these five dimensions below.

Scale

Both CBA and affordability tests are performed on a specific geographical perimeter. In the case of WFD implementation, at least four hydrographical units could be considered: the water body, the catchment or sub-catchment, the river basin, or the national scale.

Screening

CBA and affordability tests could be performed systematically and consistently for each hydrographical unit. Alternatively, one may attempt to limit the number of units analysed or to reduce the depth of the analyses. Preliminary screenings support a decision here and, in doing so, save resources. For example, water managers may want to identify hydrographical units where implementation costs are likely to be disproportionately high.

Costs and benefits data

Data are a necessary input to both CBA and affordability tests. Here, we focus on costs and benefits data. They may be assessed qualitatively, quantitatively (but not monetised) or monetarily. Costs include investment, operating, administrative and environmental costs as well as income reductions. Benefits involve market and non-market benefits and typically inform CBA only. Finally, we examine whether benefit transfers were used. Benefit transfers apply benefit values estimated from a particular location to another location with similar characteristics. This method is often used when local data are unavailable, but it comes with obvious methodological weaknesses (Klauer *et al.*, 2016).

Uncertainty

Uncertainty is a common feature of environmental policy making processes. In WFD water management, this may refer to the status of water bodies (and therefore to the nature and costs of measures that should be implemented), the effectiveness and efficiency of measures, input data, the monetisation of benefits and costs, and methodological limitations related to the use of benefit transfers. Here, we consider whether and how these uncertainties have been taken into account when assessing disproportionality.

Additional parameters

We consider here various methodological decisions to operationalise CBA and affordability tests. For CBA, this includes the cost-benefit ratio, i.e. the threshold distinguishing proportionally and disproportionally high costs. Economic theory suggests that the cost-benefit ratio should be one. We also consider the rate used to discount future benefits and costs. Discount rates respond, amongst others, to the insight that many people prefer short-term over long-term gains and long-term over short-term costs. A high discount rate gives more weight to current expenses while a low discount rate favours long-term benefits. Therefore, the discount rate has an ethical dimension because it determines the extent to which the interests of future generations are taken into account (Martin-Ortega *et al.*, 2014; Martin-Ortega *et al.*, 2015). We also study which categories of users, criteria and thresholds were used in affordability tests.

3. Data and methods

This article compares the UK (specifically England) and France, two countries that have relied extensively on disproportionate costs to justify exemptions (Levraut, 2013; Environment Agency, 2015).

In England, economic analyses were performed consistently across the country, up until 2015 at national and after 2015 at catchment level. We therefore explore the national level, one representative river basin and one equally representative catchment: the Humber basin and the Aire and Calder catchment, respectively.

Economic analyses in France, on the other hand, differed significantly from one river basin to another. Consequently, this research focuses on the national and the river basin level whereby all river basins in mainland France and Corsica were investigated, namely Adour-Garonne, Corsica, Loire-Brittany, Meuse, Rhine, Rhone and Coastal Mediterranean, Sambre, Scheldt, and Seine-Normandy. We do not take into account the French overseas territories.

This research examines the first and the second WFD management cycle, i.e. economic analyses carried out to support the 2009 and 2015 RBMPs. To this end, we analysed 77

policy documents drafted between 2003 and 2016 by policy makers at the local, regional and national level in the UK and France as well as at EU level. Furthermore, we conducted, transcribed and analysed 32 semi-structured interviews with state and non-state actors directly involved in the implementation of the WFD in these two countries. Sections A and B in our Supplementary Materials provide a complete list of interviewees and policy documents.

4. Political ambitions and objective setting in England and France

This section discusses the general ambition displayed by England and France during the implementation of the WFD. RBMPs and Programmes of Measures are 'ambitious' when they set objectives that are significantly higher than the initial situation – and 'cautious' when this is not the case. We use the terms 'ambitious' and 'cautious' neutrally, with no positive or negative connotations.

England

In each constituent part of the UK – England, Northern Ireland, Scotland, and Wales – a designated non-departmental public body manages the water environment and, therefore, produces RBMPs and performs economic analyses. In England this is the Environment Agency (EA), which carried out this task from six regional offices until 2014 and, since then, from 14 area offices. The Department for Environment, Food and Rural Affairs (Defra) is legally responsible for the timely and correct implementation of the WFD. Defra's Secretary of State approves the final RBMPs, including the WFD water quality objectives (INT-EN01). This suggests that the preparation of RBMPs in England is very much centralised.

Water managers in England take a cautious and pragmatic approach to WFD implementation. In the first management cycle, 26% of all surface water bodies were monitored to have a good or high ecological status or potential. The aim was to reach good ecological status in 30% of all water bodies by 2015. In the second cycle, however, the EA aimed to increase the proportion of surface water bodies with a good ecological

status from 17% monitored in 2015 to 21% in 2021, and to reach a less stringent objective for ecological status in 25% of all cases (Environment Agency, 2015). This could suggest that water quality deteriorated between 2009 and 2015. However, the changed figures are mainly due to a re-designation of water bodies, resulting in a decrease in the overall number of water bodies, and to more comprehensive monitoring data from further investigations. Moreover, if water managers were uncertain whether necessary measures could really be implemented, they resorted more systematically to exemptions in the second cycle, specifically deadline extensions (INT-EN01).

This suggests that water managers in England interpret the WFD as an obligation to *aim* to achieve good status (except for exemptions), i.e. a "best effort approach" (Bourblanc *et al.*, 2013: p. 1457). In other words, the English approach to the WFD aims to avoid over-implementing the Directive – also known as gold plating (Jans *et al.*, 2009). This stands in contrast to the politically motivated ambition to implement the WFD beyond minimum requirements in France, as we will explain later.

According to Bourblanc *et al.* (2013: p. 1465), "the more politicians and policy makers feel they are held accountable by EU institutions, the more the level of ambition will be adjusted to the perceived adequate implementation process in front of the EU". Water managers in England see the implementation of the Programmes of Measures, rather than the achievement of good water status, as a legally binding requirement. They therefore prefer to adopt Programmes of Measures that are likely to be implemented even if – or better, exactly because – they display a certain lack of ambition (Dieperink *et al.*, 2012; INT-EN04).

The degree of caution expressed here is well compatible with the reluctant position that the UK has generally taken towards European integration and the level of scepticism shown as to the benefits the EU can provide to member states. The UK government has always sought to avoid 'gold-plating' during the transposition and implementation of EU law and, to this end, encouraged ministries, departments and independent regulatory agencies to apply EU standards to the minimum so as to minimise costs and efforts where they are not justified in terms of benefits (Fritsch, 2011; Knill, 2001; Wurzel, 2002; UK Government, 2015).

France

Water management in France is decentralised, which is why the river basin level deserves particular attention. In each basin, a River Basin Committee brings together elected policy makers at the local level (40% of all seats), water users (industry and commerce, agriculture, recreation, environmental movements, water consumers, 40%) and non-elected officials from local authorities (20%). Supported by one of the six water agencies - public bodies operating at regional level under the responsibility of the Ministry of Environment - each Committee defines the water management priorities in their basin, establishes the overall aim (i.e. the percentage of water bodies that should reach good status by the next deadline) and recommends the budget available to implement the Programme of Measures (INT-FR07, INT-FR10, INT-FR18, INT-FR23, INT-FR25, INT-FR27). The water agencies determine the water quality objectives for individual water bodies. The River Basin Coordinating Prefect, a state representative at the regional level, then approves the RBMP (Levraut, 2013). The Ministry of Environment coordinates this work, being legally responsible for the implementation of the WFD (Levraut, 2013).

In contrast to water managers in England, authorities in France generally set ambitious water quality goals which were more difficult to achieve (Levraut, 2013). The *Grenelle de l'environnement*, a political convention that included members of civil society and took place in 2007, decided that two thirds (in practice 64%) of all surface water bodies should be in good ecological status by 2015. This effectively translates into a legally-binding commitment to restrict the use of exemptions to one third of all surface water bodies or less – an ambitious, symbolic target that had a major influence on the planning process at river basin level (INT-FR12). In 2009, 41% of all surface water bodies were already in good ecological status (Levraut, 2013). France aimed to increase this figure by another 23%. In 2015, only 44% of all surface water bodies were in good ecological status, and the new aim was to improve this figure to 66% by 2021 (INT-FR17). However, figures of water bodies in good status are not quite comparable between the first and second cycles. This is because the guidelines to assess the status of water bodies have changed in between. Both in the first and the second cycle, water managers

preferred deadline extensions over less stringent objectives to justify exemptions (INT-FR17).

Bourblanc *et al.* (2013: p. 1449) offer several reasons for the different approaches taken in England and France. The "visibility of the policy process" (ibid.), not the least thanks to the highly political, public role played by the *Grenelle de l'environnement,* is of particular importance when it comes to understanding the high ambitions pursued in France. Another factor is "the division of responsibilities" (ibid.). Although the River Basin Committees, supported by the water agencies, set the objectives, the Committees are not responsible for their achievement and funding. Usually, local authorities are in charge of implementing the measures. River Basin Committees therefore do not necessarily feel accountable for the objectives they set. The authors also argue that accountability towards the European Commission matters. In contrast to the UK, pro-European sentiments are a defining element of France's international identity, and the country is genuinely committed to achieve policy goals set at EU level. It should be noted, though, that its performance has always been somewhat less impressive in the field of environment. The European Commission repeatedly initiated infringement procedures against France, and it is plausible to assume that the high ambitions pursued by France in the water sector were and are an attempt to improve its reputation (Bourblanc *et al.*, 2013).

In short, the UK and French approaches to the WFD stem from two different policy and administrative stances. We will now show how the economic analyses performed to justify exemptions reflect these differences.

5. Operationalising disproportionality analyses

In our two case studies, the logic behind exemptions and their justification differed substantially. We also observe evolution over time, i.e. between the two management cycles.

In England, water managers primarily referred to the uncertain status of water bodies to justify exemptions in the first cycle (Environment Agency, 2009). Uncertainty comes with the risk that costs would outweigh benefits and that public investments be misspent for unnecessary or ineffective measures. Water managers thus favoured deadline extensions to collect more data on the status of water bodies and spread the costs of measures over time (Defra, 2009). In the first cycle, economic analyses therefore played a minor role only in exemption-related decisions. The European Commission and environmental movements criticised this extensive reliance on uncertainty as a basis for exemptions (INT-EN10; INT-EN18). Defra responded by publishing a statement of position which, amongst others, committed to enhance their water quality data so as to avoid legal action from the WWF and the Angling Trust (INT-EN10; INT-EN15; INT-EN18). In the second management cycle, economic analyses played a more prominent role. The EA trained their area staff to perform CBA on each catchment and used these analyses to define the level of ambition (good status or less stringent). When funding was not readily available for necessary measures, Defra would apply for a deadline extension (INT-EN01).

In France, River Basin Committees were constrained in so far as they were obliged to pursue the national target set by the *Grenelle de l'Environnement*, according to which two thirds of all surface water bodies were to be in good ecological status by 2015 (INT-FR12). Economic analyses therefore were not only designed to identify and justify cases of exemptions, but also to limit their number. However, we observe a considerable degree of variation across river basins as to the methods used to justify the use of exemptions. Analysts performed over 700 CBA in total (Feuillette *et al.*, 2016). Water managers largely preferred deadline extensions over less stringent objectives in order to stick to higher ambitions. At the end of the first cycle, the European Commission criticised France for the lack of available justification for exemptions (Levraut, 2013). In the second management cycle, the Ministry attempted to harmonise methods across river basins and requested to make economic analyses publicly available (INT-FR17). However, not all water agencies complied.

