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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

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}
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A Blueprint to Safeguard Europe's Water Resources

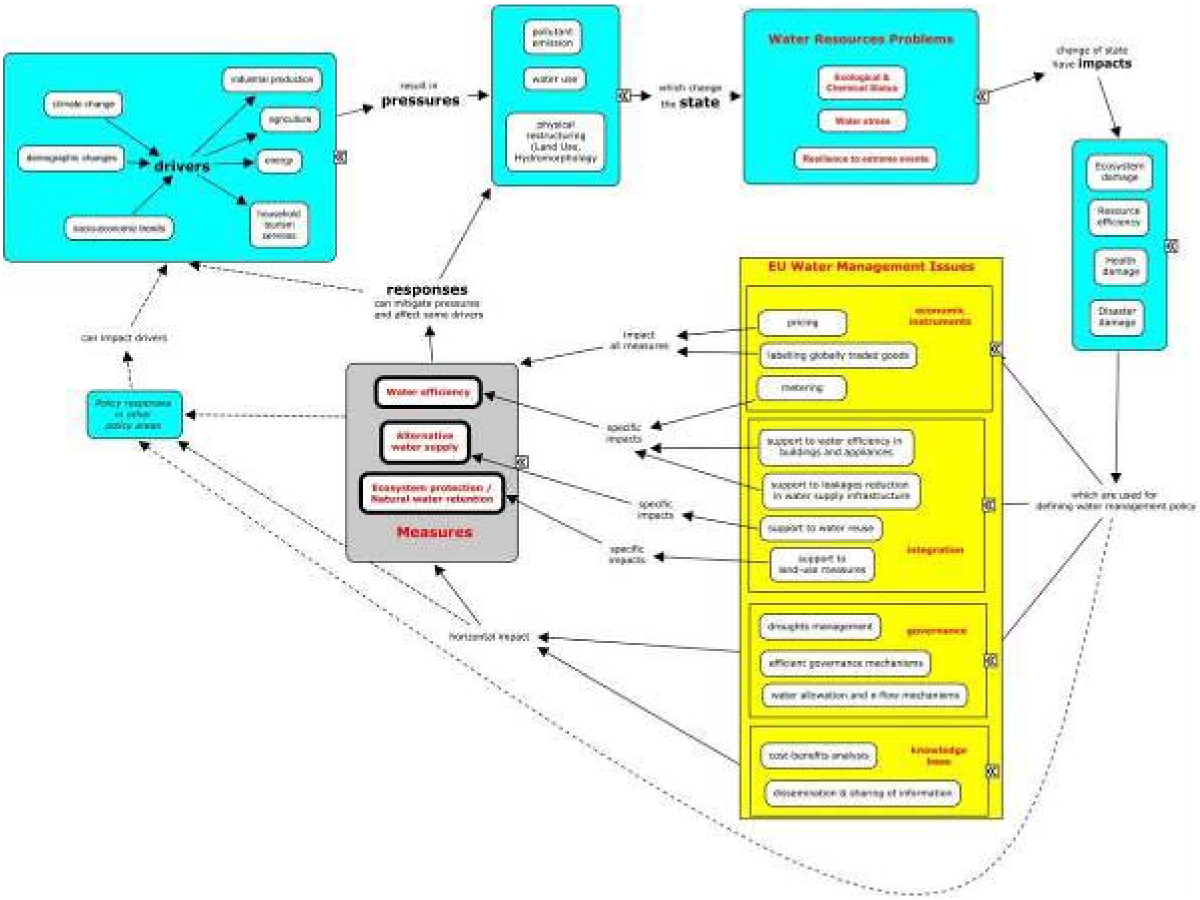
1. ANNEX 1: BASELINE AND SCENARIOS FOR WATER RESOURCES

1.1. Trends for state of water resources, pressures and drivers based on reported information and external sources

1.1.1. What are the underlying causes leading to the status of EU waters?

The assessment of the underlying causes for the current (and future) State of water resources, described in the previous section, follows a DPSIR framework cycle (Driving forces, Pressures, States, Impacts, Responses) that can be synthesised as in the figure below:

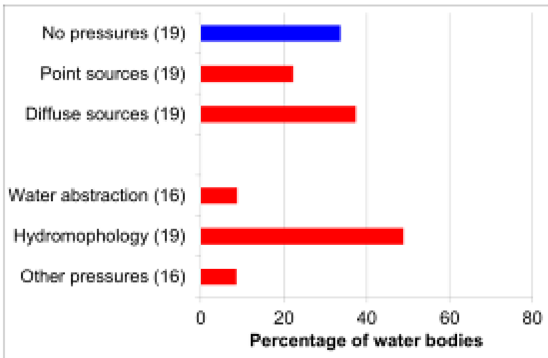
DPSIR framework for the Blueprint - Source: DG Environment, 2012



The present section explores the main Pressures (pollutant emissions, water use, physical restructuring) affecting the state of water resources and identifies the anthropogenic and natural Drivers of these pressures. Then it looks at the degree of implementation of policy Responses, i.e. concrete measures and support actions (institutional framework, policies and legislations, allocation instruments, knowledge base) that would be able to tackle both pressures and drivers if sufficiently implemented.

The main pressures having an impact on the aquatic ecosystems are diffuse pollution sources (e.g. from agriculture, airborne pollution); hydromorphological alterations (physical modifications of surface water bodies e.g. from hydropower, navigation and flood protection) and water abstraction. The picture below shows that these pressures occur in the majority of MS and in a large number of water bodies

Percentage of river water bodies with significant pressures (number of MS in brackets): Source: EEA (2012)



Although considerable success has been achieved in reducing the discharge of pollutants into Europe's waters in recent decades (mainly thanks to the implementation of the Urban Waste Water Directive (UWWD) and the Integrated Pollution Prevention & Control Directive (IPPCD)), point source pollution is still reported as a significant pressure in more than 40% of transitional waters, indicating that there are remaining challenges related to urban and industrial waste water in many deltas and estuaries in Europe. Furthermore, although downward trends in pollution related to urban and industrial wastewater can be observed in most of Europe's surface waters, these trends have levelled in recent years and there are still significant gaps in particular in Eastern and Southern MS[1].

Progress has been significant in reducing the diffuse pollution of nitrates from agriculture[2] and there has also been a gradual reduction in phosphorus concentrations in many European lakes (primarily thanks to improved wastewater treatment and bans on phosphates in detergents). However, agriculture is still mentioned in more than 90% of the River Basins Management Plans (RBMPs) as a main driver causing significant impacts on water quality and quantity.

Declines in emissions have been observed for some hazardous chemicals such as heavy metals from waste water treatment plants and some pesticides as a result of restrictions on their use[3], but the persistency of some restricted substances means that they will still be found for decades in the water environment. Other substances such as pharmaceuticals and personal care products, often referred to as emerging pollutants, are increasingly being monitored and

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[1] See EC reports on UWWD http://ec.europa.eu/environment/water/water-urbanwaste/implementation/implementationreports_en.htm

[2] see EC reports on ND http://ec.europa.eu/environment/water/water-nitrates/index_en.html

[3] See European Environment Agency's 2011 overview of "Hazardous Substances in Europe's fresh and marine waters" (http://www.eea.europa.eu/publications/hazardous-substances-in-europes-fresh).

found in water bodies across the EU. A number of these have properties which pose risk via or to the aquatic environment.[4]

Around 40% of surface water bodies are subject to significant hydro-morphological pressures, which, from the assessment of the RBMPs, emerge as the most significant pressure on river water bodies. Only 12% of such water bodies have been designated as Heavily Modified with a lower environmental objective by the Member States. This means that MS should achieve good ecological status for the remaining 28%, by taking necessary measures to reduce the hydro-morphological pressure such as Natural Water Retention Measures (NWRMs).