We now apply our framework of analysis to each country. We offer a summary of our findings in Table 1 below and provide additional information in Section C in our Supplementary Materials.

Scale

Water managers in England and France operated at different scales to perform economic analyses and set water quality objectives. In the first management cycle, analysts in England mainly performed economic appraisals at the national or river basin scale as part of an impact assessment of the RBMPs (INT-EN01). In the second cycle, EA staff performed CBA at sub-catchment scale (the number of water bodies within these sub-catchments varied), close to each other or with similar activities impacting them (INT-EN05). In France, the water agencies conducted CBA and affordability assessments at the water body, catchment (groups of around ten water bodies) or river basin scale (INT-FR02; INT-FR09; INT-FR14; INT-FR22; INT-FR23; INT-FR27). While the EA tried to optimise the scale used for the analysis in the second cycle in order to balance the level of detail with the number of analyses, authorities in France were less concerned about this aspect.

However, scale matters. On the one hand, authorities operating at larger scales reduce the number of analyses and therefore save time and resources. Moreover, analyses at larger scales reduce the risks of double counting costs and benefits that apply to several water bodies (INT-EN05). To illustrate, let us consider a factory that is located at a particular water body and that pollutes another water body as well. Reducing the pollution load, for example by building a treatment plant, will incur costs for the factory. These costs would be considered for the water body where the factory is located. However, the benefits accrue to both water bodies. The overall analysis would be faulty if the analyst took into account these costs in CBA for both water bodies: this would be double counting. On the other hand, analyses at smaller scales may consider more robust local data. The catchment scale thus seems to be ideal if one wants to increase the robustness of the analysis and avoid an overestimation of costs or benefits. At the same time, this practical problem raises legal questions: Art. 4.4 and Art. 4.5 WFD require decision-making and reporting at the water body scale. However, there is disagreement

as to whether the underlying analysis must be performed at the water body scale as well. So far, this ambiguity has not yet been resolved legally.

Screening procedure

In order to assess whether measures to improve the quality of each water body would incur disproportionate costs, economists have the choice between detailed disproportionality analyses on each hydrological unit or screening procedures. The latter enable analysts to sort and group cases, but also to select the water bodies on which a detailed assessment should be undertaken. Due to time and resource constraints, both countries used screening procedures; however, their screening processes differed substantially.

In England, in the first cycle, water managers used decision trees to sort cases and decide upon exemptions and their justification: unfavourable natural conditions, technical infeasibility, or disproportionate costs (see Figure 1 below). Analyses related to disproportionate costs were usually performed at national level, i.e. showed little context sensitivity, and were generally not very detailed (Defra & Environment Agency, 2009).

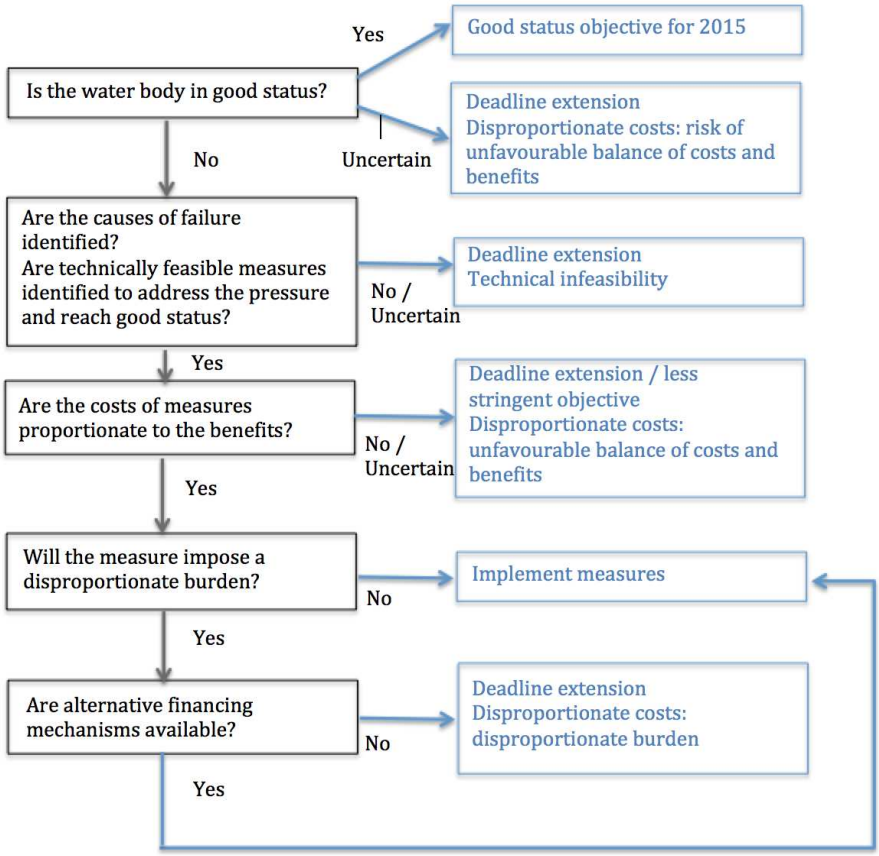

Figure 1: Summary of the main steps used by the EA in its decision trees to decide on exemptions in the first management cycle, Source: authors.

In the second management cycle, area EA offices applied a step-wise procedure or 'triage approach' so as to perform in-depth analyses only if they were absolutely necessary and the expected impacts high (Environment Agency, 2014b: p. 8). In a first step, analysts would identify and describe the potential impacts of different bundles of measures; no monetisation was envisaged at this stage. They estimated the expected (dis)benefits using a scale from 'significant' to 'noticeable' and 'no net change' and compared them to the 'do-nothing option'. The second step, a 'stage 1' valuation, took into account a range of monetised benefits and explored which bundles of measures were particularly cost-beneficial or not. If necessary, a 'stage 1+' valuation was performed. This analysis included a more comprehensive range of monetised benefits identified during the qualitative description. Finally, analysts could perform a 'stage 2' site-specific valuation if the previous results were inconclusive (Environment Agency, 2014b). This advanced appraisal method was rarely used in practice, since stage 1+ analyses were usually satisfactory (INT-EN01).

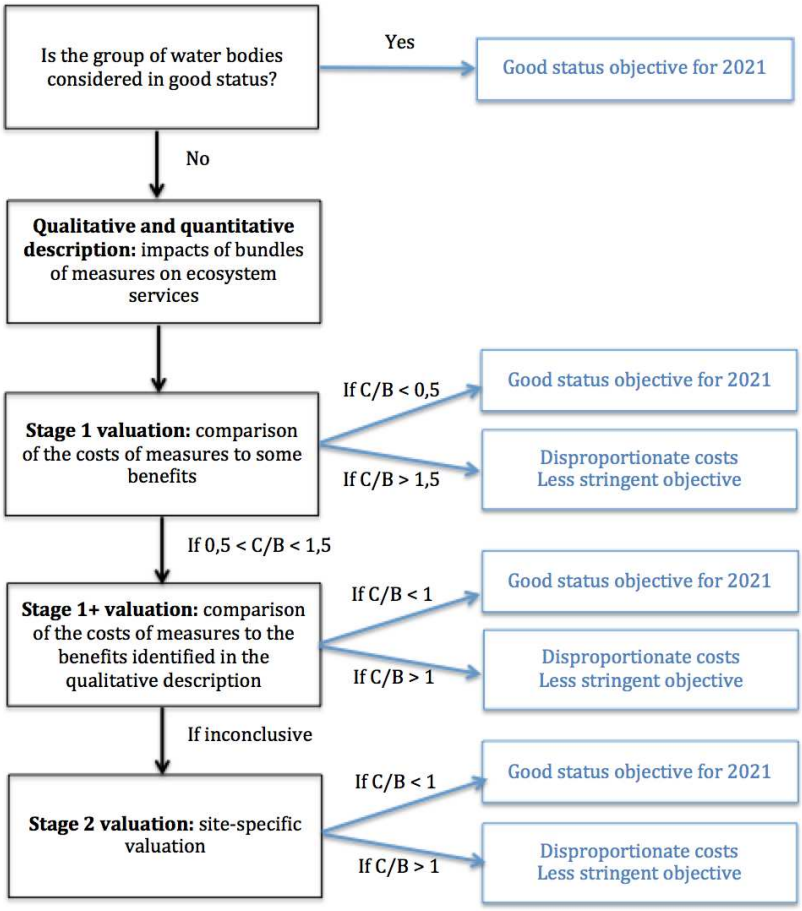

Figure 2: Main steps used by the EA to decide on exemptions in the second management cycle, Source: authors.

The water agencies in France used different screening criteria. This included stakeholder ability to pay, the costs of measures compared to past expenditures, particularly high costs incurred by a specific type of measure, and cost thresholds (INT-FR09; INT-FR23, INT-FR27). In the second management cycle, national guidance recommended CBA when measures were not a priority and where affordability tests produced negative results (Commissariat Général au Développement Durable, 2014).

Screening procedures may have a profound impact on management decisions. In England, the EA used a staged approach to determine the depth of the analysis. Analysts thus undertook a more or less comprehensive CBA for most water bodies. Because 'stage 1' valuations did not take into account the full range of benefits, this process could lead to the exemption of water bodies where protective measures would actually come with a positive cost-benefit ratio. In other words, the EA's staged procedure, relying on a

subset of potentially available data, resulted in a more cautious approach when it came to objectives and exemptions. That said, a preliminary study published by the EA (2013) concluded that the results of 'stage 1' valuations did not significantly differ from more in-depth assessments. Consequently, the relevance of this factor should not be overestimated.

In France, however, analysts used screening criteria to select water bodies on which to perform a CBA. This approach had the advantage of reducing the number of analyses to be performed. However, it also limited the potential number of exemptions. As such, it favoured a more ambitious interpretation of the WFD. For example, applying a cost threshold means that measures with low costs, but also potentially low benefits, were not eligible to an exemption. The diversity of screening criteria used in France also shows that they are more relevant if tailored to local characteristics. In the Rhone and Coastal Mediterranean basin a cost threshold was used due to the geography of the river basin. While protective measures were inexpensive in mountainous areas with low human pressures on water bodies, actions were costly in densely populated and industrialised cities (INT-FR27). Another example is Loire-Brittany where water pollution through agriculture is a major problem, which was therefore explicitly flagged up for an economic appraisal (INT-FR23).

Costs and benefits data

Costs and benefits data constitute a crucial input to economic analysis. They may differ as to their nature (qualitative, quantitative or monetary), their source, their quality and their scale. All these characteristics may influence water management decisions.