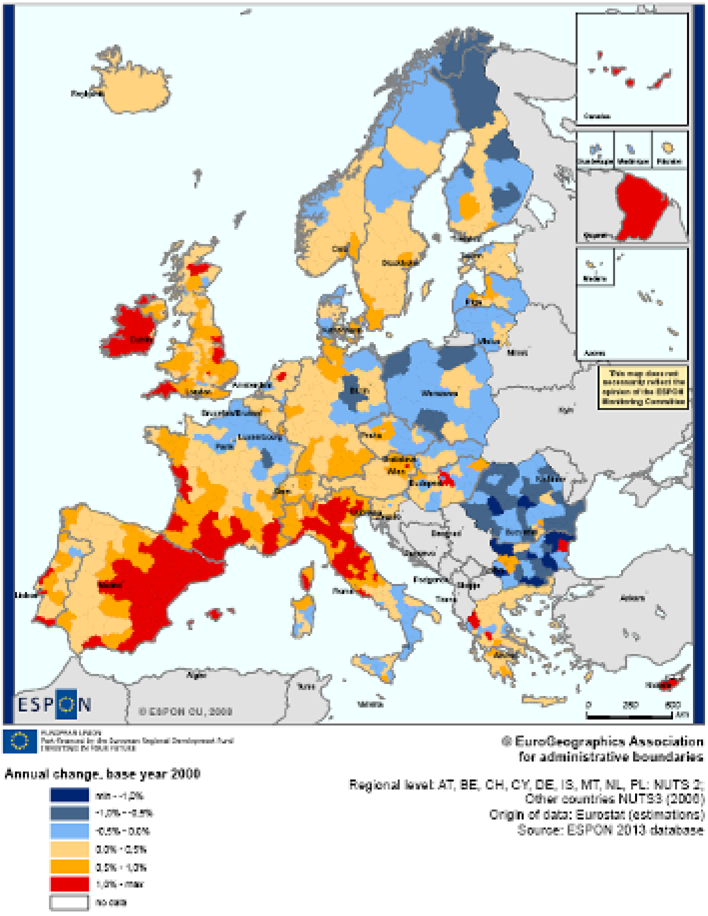
Water abstraction (from surface or ground water bodies) is a main cause of water stress when it goes beyond natural limits (over-abstraction). Main pressures from water consumption (water which is not returned to the water body after use) are concentrated on irrigation and domestic demand, including tourism. Agriculture is the main consumptive user, in particular in the South of Europe, where it is responsible for up to 70% of total water use. In addition, there is considerable ‘loss’ of water (around 40%) in public distribution and supply networks prior to it reaching consumers, thus aggravating shortages in already water scarce regions. Moreover, illegal abstraction is also a worrying phenomenon. It is estimated (WWF, 2006) that in Spain alone there are more than half a million illegal wells. This situation calls for ways to increase water efficiency and tackle illegal water abstraction.

The pressures on EU waters presented above are themselves due to some drivers that can be expressed in terms of demographic growth, land use and economic activity.

Although the European population is increasing slowly over time, analysis of regional trends over the last 15 years show increasing regional variations, with a trend of East-West polarisation, mostly due to negative migration balance in Eastern Europe, and a demographic increase in most of the urban regions and in South-West Europe, mainly due to internal and external migrations (see figure below). This results in a higher demand for water that can stress local water balances.

Annual net migration development for 2001-2005(Source ESPON, 2008)

[4] See Commission Proposal for a Directive amending the WFD and EQSD (COM(2011)876), proposing the addition of priority (hazardous) substances to Annex X of the WFD.