In the first management cycle, the EA extracted cost-related data from water company business plans (INT-EN03; INT-EN06), earlier impact assessments and in-house sources, for instance data collected through permits. However, analysts did not consider all costs (Defra, 2009). In the second cycle, the Agency tried to broaden the data available to the analyses (INT-EN03) based on in-house sources and used a database on agricultural activities and pollutants that would subsequently inform CBA (INT-EN08). Although EA staff was encouraged to use local costs (INT-EN05), analysts often relied on national

databases that did not always accurately reflect local realities (INT-EN21). With regards to benefits, the EA relied on the National Water Environment Benefits Survey (NWEBS), which elicited preference values from 1,487 people in 50 locations and valued aesthetic, biodiversity and recreational benefits of water status improvement. In the first management cycle, EA economists used these values to prepare national and regional impact assessments (Metcalfe, 2013). In the second cycle, EA staff integrated an updated version of these benefit values into the stage 1 valuation process (Environment Agency, 2014b). Furthermore, a qualitative assessment was made to better take into account non-monetised and non-market benefits. As a cogent example, the concept of ecosystem services, which informed valuations, was used to frame this plurality of benefits in assessments (INT-EN05; INT-EN09).

In France, economists calculated investment and maintenance costs based on databases developed by the water agencies, experts assessments, in-house and external studies and local data (INT-FR06; INT-FR09; INT-FR23). In the second management cycle, water agencies enhanced the quality and quantity of their data on costs, in particular through additional studies, e.g. on hydromorphological measures (INT-FR27; INT-FR25). When it comes to benefits, the Ministry prepared a systematic review of valuation studies so as to build a national database of non-market benefits (angling, kayaking, bathing, windsurfing, hiking, observing, boating) and non-use values (property values). Market benefits mainly refer to the costs saved on drinking water treatment and generally weighted for more than 50% of the total benefits (Feuillette *et al.*, 2016). Unfortunately, the Ministry only found about 40 studies and was unable to assess many categories of benefits. It then saved those benefit values that could be extracted from the academic literature, as incomplete as they were, in a Microsoft Excel tool designed to perform the CBA (Feuillette *et al.*, 2016; INT-FR13). Consequently, some benefit categories, in particular non-market benefits, were not systematically considered during the CBA although they constitute, in an ideal world, an important element of disproportionality analyses. In order to establish the benefits of protective measures in a specific water body, the analyst would then select the most relevant non-market benefit values and multiply the Ministry's default value by the number of water users. The Ministry suggested to use local data sources to establish the number of water users, for instance surveys on site visits. In practice, however, analysts relied on generic figures of the

population near a water body (Feuillette *et al.*, 2016). Some water agencies also prepared local studies to improve the data (INT-FR09; INT-FR23; INT-FR27). In the second management cycle, the Ministry updated its systematic review through the inclusion of new publications, although not numerous (Commissariat Général au Développement Durable, 2014).

The approach followed in England seems to have favoured more ambitious water quality objectives than the one pursued in France. This is because EA staff did not take into account all the costs related to the achievement of good water status while the parallel usage of NWEBS and additional qualitative analyses provided a comprehensive overview of all the benefits. Unsurprisingly, this approach increased the cost-benefit ratio. In France, in contrast, the database on benefits was patchy, and non-market benefits were rarely taken into account, favouring a less ambitious implementation of the WFD. This factor may partly explain why only 25% of all CBA had a negative cost-benefit ratio in England (Environment Agency, 2015), as compared to 75% in France. Obviously, this conflicted with the high ambitions associated with WFD implementation in France. Water economists therefore criticised the method used for the valuation of benefits and promoted a more qualitative approach (Feuillette *et al.*, 2016).

Using benefit transfers seems to be unavoidable if one faces a large number of water bodies. However, analysts in England appear to apply this method in a more accurate way than in France. This may explain why economists in the French water agencies criticised the use of benefit transfers. The basis on which authorities in France applied benefit values was particularly problematic. Analysts would use the number of residents near a water body, so that areas with a smaller population density were heavily penalised (Feuillette *et al.*, 2016). This approach favoured a less ambitious implementation of the WFD. We do not make similar observations in England where analyses were carried out at the catchment rather than the water body scale. This is because average population densities are generally more homogenous at larger hydrographic scales. Moreover, analysts at the local level included upper bound benefits values and looked at wider benefits for scarcely populated areas with a high non-use value. Finally, EA staff did not only consider upstream-downstream issues in their economic analyses, but also during the planning process (monitoring and determination

of the water status and subsequent measures) (INT-EN05). The use of benefit transfers was thus less problematic in England than in France.

Uncertainty

Both countries considered uncertainties during the whole planning process. This includes uncertainties related to the status of water bodies, to activities impacting the aquatic environment and to the efficiency of measures. However, England and France responded very differently to their presence, and these responses reflect the different ambitions of these countries associated with WFD implementation.

In the first cycle, the inability to accurately assess the current status of water bodies, the reasons for a degraded status and the necessary measures were a key reason for water managers in England to request exemptions based on disproportionate costs. Obviously, uncertainties related to the water status may result in uncertainties as to the nature, effectiveness and efficiency of measures taken to improve water bodies (Environment Agency, 2009). Accordingly, analysts were trying to avoid the possibility that the costs outweigh the benefits if inappropriate and inefficient measures were to be taken. In order to win time for additional research, regulators preferred deadline extensions to less stringent objectives (Defra, 2009). Although in the second management cycle uncertainty was less central to disproportionality analysis, EA staff continued to take into account uncertainties when they prepared the 2015 RBMPs. For example, they discounted benefit values based on their level of confidence in the data describing the water status (INT-EN08). Consequently, EA analysts took uncertainties into account to avoid misspending (Defra & Environment Agency, 2009), resulting in a cautious approach to setting water quality objectives.

In line with the French commitment to implement the WFD to a high standard, the overall approach was to avoid exemptions towards less stringent objectives unless the impossibility of reaching good status by 2027 had been proven (Ministère de L'Ecologie de l'Energie du Développement Durable et de la Mer, 2009). Consequently, a majority of exemptions requested were deadline extensions. Like in England, the idea was to gain time to increase the scientific knowledge base. Water agencies even pursued the

objective of good status for several water bodies characterised by high degrees of uncertainty (Levraut 2013; INT-FR10). Moreover, analysts used a cost-benefit ratio of 0.8 to account for the possibility that benefit values were underestimated, resulting in rather ambitious objectives in case of uncertainty (Ministère de L'Ecologie de l'Energie du Développement Durable et de la Mer, 2009).

Additional parameters

Several additional parameters were used in both countries to operationalise the CBA and the affordability tests. This includes the discount rate and the cost-benefit ratio in CBA and various indicators and thresholds in affordability tests.

In England, analysts used a discount rate of 3.5% for the first 30 years and 3% for any subsequent years, in accordance with guidance from the Treasury (HM Treasury, 2003). The cost-benefit ratio was primarily used in stage 1 valuations in screening procedures: if the cost-benefit ratio was between 0.5 and 1.5, economists would perform a stage 1+ valuation (Environment Agency, 2014b). In France, analysts used a cost-benefit ratio of 0.8 and a discount rate of 4% over 30 years in the first management cycle and of 2.5% in the second (Commissariat Général au Développement Durable, 2014).

The discount rate used in France in the first management cycle was thus higher than in England. This resulted in a higher number of exemptions in France, because it valued future benefits less. However, France changed the discount rate in the second cycle; in fact, it is lower than in England now. This change favoured more ambitious water quality objectives and is well in line with the ambitious take on WFD implementation in France. In England, the discount rate was medium, remained stable over time and therefore had a moderate impact only on the result of the analyses. In doing so, England followed the conventional approach, taken from welfare economics, of determining economic efficiency when the benefit-cost ratio is greater than 1, i.e. when discounted benefits outweigh discounted costs. In contrast, water managers in France chose a cost-benefit ratio below one, which favoured benefits over costs, i.e. more ambitious targets.

Regulators in England interpreted the inability to pay as a "disproportionate burden" (Defra & Environment Agency, 2009: p. 8). In the first management cycle, EA analysts used this argument to justify exemptions in two cases only. The first one concerns water bodies polluted by abandoned mines. Analysts decided to spread costs over time so that expenditures would match available public funding. The second case relates to water bodies awaiting the installation of fish passes. Deadline extensions then served to gain time with a view to identifying additional sources of funding in the public and private sector (Defra & Environment Agency, 2009).

Water managers relied much more extensively on disproportionate burdens in the second cycle. They set the 2021 objectives on the basis of Programmes of Measures that could be delivered with budgets and policies that were already in place. Measures with no reliable and credible funding were not presumed to be deliverable. The authorities did not consider other, insecure funding sources at this stage. This practice is at variance with previous agreements at EU level. So far, the European Commission has not commented on its lawfulness yet. For example, the financial amount that the water industry may spend on environmental protection measures is agreed together with Ofwat, the regulating body of the privatised water and sewerage industry, in so-called periodic reviews. These processes take place every five years and are disconnected from the WFD management cycle (INT-EN07; INT-EN16; INT-EN18). Consequently, it is difficult to anticipate how much the water industry will be able to spend on WFD measures in the future. Likewise, achieving good water status may require additional legislative activities, budgetary reallocations, funding applications to the Treasury, and decisions taken by other ministries and government departments, all having uncertain outcomes. While exemptions based on less stringent objectives relied on economic analyses, exemptions requesting an extension of deadlines were based on affordability tests (INT-EN01). The question of who would pay for those measures was, first and foremost, explored in impact assessments (INT-EN09). Our analysis suggests that a majority of the costs would be borne by the water industry and national government. Consequently, the English approach to affordability was extremely cautious, in line with the British take on WFD implementation. The 2021 objectives set were based on secure funds and existing policies.

In France, water agencies assessed the ability to pay thanks to a set of indicators for each sector and defined thresholds in order to determine when costs would be seen as disproportionate. To illustrate, costs were considered unaffordable for households if the water bill exceeded 3% of their income (Ministère de L'Ecologie de l'Energie du Développement Durable et de la Mer, 2009). The Water Agency Rhine-Meuse used a particularly elaborate method to assess affordability: for each sector, economists would assess the costs of protective measures. Several indicators would then be calculated and thresholds applied. Those had been agreed prior to the assessment with the River Basin Committee and affected stakeholders (INT-FR14). A more detailed assessment of the indicators and thresholds used in Rhine-Meuse is available in our Supplementary Materials.

Authorities in France assessed affordability in very different ways. Affordability tests did not refer to the availability of funding, but to indicators developed for each sector or stakeholder. This approach was much more ambitious than the British one, particularly in river basins where affordability tests were used in combination with CBA results. In such cases, action would be taken even if the costs were higher than the benefits, as long as there was evidence that stakeholders could afford protective measures. Some water agencies however were not fully convinced by the indicators and thresholds used (see our Supplementary Materials for an example on the gross operating surplus of farmers). Those thresholds were often considered to be non-discriminating, i.e. almost all measures would then be above or below the threshold (INT-FR22; INT-FR23; INT-FR27). The case of Rhine-Meuse is thus particularly interesting because the Agency chose indicators and thresholds that were specifically tailored to local circumstances and the stakeholders concerns. Thanks to this analysis, economists in France took into account distributional effects and the impacts of the costs of measures on each sector.