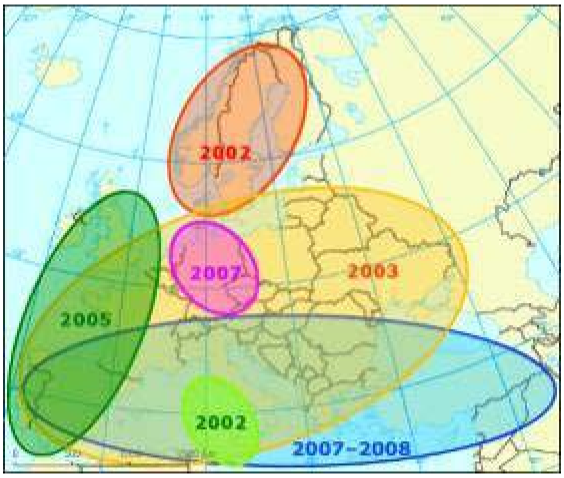
These demographic changes are associated with intense land-use changes, in particular the continued expansion of artificial surfaces (urban sprawl and infrastructure development) at the expense of agricultural land, grasslands and wetlands across Europe, with impacts on the water cycle and water resources (lower recharge of ground water, increase flood risk, leaching of pollutants) (EEA, 2010). Recent studies show that deforestation by urbanisation and industrialisation in coastal areas of certain basins such as the Western Mediterranean can disturb the regional water cycle, reducing precipitation in the region (Ellison et al. 2011), while urbanisation (soil sealing) in the Mediterranean can trigger floods in Central Europe.

The process of conversion into more intensive agriculture is still on-going in Central and Eastern Europe, while intensity remains high in Western Europe, maximising the crop production-oriented functions of ecosystems, with the subsequent impact on chemical and ecological status of water due to nitrates, phosphates and pesticides, and on the water cycle due to drainage (Kravçik et al, 2008). Water pollution and abstraction from industry has been affected by changes in the structure of industrial production in Europe, by improvements in the processes and by regulations on waste water treatment. Regarding consumers, there is an increasing pressure on water resources derived from upgraded standard of living and the use of water consuming technologies in houses or crops in the gardens (Iglesias, 2007).

1.1.2. Past trends for extreme events

Drought is a natural phenomenon. It is a temporary, negative and severe deviation along a significant time period and over a large region from average precipitation values (a rainfall deficit), which might lead to meteorological, agricultural, hydrological and socioeconomic drought, depending on its severity and duration. Data from the recent 30 years suggest that drought events are increasing in frequency across Europe. South-eastern Europe is increasingly facing extended periods of droughts, and both Northern and Western Europe have been affected in more recent years. A prolonged drought across the entire Iberian Peninsula was experienced in the years 1990-1995, while large parts of continental Europe were affected by droughts in 2003. Most recently, UK, France, Germany and Poland experienced a very dry spring in 2011.

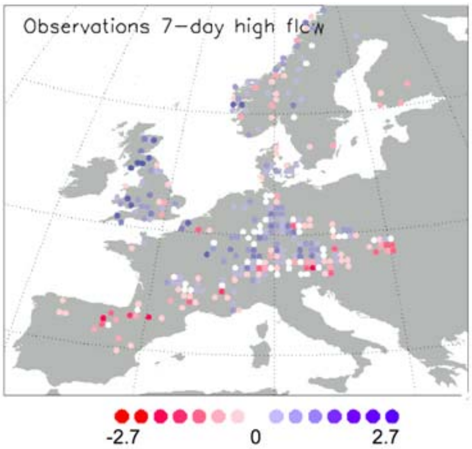
Main drought events in Europe, 2000–2009 - source: EEA.



Floods are extreme events that can have large impacts on human societies and ecosystems. They arise from a multitude of causes and can have very different consequences depending on regional and local circumstances. Floods are part of the natural hydrological cycle, but adverse impacts arise when water masses inundate infrastructures and land that cannot cope with excessive water. Major flood disasters in Europe have caused loss of lives and economic loss that amount to billions of euro, but aggregated over large areas small local floods also produce significant losses. Analyses of trends of past flood events suggest flood hazard have increased in parts of Europe. Available evidence suggests high flows have been increasing in northern Europe, especially in western Britain and coastal Scandinavia. Regional patterns are, however, diverse, with many weak negative trends occurring in northern Europe as well, and a very mixed pattern in central Europe, mainly as concerns fluvial floods..