Summary of our findings

Table 1 below summarises our findings for England and France and indicates whether methodological choices resulted in more ambitious (+), more cautious (-) or neutral (0) water quality objectives:

Dimension	England	France
Approach	Cautious (-)	Ambitious (+)
Scale	1st cycle: national and river basin (potentially -) 2nd cycle: sub-catchments (0)	Both 1st and 2nd cycle: water body, catchment and river basin level (+/-)
Screening	1st cycle: decision trees, no in-depth analysis 2nd cycle: "triage" approach consisting of a qualitative description of measures that impact on ecosystem services, stage 1: CBA with NWEBS benefit values, stage 1+: CBA with wider benefits, stage 2: site-specific valuation (overall: potentially -)	Both 1st and 2nd cycle: various criteria used including the ability to pay, cost thresholds, past expenditures and non-priority measure (+)
Data	1st cycle: range of costs not monetised (+), NWEBS benefit values (+) 2nd cycle: more costs assessed (0), NWEBS and qualitative assessment of ecosystem services (+)	Both 1st and 2nd cycle: incomplete database of benefits (-), use of benefit transfers (-), benefit values applied to population densities (-)
Uncertainty	Both 1st and 2nd cycle: uncertainty in favour of deadline extensions (-)	Both 1st and 2nd cycle: uncertainty in favour of good status (+)
Additional parameters	CBA used to justify less stringent objectives Both 1st and 2nd cycle: discount rate 3,5% over 30 years, then 3%; if 0,5<cost-benefit ratio<1,5 in stage 1, perform stage 1+ (2nd cycle) (0) Affordability: disproportionate burdens 2nd cycle: deadline extensions set when no secure funding was available (-)	CBA used to justify deadline extensions and in a few cases less stringent objectives Both 1st and 2nd cycle: cost-benefit ratio=0,8 (+). Discount rate: 1st cycle: 4% (-), 2nd cycle: 2,5% (+) Affordability: Both 1st and 2nd cycle: criteria and thresholds used (+ when used in addition to CBA to set deadline extensions, in this case, both analyses had to show negative results, 0 when affordability was a sufficient criteria to set a deadline extension)

Table 1: Synthesis of findings.

To sum up, our analysis shows that the above five dimensions do affect the results of disproportionality analyses and may serve to set more or less exemptions:

- Scale influences the number of analyses performed, the risk of double-counting benefits and costs and the robustness of data used in the analysis. In our view, the catchment scale is preferable here.
- Screening procedures determine the depth of the analysis performed and, in doing so, the degree of precision of costs or benefits data. Furthermore, screening procedures, if strictly used, reduce the number of analyses and therefore of potential exemptions.
- The quality and quantity of data related to benefits and costs has, according to our analysis, the greatest impact on the result of CBA. The lack of benefits data

and the sensitivity of the analyses to the population living near a water body largely explain the numerous negative CBA results in France. This is independent from the discount rate and the cost-benefit ratio.

- Uncertainties are used in two contradictory ways: as an argument to justify exemptions, with a view to avoiding disproportionally costly measures, or to set ambitious aims for individual water bodies because an exemption cannot be justified on basis of the data available.
- Finally, inability to pay can either be used alone to support deadline extensions, thus making the justification easier, or on the contrary in addition to CBA to diminish the number of possible exemptions.

As argued above, data related to costs and benefits appeared to have the greatest impact on the results of economic analyses. Surprisingly, it is the only dimension where England generally displayed greater ambition than France. Nevertheless, in England, benefits are more likely to be higher than the costs. Because the outcomes of those analyses were not in line with the general approach towards WFD implementation dominant in France French regulators, favouring ambitious water quality targets, complemented CBA with additional criteria to tilt the scale against the use of exemptions. This includes requirements to identify additional arguments for exemptions, for instance unfavourable natural conditions or technical infeasibility, the use of thresholds to limit the overall number of water bodies associated with disproportionate costs, and combinations of CBA and affordability tests. Overall, the high number of CBA displaying higher costs than benefits in France has certainly been a cause for distrust towards the use of CBA in WFD implementation in France.

Obviously, decisions taken with regards to the above five dimensions were also subject to more general constraints, i.e. factors unrelated to the WFD. Three factors play a role here and deserve more attention in future studies: first, resource constraints, explaining the poor method used on benefits valuation in France; second, the presence of statutory guidelines on economic analyses in general; and finally, attitudes about the usefulness of economic appraisal methods in public policy more broadly.

6. Conclusion

Our article has explored the use of economic analysis to justify exemptions during the implementation of the WFD in England and France. Relying on an analytical framework consisting of five dimensions– scale, screening, benefit and costs data, uncertainty, and additional parameters – we show that the two countries rely on economic analysis, that their operationalisation differs, that these differences reflect, to some extent at least, political ambitions in the field of water policy and, finally, that the usage of economic analysis influences the process of setting water quality objectives. All this suggests that policy appraisal tools have a political dimension and are not, and cannot be, neutral when it comes to aiding decision makers.

This argument departs from the mainstream narrative put forward in environmental economics according to which analytical tools such as CBA are politically neutral, if applied correctly by the textbook (Owens *et al.*, 2004). Economic analyses lose this neutrality only as a result of inaccurate and flawed usages by practitioners. Instead, this article builds on an emerging research agenda in public policy and political science exploring the political dimension of policy appraisal in legislation and programme implementation (Cashmore *et al.*, 2010; Coletti & Radaelli, 2013; Fritsch *et al.*, 2017; McGarity, 1991; Turnpenny *et al.*, 2008). The specific usage of policy appraisal tools can, intentionally or unintentionally, shape the outputs of political decision-making processes (Dunlop *et al.*, 2012) and, in fact, support almost contradictory political aims. However, this argument has rarely been spelt out in detail in an interdisciplinary water policy context.

We contribute to extant scholarship by suggesting three pathways – related to *input*, *process*, and *output* - through which economic analyses may influence water policy decisions, thereby bringing in another degree of sophistication to previous work on policy appraisal. First, screening processes are useful examples to highlight the importance of data inclusion rules in economic analysis – they basically alter the range of materials defining the *input* of the analysis, thereby answering the question of *what* is actually analysed. Second, we provide evidence for variance in the interpretation of uncertainties, the choice of the cost-benefit ratio, the discount rate, thresholds in affordability tests, and other *process*-related features of economic analysis. The way data

is processed, decisions are taken and key concepts interpreted may tip the scale in one way or another – referring to the *how* question of economic analysis. Finally, tools come with different degrees of *precision* and *soundness* of analysis. Consequently, methodological choices influence the *output* of water policy decisions. This includes various aspects, but most importantly the degree of ambition and the affected parties – the *to what end* and *who*. Examples include the challenges related to benefit transfers and the scale at which analyses are performed. Future research could address these questions in more detail and reflect in more depth upon factors explaining specific methodological choices in economic analyses, both in the water sector and beyond.

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Justifying exemptions through economic appraisal: ecological ambitions and water policy in France and the United Kingdom

Supplementary material

A. List of interviewees

Interviewee code	Organisation
INT-EN01	Defra
INT-EN03	Formerly Environment Agency
INT-EN04	Formerly Environment Agency
INT-EN05	Environment Agency
INT-EN06	Environment Agency

INT-EN07	Aire Rivers Trust
INT-EN08	Formerly Environment Agency
INT-EN09	Environment Agency
INT-EN10	WWF UK
INT-EN12	Consumer Council for Water
INT-EN15	**Independent Consultancy and** Catchment Based Approach Support Group
INT-EN16	Yorkshire Water
INT-EN18	RSPB
INT-EN21	Environment Agency
INT-FR02	Agence de l'eau Artois-Picardie
INT-FR03	Agence de l'eau Artois-Picardie
INT-FR04	Agence de l'eau Artois-Picardie
INT-FR05	Agence de l'eau Artois-Picardie
INT-FR06	Agence de l'eau Seine-Normandie
INT-FR07	Agence de l'eau Seine-Normandie
INT-FR09	Agence de l'eau Rhin-Meuse
INT-FR10	Agence de l'eau Rhin-Meuse
INT-FR12	Formerly Ministry of Environment, Sustainable Development and the Sea (MEDDE)
INT-FR13	Ministry of Environment, Sustainable Development and the Sea (MEDDE)
INT-FR14	Formerly Agence de l'eau Rhin-Meuse
INT-FR17	Ministry of Environment, Sustainable Development and the Sea (MEDDE)
INT-FR19	Agence de l'eau Rhin-Meuse
INT-FR22	Agence de l'eau Adour-Garonne
INT-FR23	Agence de l'eau Loire-Bretagne
INT-FR24	Agence de l'eau Rhône-Méditerranée Corse / Formerly MEDDE
INT-FR25	Agence de l'eau Rhône-Méditerranée Corse
INT-FR27	Agence de l'eau Rhône-Méditerranée Corse

B. List of policy documents

Doc N°	Author	Date	Title
1	ACTeon, ABP mer, The Andersons Centre, & RPA	2015	Assessing affordability of measures to meet Water Framework Directive requirements in England
2	Agence de l'eau Adour-Garonne	Undated	Synthèse de l'étude coûts disproportionnés réalisée pour le second cycle de la DCE.
3	Agence de l'eau Adour-Garonne, IREEDD, & Cereg	2015	Analyse des Couts Disproportionnes pour les Masses D'eau Impactees par des Pollutions Industrielles et / ou Domestiques, Rapport de phase 2, Analyse détaillée de 4 masses d'eau
4	Agence de l'eau Adour-Garonne, & SCE	2009	Analyse du coût disproportionné pour les masses d'eau impactées par des pollutions industrielles et/ou domestiques, Rapport provisoire.
5	Agence de l'eau Adour-Garonne, & SCE	2009	Analyse du coût disproportionné pour les masses d'eau impactées par des pollutions industrielles et/ou domestiques, Synthèse.
6	Agence de l'eau Artois-Picardie	Undated	Synthèse de la justification des dérogations utilisées sur le bassin Artois Picardie
7	Agence de l'eau Artois-Picardie,	2009	Les avantages économiques au bon état écologique de l'eau.

	DIREN Nord-Pas-de-Calais, EcoWhat, & EcoDecision		
8	Agence de l'eau Artois-Picardie, & EcoLogique Conseil	2015	Réalisation d'une analyse coûts-bénéfices des mesures complémentaires prévisionnelles 2016-2021 sur des groupes de masses d'eau cohérents du bassin Artois-Picardie, susceptibles de faire l'objet de demandes de dérogations dans le cadre de la mise à jour du programme de mesures du SDAGE (2016-2021), Rapport final.
9	Agence de l'eau Rhin-Meuse	2010	Note méthodologique relative aux analyses économiques menées dans le cadre du programme de mesures.
10	Agence de l'eau Rhin-Meuse	2015	Note méthodologique relative aux analyses économiques menées dans le cadre du programme de mesures et de la détermination des objectifs environnementaux.
11	Agence de l'eau Rhin-Meuse	2015	Note méthodologique de justification des objectifs moins stricts pour le deuxième cycle
12	Agence de l'eau Rhin-Meuse	2016	Note méthodologique de définition des objectifs environnementaux assignés aux masses d'eau de surface
13	Agence de l'eau Rhône-Méditerranée Corse	2009	Bassin Rhône Méditerranée, SDAGE 2010-2015, Exemptions pour coûts disproportionnés, Méthodes et résultats
14	Agence de l'eau Rhône-Méditerranée Corse	2016	Note de justification des demandes d'exemptions à l'echeance 2015 pour les masses d'eau du bassin Rhône-Mediterranee, Documents et données techniques pour l'élaboration du SDAGE 2016-2021 du bassin Rhône-Méditerranée
15	Agence de l'eau Seine-Normandie, Commission Géographique vallées d'Oise, & Direction Régionale de l'Environnement Picardie	2007	Commission Géographique des vallées d'Oise, estimation financière du programme de mesures, propositions d'objectifs.
16	Bassin Rhône-Méditerranée	Undated	SDAGE 2010-2015, Exemptions pour coûts disproporitonés, Méthode et résultats.
17	Bureau du Comité de Bassin Rhône-Méditerranée	2014	Préparation du SDAGE 2016-2021, Analyses économiques dans le cadre de l'élaboration du SDAGE / PDM 2016-2021
18	Catchment Based Approach	2017	CaBA (http://www.catchmentbasedapproach.org/about)
19	Chegrani, P.	2005	Document de travail, Evaluer les bénéfices environnementaux sur les masses d'eau.
20	Chegrani, P.	2007	Evaluer les bénéfices issus d'un changement d'état des eaux, Collection « Etudes et Synthèses », Etudes économiques et évaluation environnementale
21	Chegrani, P.	2007	Evaluer les bénéfices issus d'un changement d'état des eaux - Annexe, Collection « Etudes et Synthèses », Etudes économiques et évaluation environnementale
22	Comité de bassin	2009	Schéma Directeur d'Aménagement et de Gestion des

	Artois Picardie		Eaux 2016-2021. Bassin Artois-Picardie.
23	Comité de bassin Artois Picardie	2015	Schéma Directeur d'Aménagement et de Gestion des Eaux 2016-2021. Bassin Artois-Picardie. Documents d'accompagnement districts Escaut et Sambre.
24	Comité de bassin Loire-Bretagne	2015	Bassin Loire-Bretagne. Documents d'accompagnement du SDAGE 2016-2021.
25	Comité de bassin Rhin-Meuse	2015	SDAGE 2016-2021, Objectifs de qualité et de quantité des eaux du district Rhin, Tome 2
26	Comité de bassin Seine-Normandie, Commission permanent des programmes et de la prospective	2014	Programme de mesures 2016-2021
27	Commissariat Général au Développement Durable	2012	Mise en oeuvre de la directive cadre sur l'eau: position de la France en Europe en 2009. Chiffres & statistiques(367): 1-10
28	Commissariat Général au Développement Durable	2014	Évaluer les bénéfices issus d'un changement d'état des eaux (actualisation en vue du 2ème cycle DCE).
29	Courtecuisse, A.	2005	Water Prices and Households' Available Income : Key Indicators for the Assessment of Potential Disproportionate Costs – Illustration from the Artois-Picardie Basin (France), IWG-Env, International Work Session on Water Statistics, Vienna, June 20-22 2005
30	Defra	2009	Impact Assessment of 1st Cycle of River Basin Plans developed to implement the EC Water Framework Directive, Summary: Interventions & Options.
31	Defra	2011	Defra Statement of Position. Defra statement on the principles of River Basin Planning Guidance and the future direction of Water Framework Directive implementation.
32	Defra	Undated	Overall Impact Assessment for the Water Framework Directive (2000/60/EC), adopted by the European Union Council and European Parliament on 22 December 2000, Summary: intervention and options.
33	Defra, Environment Agency	2009	Water for life and livelihoods, River Basin Management Plan, Humber River Basin District, Annex E: Actions appraisal and justifying objectives.
34	Defra, Environment Agency	2015	Water for life and livelihoods, Part 1: Humber river basin district, River basin management plan.
35	Devaux, J.	2008	Atteinte du bon état des eaux en Seine-Normandie. Analyses coûts bénéfices à différentes échelles.
36	Direction Régionale de l'Environnement Picardie, Comité de bassin Seine-Normandie, Commission	2007	Estimation financière du programme de mesures. Propositions d'objectifs.

	Géographique vallées d'Oise		
37	Environment Agency	2009	Water for life and livelihoods, Impact Assessment, Impact Assessment of the River Basin Management Plan for the Western Wales River Basin District.
38	Environment Agency	2009	Water for life and livelihoods, Impact Assessment, Impact Assessment of the River Basin Management Plan for the Western Wales River Basin District. Appendix 2.
39	Environment Agency	2009	Water for life and livelihoods, Impact Assessment, Impact Assessment of the River Basin Management Plan for the Western Wales River Basin District. Appendix 3.
40	Environment Agency	2009	Water for life and livelihoods, River Basin Management Plan, Humber River Basin District, Document submitted to Secretary of State for approval. Bristol.
41	Environment Agency	2013	Updating the National Water Environment Benefit Survey Values: summary of the peer review.
42	Environment Agency	2013	Valuing Environmental Benefits, External Briefing Note.
43	Environment Agency	2014	A consultation on the draft update to the river basin management plan, Part 3: Economic analysis – extended report.
44	Environment Agency	2014	Water Appraisal Guidance; Assessing Costs and Benefits for River Basin Management Planning.
45	Environment Agency	2015	Update to the river basin management plans in England, National Evidence and Data Report.
46	Environment Agency	Undated	Environmental Economics: A tool for river basin management planning.
47	Environment Agency, Defra	2009	Water for life and livelihoods, River Basin Management Plan Northumbria River Basin District. Bristol.
48	Environment Agency, Defra	2009	Water for life and livelihoods, River Basin Management Plan, North West River Basin District. Bristol.
49	Environment Agency, Defra	2015	Impact Assessment, Update to the river basin management plans for England's water environment.
50	Environment Agency, Dorset Wildlife Trust, Nottinghamshire Wildlife Trust	Undated	Improving Water Quality Guidance for Local Authorities.
51	European Commission	2012	Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Blueprint to Safeguard Europe's Water Resources COM(2012) 673 final.
52	European Commission	2012	Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC), River Basin Management Plans, Commission Staff document, Member State: France, Accompanying the document, European Commission.
53	European Commission	2012	Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC), River Basin Management Plans, Accompanying the document.

54	European Commission	2012	Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC), River Basin Management Plans, Commission Staff document, Member State: United Kingdom, Accompanying the document, European Commission.
55	European Commission	Undated	Common Implementation Strategy For The Water Framework Directive (2000/60/EC) And The Floods Directive (2007/60/EC), Strengthening the implementation of EU water policy through the second river basin management plans, Work Programme 2013-2015.
56	European Commission, WRc	2015	Screening Assessment of Draft Second Cycle River Basin Management Plans.
57	HM Government	2011	The Natural Choice: securing the value of nature
58	HM Treasury	2003	THE GREEN BOOK, Appraisal and Evaluation in Central Government, Treasury Guidance, London
59	House of Commons	2015	Water Framework Directive: achieving good status of water bodies.
60	Kouyoumdjian, C.	2014	Justification économique des reports de délais d'atteinte du bon état pour les masses d'eau du bassin Seine-Normandie dans le cadre de la DCE.
61	Large, A.	2008	Justification des dérogations économiques à l'atteinte du bon état des eaux en Seine-Normandie. Approche à différentes échelles. Mémoire de fin d'étude.
62	Levraut, A-M.	2013	Évaluation de la politique de l'eau.
63	Metclafe, J.	2013	The National Water Environment Benefits Survey Values, A briefing note.
64	Ministère De L'Ecologie, De L'Energie et Du Développement Durable	Undated	Retour d'expérience sur l'économie dans les SDAGE
65	Ministère De L'Ecologie, De L'Energie et Du Développement Durable	2009	Guide méthodologique de justification des exemptions prévues par la directive cadre sur l'eau.
66	Ministère De L'Ecologie, Du Développement Durable Et De L'Energie.	2012	Mise en œuvre de la directive-cadre sur l'eau, Pour un bon état des eaux en 2015.
67	Ministère De L'Ecologie, Du Développement Durable Et De L'Energie	2014	Guide méthodologique de justification des dérogations prévues par la directive cadre sur l'eau.
68	Ministère De L'Ecologie, Du Développement Durable Et De L'Energie	2014	Guide Programme de Mesures

69	Ministère De L'Ecologie, Du Développement Durable Et De L'Energie	2014	Instruction du Gouvernement du 22 avril 2014 relative à la mise à jour des schémas directeurs d'aménagement et de gestion des eaux et des programmes de mesures associés.
70	Ministère De L'Ecologie, Du Développement Durable Et De L'Energie	2015	Guide DCE Programme de Mesures, Guide pour l'élaboration, la mise en œuvre et le suivi du programmes de mesures en application de la Directive Cadre sur l'Eau.
71	Ministère De L'Ecologie Et Du Développement Durable	2005	Evaluer les bénéfices environnementaux sur les masses d'eau.
72	Ministère de l'Ecologie et Du Développement Durable	2006	Circulaire DCE 2006/17 relative à l'élaboration, au contenu et à la portée des programmes de mesures
73	Nera, Accent	2007	Collaborative Research Programme On River Basin Management Planning Economics, Report on The Benefits of Water Framework Directive Programmes of Measures in England and Wales.
74	Regulatory Impact Unit	2003	Better Policy Making: a Guide to Regulatory Impact Assessment.
75	Secrétariat Technique de Bassin Loire-Bretagne	2014	Programme de mesures 2016-2021 : principes d'élaboration, Note de cadrage
76	Secrétariat Technique de Bassin Seine-Normandie	2013	Méthode de construction du programme de mesures 2016-2021
77	Stanley, K., Depaoli, G., Strosser, P.	2012	Comparative study of pressures and measures in the major river basin management plans in the EU, Task 4 b - Costs & Benefits of WFD implementation, Financing Water Management and the Economic Crisis – A review of available evidence, Final report.

C. Detailed analysis of the economic analyses performed

1) Overview of the method used

England	1st cycle CBA were mainly performed at the national and river basin levels in the impact assessment framework. Impact assessments mainly focused on the level of ambition to set for 2015 and the extent to which deadline extensions should be used (INT-EN01). The national impact assessment compared the costs and benefits of the 'do nothing' option with those of achieving good status. The final river basin impact assessments compared

	the objectives set in the RBMPs for the 1st cycle with a reference case (30). Disproportionate costs were used in three different cases, i.e. when there was: • an unfavourable balance of costs and benefits, • a significant risk that costs be higher than benefits (uncertainty), • disproportionate burdens. The second argument (uncertainty) was the most largely used (39). <u>2nd cycle</u> In the second cycle, numerous CBA were produced at the "operational" catchment level, leading to over 330 CBA (INT-EN05). The EA produced national guidance (44) and spread sheets for its local teams. EA regional staff was trained to perform the appraisals, in particular through an online audio presentation (46). This process was very resource and time consuming (INT-EN01; INT-EN05). The CBA relied on a step-wise process. A qualitative analysis which relied on an ecosystem services framework was first performed. The net present value was calculated based on costs and different possible degrees of benefits monetisation. As a result, less stringent objectives were set when costs outweighed benefits, i.e. when good status was not considered worth achieving (46; 49; INT-EN05). Catchment appraisals were aggregated into river basin and national impact assessments. In particular, the national impact assessment compared two scenarios. The first aimed to reach good status for all water bodies when technically feasible. The second and ultimately adopted scenario only considered implementing cost-beneficial (and technically feasible) measures (49; INT-EN01). This long-term scenario was then proportioned to the six following years (2015-2021) on the basis of available funding. Its costs and benefits were also assessed (49; INT-EN05).