Flood trends[5] across Europe, 1962 – 2004 - Source (Stahl et al. 2011), quoted in (EEA, 2012

[5] Blue circles denote increase in flood trend, red circles denote decrease in flood trend), with trend magnitude expressed in standardized units



1.1.3. Pressures and drivers

Point source pollution is still reported as a significant pressure in more than 40% of transitional waters, indicating that there are remaining challenges related to urban and industrial waste water in many estuaries in Europe.

The average concentrations of orthophosphate in European rivers halved over the past 20 years. During the past few decades there has also been a gradual reduction in phosphorus concentrations in many European lakes. Phosphorus levels have declined in recent years due primarily to improved wastewater treatment and bans on phosphates in detergents.

They therefore need to be considered alongside other substances during the regular review of the priority substances list under the Water Framework Directive. The Water Framework Directive complements action on chemicals under other sectoral legislation, for example the REACH Regulation, Plant Protection Products and Biocides legislation[6].

Some of the existing physical modifications of surface water bodies are linked to specific legitimate uses such as storage of drinking water, agriculture, hydropower, navigation, flood protection, etc. Where the benefits achieved by the physical modification cannot be reasonably achieved by other means that are a significantly better environmental option, Article 4.3 of the WFD allows Member States (MS) to designate the water bodies as Heavily Modified Water Bodies (HMWB). This is subject to the condition that the change necessary to bring back the water body to good ecological status would have a significant adverse effect on a sustainable development activity. An alternative objective to good ecological status is applied to these water bodies, namely good ecological potential, which takes into account the physical modification that is necessary for the use.

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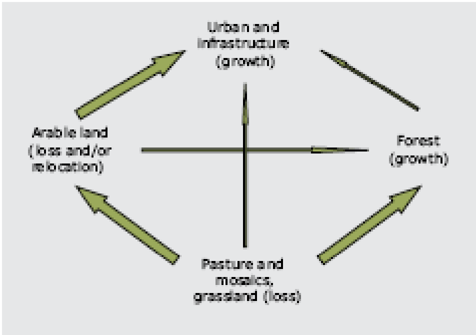
[6] See Annex VI of the Impact Assessment accompanying the Proposal to amend Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy - SEC(2011)1547; http://ec.europa.eu/environment/water/water-dangersub/pdf/sec_2011_1547.pdf

Across most of the continent, urbanisation and the accumulation of assets in flood prone areas have led to increasing trends in the damages and economic consequences of floods. Urbanisation (soil sealing) in the Mediterranean can trigger floods in Central Europe.

On the other hand, deforestation by urbanisation and industrialisation in coastal areas of certain basins including the Western Mediterranean can disturb the regional water cycle, reducing precipitation in the region (Ellison et al. 2012).

Predominant net land conversions in Europe 1990–2006 (source EEA, 2010)



1.1.4. Baseline for the state of water resources

The Baseline developed in the context of this Impact Assessment takes on board geographical and economic disparities across the EU, the uncertainty on climate and socio-economic drivers, and includes the achievements by water policy in restoring and preserving the water cycle and improving the ecological and chemical status of all river basins. The outlook has a medium term horizon (2030) enabling the identification of gaps in current policy implementation and supporting an optimisation model, and a longer term horizon (2050) with a greater uncertainty, to be used for the building of a robust decision making framework.

As indicated by recent IPCC Special Report on Extreme Events[7], "projected changes in climate extremes under different emissions scenarios generally do not strongly diverge in the coming two to three decades, but these signals are relatively small compared to natural climate variability over this time frame." The reference period 1981-2010, including inter-annual variability, is therefore used in the context of the 2030 scenarios, while results provided by the ClimWatAdapt project are used to describe the vulnerability of water resources for the horizon 2050.

The on-going assessment of RBMP provides information on the likely uptake of the measures and resulting pressures to water bodies:

- In many RBMPs, there is considerable scope for greater implementation of source control measures across all sectors and for the restoration of water bodies which have been significantly altered through physical modifications, leading to changes in water flows, habitat fragmentation and obstructions of species migration.

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[7] http://ipcc-wg2.gov/SREX/images/uploads/SREX-SPM_Approved-HiRes_opt.pdf, page 9

- RBMPs include modification of the water pricing system to foster a more efficient use of water (in 49% of the RBMPs), the improvement of the efficiency of water agricultural uses (in 45% of the RBMPs), measures to enhance water metering (in 40% of the RBMPs) and measures to increase treated water reuse (in 50% of the RBMPs).

Impact of other EU policies

The MFF Communication mentions that Environment and Climate objectives need to be reflected in all instruments to ensure they contribute to the shift towards a low carbon, resource efficient and climate resilient economy, which includes obviously the measures needed for the protection of water resources. The communication mentions the intention to increase the proportion of climate related expenditure to at least 20% in the next EU budget (2014-2020). This potentially includes most water management measures as long as they contribute to low carbon economy (water savings, energy savings in water supply and treatment, low input agriculture, etc.) or climate change adaptation (prevention of water scarcity, droughts and floods).

Structural Funds will be available for water resource protection measures, in particular waste-water treatment or recycling plants. They can also support actions to restore ecosystems (including in Mediterranean coastal areas) and actions for green infrastructure projects (natural water retention measures).

The European Commission's proposals[8] for a reform of the CAP after 2013 include a number of measures with a direct or indirect impact on water resources management, in particular:

- 30% of direct payments to be tied to a greening component, ensuring that EU farmers receiving direct payments go beyond the requirements of cross-compliance and deliver environmental and climate benefits as part of their everyday activities.

- Cross-compliance standards for maintaining soil organic matter level and the protection of wetlands and carbon rich soils. Both standards are aimed at climate change mitigation and adaptation but they should also benefit water quality and water quantity.

- The proposal also foresees the inclusion of the Water Framework Directive and the Directive on the sustainable use of pesticides into cross-compliance once they are fully implemented by Member States and concrete rules relevant to farming are identified.

- Extension of the scope of the Farm Advisory System to inter alia the protection of water

- Rural development policy should continue to offer a range of measures which will influence water quality, water quantity and the hydro morphology. Some of these

[8] See http://ec.europa.eu/agriculture/cap-post-2013/legal-proposals/index_en.htm

will operate through investments (e.g. in more efficient irrigation systems or in forestry); others through payments to reward beneficial or mitigating practices (e.g. the Agri-environment-climate measures) or to compensate for disadvantages (e.g. payments to areas particularly affected by implementation of the Water Framework Directive); still others through support for training activities and co-operation on environmental projects. Particular conditions have been proposed for support for investments in irrigation.

- The ambition is that the system of designing rural development programmes should be based more on outputs (results), less on inputs (spending). It will function through more detailed "priorities" – some of which will explicitly mention water – and improved indicators. However, as a safeguard, Member States will be required to spend at least 25 % of their envelope from the European Agricultural Fund for Rural Development (EAFRD) on three key measures relevant to water.

The baseline takes also on board the policies agreed in the Climate and Energy package, i.e. the legally binding targets for renewable energy sources (RES) to achieve a 20% overall share and a specific 10% share in transport and the legally binding targets for non-ETS GHG emissions and the ETS target to achieve the 20% reduction target in 2020 compared to 2005[9].