France (National level)	<u>1st cycle</u> National guidance recommended using the following process to justify disproportionate costs:

	• Identify water bodies with potential disproportionate costs, based on a cost-effectiveness analysis and the funding available in the water agency. • Perform a CBA on the pre-identified water bodies. If B<0,8C, costs are disproportionate. • If B>0,8C, look at the distribution and affordability of costs between sectors, taking into account subsidies. If costs are unaffordable, set a deadline extension. (65) <u>2nd cycle</u> It was particularly stressed that deadline extensions should serve to spread costs over time. As such, the idea was to: • Assess the funding available in the river basin (water agencies subsidies, stakeholders' ability to pay for the measures, past expenditures…) • Compare different investment scenarios (for different sectors, based on a CBA at the river basin scale) • Prioritise measures • Build a PoM based on priority measures and within the financial amount available • Measures that could not be included in this PoM would then be delayed (a CBA and an analysis of stakeholders' ability to pay should be performed to confirm that costs are disproportionate or to support a local decision) Several criteria could be used to determine the order of priority of measures: • Ecological stakes, • Technical feasibility, • Cost-efficiency, • National political stakes, • Gap with good status, • Cost-benefit ratio (67)
Adour-	Justifications based on technical feasibility as well as strongly favouring

Garonne (AG)	natural conditions. In the 1st cycle, an economic appraisal was only performed on four water bodies, which led to a more in-depth analysis that included local data and a qualitative description. In the 2nd cycle, 20 water bodies were analysed for DC. The analysis consisted in two steps: 1) a qualitative and quantitative territorial analysis (technical analysis, simplified economic analysis, identification of ecological stakes and uses); 2) a monetary CBA, if necessary. When costs were higher than benefits, a less stringent objective was set. Otherwise, affordability was analysed. In case of unaffordability, a deadline extension was set (3; 5; INT-FR22).
Artois-Picardie (AP)	Exemptions were mainly based on natural conditions and technical feasibility (INT-FR03; INT-FR05). <u>1st cycle</u> Three scenarios with different levels of ambition (no more investments, current investments, investments necessary to implement the WFD) were elaborated to compare the costs, benefits, impacts on jobs and activities of each option at the river basin level (7). Disproportionate cost analyses were mainly based on ability to pay, and more particularly on the impact that the PoM would have on water bills. CBA at the water body level were scarcely used (22; INT-FR05). <u>2nd cycle</u> Technically feasible measures were first selected and prioritised based on cost and efficiency criteria (INT-FR02). The overall amount of money that could be spent was assessed (amounts similar to those defined in the 1st cycle, as it was decided to keep expenditures steady for each sector + estimation governments' funds available). The PoM was finalised taking into account this information and costs were spread over several management cycles (23), (INT-FR02; INT-FR03; INT-FR04). A CBA was performed at the river basin level to check the overall ambition. A CBA was also performed for each water body to see if a disproportionality assessment applied (INT-FR02). Affordability of each sector for each water body was also estimated (8).

Loire-Bretagne (LB)	1st cycle Potentially disproportionately costly measures were pre-identified based on local expertise and an assessment of ability to pay at the river basin level. Measures related to hydromorphology and agriculture were identified as particularly expensive. A CBA was then performed on pre-identified groups of water bodies. When the results of the analysis was in contradiction with local expertise, ability to pay was assessed at the water body level (INT-FR23). 2nd cycle Ability to pay was assessed at the river basin level. A CBA was then performed on each water body. Indicators on affordability were calculated for each water body, for discussion with the river basin committee. Costs of measures were also compared to past expenditures (in the 1st cycle) and a priority order was established between measures (75; INT-FR23).
Rhin-Meuse (RM)	Costs were considered disproportionate if there was both an inability to pay for the measures and an unfavourable cost-benefit ratio. CBA were only performed at the water body level if there was an inability to pay for the measures (9; INT-FR09; INT-FR10).
Rhône-Méditerranée Corse (RMC)	A pilot study was performed to test the method. The original idea was to choose a cost threshold below which bundles of measures were automatically considered as not disproportionately costly. Above this threshold, a CBA was performed. If 0,65<CBR<0,95, the ability to pay of stakeholders was assessed. However, this last criteria did not discriminate measures and was thus of little help for the decision. Therefore, in the final methodology, it was decided to only perform a CBA (no affordability assessment) (13; INT-FR25; INT-FR27). In the 2nd cycle, the overall amount of the PoM was also compared to usual expenditures in the water sector. The idea was to build a PoM within stakeholders' ability to pay and to show them that the amount of the PoM was not disproportionate compared to usual expenditures and available funding (and thus increase the acceptability of the PoM)(14; INT-FR25, INT-FR27). The water agency also assessed some economic benefits at the river basin level to show stakeholders the positive impacts of environmental

	restoration on the economy (impacts on jobs, avoided treatment costs for drinking water…) (INT-FR25).
Seine-Normandie (SN)	1st cycle The river basin committee agreed to increase past expenditures by 30%. Remaining costs were spread over the 2nd and 3rd management cycles (35; 60). A PoM that would reach good status (taking into account technical feasibility and natural conditions) was produced and its cost assessed (61). This cost was compared with average past expenditures and impacts on households, industries and farms (36) (the method differed slightly depending on the locality (INT-FR06)). Water bodies and measures for which costs were excessive were thus pre-identified. For those water bodies, a CBA was performed at the water body level (35; 61). 2nd cycle The river basin committee decided to spend overall similar amount of money on the PoMs from the two cycles (60). Objectives were set based on this financial amount (26). Costs of measures were compared with past expenditures for each sector (waste water, storm water, industry, agriculture, aquatic environment, others) (INT-FR07). Several PoM gathering priority measures within the financial amount agreed and maximising the number of water bodies that would reach good status were proposed. Measures were prioritised based on several criteria (nature of the measure (e.g. national policy), type of pressures (e.g. number, facility to alleviate them), water body status (gap with good status), cost-effectiveness, other technical criteria) (76; INT-FR07). Economic appraisal was performed on water bodies where measures had not been included in the selected PoM. When benefits outweighed costs, the ability to pay was assessed (60).

2) Scale of the analysis

England	1st cycle Economic appraisals were performed at the highest possible geographical scale (38), mainly at the national or river basin level (73; INT-EN01). A few

	site-specific appraisals were performed to assess whether costs outweighed benefits when there was a high certainty on the water body's status, the pressures and the efficiency of measures (33). 2nd cycle In the second cycle, the CBA were performed at the level of operational catchments (34; INT-EN05).

France (National level)	National guidance recommended performing the analysis at the most relevant scale (28; 65).
AG	Analyses (CBA and affordability assessments) were performed at the water body scale (3; 5; INT-FR22).
AP	1st cycle The three scenarios were assessed at the river basin level (7). The weight of the water bill on household incomes was assessed at the local level (for each water service) (29). 2nd cycle A CBA for the overall PoM was performed at the river basin level (23; INT-FR02). A CBA was performed for each water body. Affordability was also assessed at the water body level (8; INT-FR02).
LB	1st cycle Affordability was assessed at the river basin scale. CBA were performed at the catchment scale (groups of around 10 water bodies). Affordability was assessed again at the water body scale in a few cases (INT-FR23). 2nd cycle Affordability was first assessed at the river basin scale. CBA and ability to pay assessments were performed at the water body level (INT-FR23).
RM	Analyses (CBA and affordability assessments) were performed at the water body scale (10; 25; INT-FR09, INT-FR14).
RMC	CBA were performed at the catchment scale (groups of around 10 water bodies) (13; INT-FR27).
SN	Analyses (CBA and affordability assessments) were performed at the water

	body scale. A single CBA was undertaken for groundwater (which included all water bodies). In the second cycle, available funding was also assessed at the river basin level and a CBA was performed for the overall PoM (35; 36; 60; 76).

3) Screening procedure

England	1st cycle The EA created decision trees for each element and type of water body. The trees helped to set the objective and select the most appropriate justification in case of an exemption. Although they differed from each other in detail, they shared a similar pattern. First of all, appraisals were not undertaken for basic (mandatory) measures. Analyses were also not performed on water bodies in good status (an objective of good status for 2015 was then set). When the status was uncertain, a deadline extension was set due to the risk of an unfavourable balance of costs and benefits (disproportionate costs). Otherwise, technically feasible measures and causes of failure were assessed. If unknown or uncertain, a deadline extension was assigned due to technical infeasibility. If known with high certainty, a CBA would then be performed. If the result of the CBA was uncertain, a deadline extension was set due to an unfavourable balance of costs and benefits (disproportionate costs). If there was high confidence in the result, disproportionate burdens and alternative financing were assessed Defra & Environment Agency, 2009. A few site-specific assessments were undertaken, in particular for water industry-related measures. Otherwise, assessments were based on national analyses associated with a specific measure (33). 2nd cycle In the 2nd cycle, CBA were only performed on water bodies that were not in good status or where enough evidence was available (INT-EN05). Then, a step-wise procedure or "triage approach" (p.8) was applied (44). The idea was to be strategic in the disproportionality analyses performed , i.e. to perform in-depth analyses only if necessary and where impacts were high (74).

France (National level)	1st cycle According to national guidance, economic appraisals were to apply in priority to water bodies where technical feasibility or natural conditions do not apply or had a weak basis for justification (65). A step-wise process was to be used for the CBA: in obvious cases, when costs were extremely high or extremely low, a qualitative or quantitative assessment was enough. Otherwise, a monetary assessment would be performed. This would be based on transfers of national benefit values. In a few cases, local studies could be performed if necessary (20). Ability to pay would be assessed only when costs were higher than benefits (65). 2nd cycle Economic appraisal were performed on measures that could not be included in the PoM (non-priority measures with no ability to pay) (67).
AG	1st cycle An economic appraisal was performed on only 4 water bodies due to the water agency's director's reluctance to use disproportionate costs as an argument for exemption (5; INT-FR22). 2nd cycle A simplified analysis was performed on 20 water bodies (description of uses, qualitative assessment of benefits), which were identified locally (cases where costs were particularly high). A monetary CBA was undertaken in three cases where a decision could not be taken based on the qualitative analysis only. When costs outweighed benefits, a less stringent objective was set. When benefits were higher or around costs, stakeholder ability to pay was assessed to set a deadline extension accordingly (2; INT-FR22).
AP	1st cycle A CBA at the water body level was performed in very few cases and only when there was an inability to pay for households (64). 2nd cycle Exemptions were only considered for water bodies that were not in good status (INT-FR03). Water body objectives were first estimated based on the

	current status, technical criteria and thanks to local experts (INT-FRFR 04). A CBA and an analysis of ability to pay were performed on each water body (INT-FR02).
LB	1st cycle Potentially disproportionately costly water bodies were pre-identified through an analysis of ability to pay at the river basin level and through local expertise. The analysis of ability to pay concluded that measures related to hydromorphology and agriculture were potentially disproportionally costly due to their high costs. In the few cases where there was a disagreement between the result of the CBA and local expertise, an analysis of ability to pay at the water body level was performed (INT-FR23). 2nd cycle A CBA and an assessment of ability to pay was performed on each water body (INT-FR23).
RM	Analyses were only performed for water bodies that were not in good status (INT-FR19). Water bodies that could potentially apply for DC were pre-selected based on an analysis of stakeholders' ability to pay. If this first analysis showed an inability to pay, a CBA was performed to confirm whether costs were disproportionate (9; 10). However, an exemption could only apply if the disproportionately costly measure addressed a pressure that significantly contributed to the water body's bad status, and that its costs were significantly higher compared to other measures applied to the same water body (above 20% of total costs) (12; INT-FR19). In the second cycle, ability to pay by 2033 and 2039 was also assessed. If this analysis showed an inability to pay by 2039, the water body could qualify for a less stringent objective (12; 25; INT-FR10).
RMC	A cost threshold was set at 10M euros for all the measures at the catchment level. Below this threshold, the bundles of measures were not considered disproportionately costly. A CBA was only performed if the costs were above this threshold (13; INT-FR27). A qualitative analysis was considered sufficient in cases of high costs and low benefits, and if the water body was

	not of outstanding environmental interest (Natura 2000, Ramsar…). Otherwise, costs and benefits were monetised. An in-depth local analysis could be performed if necessary, but was only undertaken in rare cases (13). In the second cycle, a CBA was only performed on water bodies with an exemption based on DC in the 1st cycle and for a few water bodies with costs that had significantly increased in the 2nd cycle (due to an underestimation of costs in the 1st cycle) (14; INT-FR27).
SN	1st cycle Water bodies that could potentially apply for DC were pre-selected based on past expenditures (costs were considered excessive when above 120% of the average of past expenditures on the river basin) and an analysis of stakeholders' ability to pay. If this first analysis showed an inability to pay by 2015, a CBA was performed to confirm whether costs were disproportionate. (15; 36) 2nd cycle Analyses were only performed for water bodies that were not in good status (76). The economic appraisal was only performed on pre-identified water bodies. The water bodies selected were those that could not be included in the PoM (due to its constrained financial amount) and that were not considered as a priority. They were pre-identified by local experts. A CBA was then performed. If B>C, affordability was assessed (60; INT-FR06).

4) Costs and benefits data

❖ *Costs*

England	1st cycle Working groups of stakeholders and representatives of different sectors identified measures and their costs for the preliminary cost-effectiveness analysis (32). They provided a database for the costs of intervention (INT-EN08). Both costs of measures and administrative costs were considered

	(54). 2nd cycle Thanks to water companies' periodic reviews, there was already strong knowledge on costs related to the water industry. A spreadsheet with national data on costs (from the cost-effectiveness database) was available for EA staff to perform economic appraisals (49) (INT-EN05).

France (National level)	The cost values that were used were those calculated for the PoM (28). Costs were allocated according to the polluter-pays principle (67). Only investment costs were taken into account (68).
AG	- Source: Water agency database, expert evaluations, local data - Costs taken into account: investment and maintenance costs (3; 4).
AP	- Source: Water agency database, data from the characterisation process (7; 23) and from existing studies - Costs taken into account: investment and maintenance costs (8)
LB	- Source: Water agency database (INT-FR23)
RM	- Source: Water agency database, INSEE database, studies, expert evaluations (9; 10). - Costs taken into account: investment and maintenance costs
RMC	- Source: Water agency database, expert assessments, studies (13; 17). In the second cycle, costs data were improved. Several studies were performed to assess costs, in particular on hydromorphology (INT-FR25; INT-FR27).
SN	- Source: Water agency database - Costs taken into account: investment and maintenance costs (35; 60)

- *Benefits*

England	1st cycle The Collaborative Research Programme led by Defra funded the National Water Environment Benefits Survey (NWEBS). The survey used stated preference valuation methods: a payment card contingent valuation question, dichotomous choice question and choice experiment (32).

	2nd cycle Regarding benefits, the qualitative assessment (1st step) was based on an ecosystem services framework. The idea was to get a comprehensive overview of the benefits of restoration measures and to better value non-monetised and non-market benefits, in accordance with the Green Book (58) and the Natural Environment White Paper Environment Agency, 2014a. The latter recommends relying on ecosystem services in environmental management so as to better take into account benefits and impacts of programmes Environment Agency, 2014a; Environment Agency, 2014b. This step was also important for identifying whether further benefits could be monetised and added to the stage 1 valuation (46) and provided information on the wider benefits that could not be monetised (INT-EN05). If an important benefit was identified at this stage but could not be monetised, the qualitative assessment could serve as a justification for setting an objective of good status (INT-EN01), especially when the cost-benefit ratio was close to 1 (INT-EN05). This step was completed thanks to local stakeholders, experts and subject specialists Environment Agency, 2014b. The NWEBS survey was updated in 2012 Metclafe, 2013, to take into account changes in population density, prices, incomes and the latest knowledge from economic literature (INT-EN01). The NWEBS results were used to monetised recreational, aesthetic and non-use values in the stage 1 valuation process Environment Agency, 2014b. EA staff could choose the most appropriate values across a range and apply them to the area where improvements were expected. Thanks to an Excel spreadsheet, they could obtain a cost benefit-ratio and a net present value for each bundle of measures (46). Local benefits and those derived from wetlands were also used at this stage Environment Agency, 2013. In stage 1+ valuation, another spreadsheet could be used to take into account the non-monetised benefits identified during the qualitative analysis and not included in NWEBS (44). In stage 2 valuation, more in-depth benefit valuations could be performed based on existing research or a local appraisal (46). Separate analyses were performed by specialists for protected areas (shellfish

	waters, bathing areas…) as their values were not covered by the NWEBS. Those values were included in the RBMPs and local plans if relevant (INT-EN01). Catchment appraisals were aggregated at the river basin and at the national level for the national impact assessment. The latter was completed with national data on the costs and benefits of measures aiming to achieve protected area objectives and non-deterioration (45; 49; INT-EN05; INT-EN09).

France (National level)	1st cycle A national database was created based on a review of existing valuation studies (19; 21). It was recommended to perform specific studies only in limited cases, when environmental and economic stakes were important (65). Unitary benefit values would then be applied to the number of users Chegrani, 2007. 2nd cycle The database on non-market benefits values undertaken in the 1st cycle was brought up to date (67). Existing data were updated so as to take into account inflation. Values from new publications were included, although new studies were not numerous. Most of them were related to wetlands (28).
AG	The ecological value of water bodies was first qualitatively estimated. In particular, the water agency assessed: - whether the water body belonged to a classified natural zone (national park, Natura 2000…) - the ecosystem services provided - whether the classified zone would benefit from an improvement in the water body's status Qualitative data were collected from state regional offices. Monetary benefit values for CBA were taken from the national database (3; 4).
AP	1st cycle The benefits monetised were mainly market benefits. Non-market benefits were only broadly assessed. The benefit values used were transposed from

	existing studies (7). 2nd cycle Benefit values were taken from existing studies or from the national database (8).
LB	Data from the characterisation process were used. Benefit values were taken from the national database. Some local studies were also performed (24; INT-FR23).
RM	Benefit values were taken from the national database. Some local studies were also performed (9; 10; INT-FR09).
RMC	Market benefits were not included in the CBA. Non-market benefits values (recreation) were taken from the national database. Local studies were performed to complete national data (INT-FR27).
SN	Benefit values were taken from existing studies or from the national database (35; 60; INT-FR13).

- *Benefits transfer*

France (National level)	1st cycle The ministry built an Excel tool to perform the CBA (35). Unitary values from the national database were thus transferred as such. A transfer function was not used, because models from primary studies were not always accessible. Furthermore, the limited number of primary studies meant a meta-analysis could not be built. Conditions for the value transfer were specified (e.g. type of water body, regular users as opposed to occasional users…) (19). 2nd cycle The ministry updated and improved the Excel tool for the 2nd cycle (67). For instance, benefit values were introduced progressively over time. The discount rate could also be changed for sensitivity analysis. It was also possible to perform the appraisal on groups of water bodies instead of individual water bodies (INT-FR13).
AG	The national tool was not used. Benefit values were transferred from the national database (2; 3; 4). Benefit values were applied to different

	population values, depending on how popular the site was and whether it was classified for its ecological interest (e.g. Natura 2000) (2).
AP	The national tool was not used. Benefit values were transferred from existing studies (7; 8).
LB	The national tool was used in the 1st cycle but not in the 2nd. Benefit values were transferred from national guidance (INT-FR23).
RM	The national tool was not used (INT 09). Benefit values were transferred from national guidance (9; 10).
RMC	The national tool was not used. Benefit values were transferred from national guidance. Benefits were applied to visits rather than population (INT-FR27).
SN	The national tool was used. Benefit values were transferred from national guidance (35; 60).

5) Uncertainty

England	A quality assurance was performed on 10% of the catchment appraisals and when aggregated for the national impact assessment. In particular, the consistency of the approach and the right implementation of the national guidance were checked (INT-EN01; INT-EN05). Many investments were also made to improve knowledge on water bodies and reduce uncertainties on the water status. However, they were still taken into account. For example, a 95% confidence level that the water body was below good status was required before considering expensive restoration measures European Commission & WRc, 2015.

France (National level)	The exemptions set were mainly deadline extensions. The use of less stringent objectives was exceptional. A cost benefit ratio of 0,8 was chosen to take into account potential underestimations of benefits. National guidance recommended using a range of benefit values in case of uncertainty. When benefits could not be valued, this should have been clearly indicated in the CBA. Economic analyses, in particular CBA, were often not the only criteria to decide on disproportionality. Rather, they

	served to strengthen other considerations (20; 28; 65; 67; INT-FR24). In the first cycle, due to the ambitious objective of reaching good ecological status in 2/3 of water bodies by 2015 (INT-FR24), several water bodies with an uncertain status were granted an objective of good status rather than a deadline extension (62).
AG	In order to take into account uncertainties on costs and benefits values, ranges of costs and benefits were considered. When the range of benefits overlapped the range of costs, benefits were considered as potentially justifying the costs. In this case, the ecological value of the water body was qualitatively estimated, in particular its uniqueness, to decide whether the lower or the upper value of the benefits would be considered (3; 5; INT-FR22).
AP	Uncertainties on status were not taken into account when setting objectives (INT-FR04). However, exemptions were never set on the sole basis of disproportionate costs but were always used with technical feasibility and natural conditions (INT-FR02, INT-FR03). 1st cycle When comparing the three scenarios at the river basin level, uncertainties on costs and benefits were indicated (max-min values). When cost values were too uncertain, they were not taken into account in the analysis (7). 2nd cycle A range of benefits were used for water body level CBA (max-min values) (8).
LB	CBA were used in combination with affordability analyses, e.g. costs should be both higher than benefits and unaffordable at the river basin level to set an exemption (INT-FR23).
RM	Both inability to pay and an unfavourable cost-benefit ratio were necessary to set an exemption based on DC (9; 10).
RMC	Exemptions were never set on the sole basis of disproportionate costs (they were always used with technical feasibility or natural conditions), due to the uncertainties on the cost-benefit assessment (14; INT-FR25; INT-FR27). Several cost thresholds above which a CBA should be performed were tested. The analysis showed that the threshold chosen had a limited impact

	on the number of water bodies affected. The impact on costs was even lower. In this river basin, measures were indeed either very expensive or very inexpensive (13).
SN	1st cycle Uncertainty was taken into account when comparing costs to past expenditures: costs were considered excessive when they amounted to over 120% of past expenditures, i.e. a 20% margin was considered. A sensitivity analysis was performed on CBA (comparison of the minimum and maximum values for benefits, changes in the discount rate used) (35). 2nd cycle A range of benefit values (minimum and maximum were taken into account) (60).

6) Additional parameters

❖ *Cost-benefit ratio*

France (National level)	The cost-benefit ratio used was 0,8 (28; 65).
AG	Ranges of costs and benefits were used. Benefits were considered higher than costs when the ranges overlapped or when the range of benefits was higher than the range of costs (5).
AP	1st cycle The costs and benefits of three different scenarios were compared, but their cost-benefit ratio was not calculated (7). 2nd cycle For CBA at the water body scale, the cost-benefit ratio used was 1 (8).
LB	The cost-benefit ratio used was 0,8 (INT-FR23).
RM	The cost-benefit ratio used was 0,8 (9; 10).
RMC	The cost-benefit ratio used was 0,8 (13; 14).
SN	The cost-benefit ratio used was 0,8 (35; 60; 61).

❖ *Affordability*

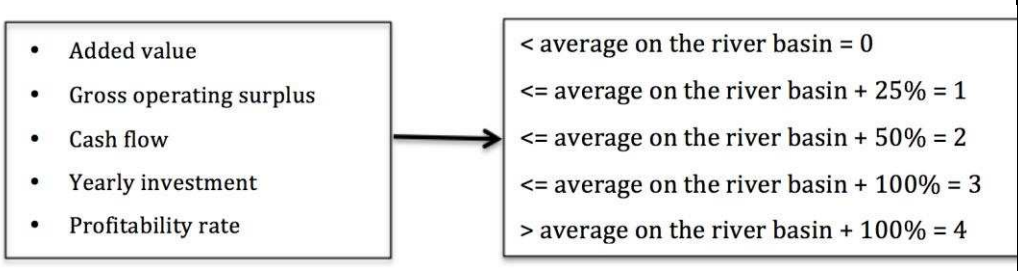
England	1st cycle "Disproportionate burden" was used when costs were too high to be borne by specific sectors or when the measures required were in contradiction with the polluter pays principle. In this case, a deadline extension was set due to disproportionate costs (38). 2nd cycle Costs of measures were compared at sector level with available funding (46). When the polluters could not pay, alternative funding was sought towards the beneficiaries and the government (via EU, central or local government) Defra & Environment Agency, 2015. Funding that could be spent or was very likely to be spent included the Environment Agency's environment and flood programmes, the Countryside Stewardship Scheme, water industry national environment programme, or the abandoned metal mines programme (49). Other funding sources will probably be available in the course of the 2nd cycle to fund more measures, but their amount or effects are not certain. For example, funding is available under the CAP Pillar 2 for farming improvements. But because those actions are voluntary, the location and extent of outcomes is unknown (INT-EN01). As another example, the financial amount that water industries can spend on environmental protection, in particular through wastewater treatment, is agreed through a separate process, the periodic review. Every five years, water companies agree with the economic regulator Ofwat on their business plans and customers charges ACTeon *et al.*, 2015. During this process, they have to discuss their business plans with other stakeholders, such as CCWater. Water companies are expected to take into account customers' views and preferences, including their willingness to pay for water companies' proposals (INT-EN01; INT-EN12). They also discuss investment requirements for environmental protection with the environment agency, in accordance with customers' views and preferences (INT-EN12). Moreover, this process doesn't coincide with the RBMP schedule (INT-EN01).

France	According to national guidance, the costs of measures had to be allocated

(National level)	to polluters or users. The following indicators could be used to assess affordability: For households: • Techniques usually implemented • Cost of the measures necessary to achieve the objective and comparison with past expenditures • Price of water and comparison with the average price in the river basin • Household incomes and comparison with the average income in the river basin For industry: • Best available technologies usually implemented • Costs of measures • Turnover • Gross operating surplus For agriculture: • Best environmental practices usually implemented • Costs of supplementary measures • Profits before tax • Gross operating surplus In the first cycle, costs were considered unaffordable for households if the water bill exceeded 3% of their income. For industries and farmers, the threshold had to be agreed with the river basin committee. However, if costs were similar to past expenditures in the sector and if there was no obstacle to investment (particularly low income, excessive water price…), measures could not be considered as unaffordable. All forms of subsidies (from water agencies, the State, the EU, local authorities…) had to be taken into account and deducted from the costs (65; 72). In the 2nd cycle, all criteria and thresholds had to be agreed with local stakeholders and the river basin committee. Other criteria could be taken into account, such as the financial amounts planned or spent (67).
AG	1st cycle

	Indicators used to assess ability to pay for industries: - Costs compared to gross operating surplus - Costs compared to past expenditures (5). 2nd cycle Indicators used to assess ability to pay: - Households: impact on water bills, comparison water bill / income (3% threshold) - Industries: costs compared to gross operating surplus Subsidies were deducted from costs (3).
AP	1st cycle Stakeholders' ability to pay for the measures was assessed, in particular for households (impact on the water bill) (INT-FR05) The indicators to use were decided with the river basin committee: - For households: impact on the water bill - For farmer and industries: comparison with the added value (6; INT FR 05). For households, the increase on water bills was assessed and compared with average incomes at the local level. The cost of measures was considered disproportionate when the water bill was above 3% of households' income (29; INT-FR05). Based on this assessment, the costs of measures were spread over the three management cycles (INT-FR05). 2nd cycle The WA commissioned a study that looked at the ability to pay at the water body level. The indicators used were inspired from the AERM method in the first cycle. For each sector, the remaining costs of measures (once subsidies from the water agency deducted) were assessed and compared to various indicators. A threshold was used to determine whether the amount was acceptable or not. - Households: weight of water bill in households' income; threshold: 3% - Tax payers: impact of measures on local taxes; threshold: 2% - Farmers: impact of measures on gross operating surplus; threshold: 2%

	- Industries: impact of measures on added value; threshold: 2% (8; INT-FR02)
LB	1st cycle For households, the cost of water bills was compared with the average income. If above 3%, the cost was considered unaffordable. For farmers, the costs of measures were compared with the average income and gross operating surplus. If above 3%, costs were considered unaffordable. For each type of measures (hydromorphology, agriculture…) costs were also compared with past expenditures. (INT-FR23) 2nd cycle Affordability was first assessed at the river basin scale. At the water body scale, affordability was not assessed per se. Indicators were calculated but not compared to a specific threshold. Indicators were the average income for taxpayers, the price of water for households, and gross operating surplus for farmers. Subsidies (water agency, European funds…) were deducted from costs in the analysis. Costs were also compared to past expenditures to show to the river basin committee that they were affordable. (INT-FR23)
RM	For each sector, the remaining costs of measures (once subsidies from the water agency deducted) were assessed and compared to various indicators. The indicators to use were decided with the river basin committee. Indicators used to assess ability to pay: Water and wastewater services • Price of water • % of water bill in household incomes Industries • Added value • Gross operating surplus • Cash flow • Yearly investment • Profitability rate

	Craftsmen • Turnover • Added value Farms • Added value • Gross operating surplus • Profit before tax • Cash flow Hydromorphology: Local taxes For water services and industry, up to four points were attributed for each indicator, depending on its distance from the average in the river basin. A total grade on 20 was calculated. If the grade was above 12, the cost was considered as potentially disproportionately costly for the sector.  Figure 1: example of points attributed to each indicator for industry, source: (9) For agriculture, a threshold of 3% was used for each indicator. For hydromorphology, a total grade of 4 was attributed. Costs were potentially disproportionate if the grade was above 3. In the 2nd cycle, only one indicator was changed for industries: yearly investment was replaced with turnover. Alternative funds were taken into account (9; 10).
RMC	Ability to pay was not used to justify disproportionate costs (13).
SN	1st cycle Water bodies were pre-identified as potentially disproportionate based on an assessment of ability to pay for households (more than 1000 euros over 9 years was considered as potentially disproportionately costly) and

	for industries and farms (more than 30 000€ per installation considered as potentially disproportionately costly) (36). 2nd cycle When B>0,8 C, affordability was looked at. The most expensive measures related to agriculture. Affordability was thus only tested for agricultural measures. Subsidies and alternative financing were deducted from the costs accruing to farmers. Costs were considered disproportionate when they were 2,5% above farms' standard gross production of (60).

❖ *Distributional effects*

England	1st cycle In the impact assessments, costs were allocated to the main affected groups (water industry, EA, central government, angling and conservation, industries, navigations and ports, local governments, agriculture and rural land management, urban and transports) (30; 37). 2nd cycle Costs were allocated to the sectors (water industries, other industries, services and infrastructures, rural land management, government) that were responsible for the pressure, although those sectors might not necessarily be paying for the measures (e.g. the Countryside Stewardship Scheme is funded by government but costs were allocated to rural land management) (49; INT-EN09).

❖ *Less stringent objectives*

England	1st cycle Very few less stringent objectives were set (for only 5 groundwater bodies according to the RBMPs (47; 48)). Deadline extensions were largely preferred. 2nd cycle The proportion of water bodies with a less stringent objective was much higher (25%) (49). Once economic appraisals were performed, bundles of measures with costs higher than benefits were flagged. The measures responsible for the negative ratio and the water bodies, or even the

	elements, that they were supposed to improve, were identified. A less stringent objective was then set for the water body or the element concerned. The objective set was the highest objective for which the benefits of measures outweighed the costs (34; INT-EN05).

France (National level)	Less stringent objectives had to be used exceptionally (deadline extensions were preferred) and only if good status was not achievable by 2027 (65; 67). In the 2nd cycle, water bodies that could apply for a less stringent objective could be pre-identified based on expert judgements and technical criteria, i.e. in cases of: • Heavy urbanisation requiring expropriations; • Heavy industrial activity requiring stopping the activity; • Fishponds. (67)
AG	Number of less stringent objectives set based on DC (INT-FR01): 1st cycle: 2 2nd cycle: 5
AP	Number of less stringent objectives set based on DC: 1st cycle: 4 (INT-FR01) 2nd cycle: 13 (23; INT-FR04; INT-FR03)
LB	Number of less stringent objectives set based on DC: 1st cycle: 2 (52) 2nd cycle: 0 (INT-FR01)
RM	Number of less stringent objectives set based on DC: 1st cycle: 0 2nd cycle: 2 In the 2nd cycle, about 30 water bodies were pre-selected for a less stringent objective, i.e. the costs of measures were still unaffordable after 2039. Only two water bodies had a less stringent objective based on disproportionate costs in the end, due to a lack of time to perform studies to justify the alternative objective. For these two water bodies, the impact

	of possible measures on the water body was modelled and the measures with the highest cost-efficiency and cost-benefit ratios were selected to determine the objective to set. (11; 25; INT-FR 9)
RMC	Number of less stringent objectives set based on DC: 1st cycle: 0 (13) 2nd cycle: 0 (14)
SN	Number of less stringent objectives set based on DC: 1st cycle: 0 (36) 2nd cycle: 0 (INT-FR07)