1.1.5. Unsustainable trends in water resources use and availability

A lack of ambition has been found in many RBMPs as regards achieving the environmental objectives of good ecological status or potential as well as extensive reliance on exemptions. In general, the extensive use of exemptions is not supported by transparent justification of the criteria applied, indicating a degree of arbitrariness in their application. Where deadlines for achieving the environmental objectives are extended beyond 2015, it is often unclear by when the objectives will be reached.[10]

Water status according to the RBMP assessment

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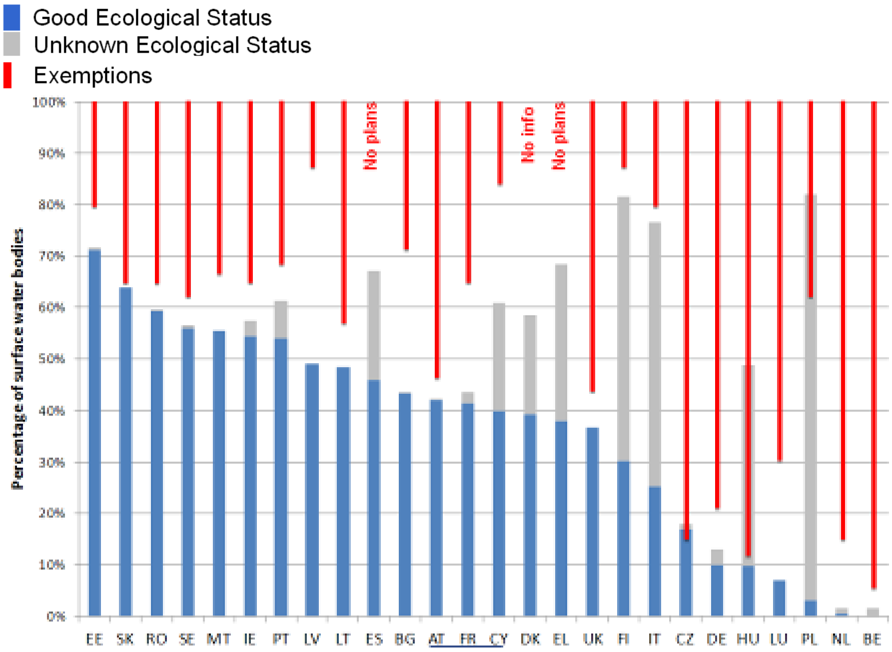
[9] http://ec.europa.eu/clima/policies/package/index_en.htm. See also Impact Assessment of the Roadmap for moving to a competitive low carbon economy in 2050, SEC(2011) 288 final

[10] Annex A RBMP Assessment.



According to the assessment of Water Scarcity and Droughts policy, the policy responses currently in place are not fundamentally reversing the trend in water scarcity in the medium time horizon (2030). Without modification to the institutional and policy measures already implemented or planned, water scarcity in 2030 is expected to increase. Vulnerability to extreme events

The frequency of heavy precipitation events is likely to increase in many areas of the globe, including Europe; this can cause flash flood and pluvial flood events. It is also very likely that mean sea level rise will contribute to upward trends in extreme coastal high water levels.[11] Droughts are also projected to increase.

At global level, the recent GEO-5 report[12] states that despite the progress, there are concerns that the limit of sustainability of water resources, both surface- and ground-water, has already been reached or surpassed in many regions, that demand of water continues to increase and that water-related stress on both people and biodiversity is escalating rapidly. These trends (mapped e.g. in Vörösmarty et al. 2010) confirm the importance of complementing the analysis of EU water resources with an assessment of the impact of goods and services imported into the EU on global water resources, taking into account local water management contexts.

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11 Special report of the Intergovernmental Panel of Cliamte Change : "Managing the risks of extreme events and disasters to advance climate change adaptation - Summary for Policy makers", IPPC, 2012.

12 http://www.unep.org/geo/geo5.asp

The future water situation and developments in the water sector have been examined in Europe until 2050 by the ClimWatAdapt project[13] in terms of vulnerability to water scarcity, droughts and floods. The analyses show that climate change has a major effect on extreme events, i.e. the occurrence of droughts and floods. On the other side, future vulnerability to water scarcity is more dependent on socio-economic development than on climate change impacts, i.e. changes in water use are likely to have more impact on water scarcity than changes in water availability resulting from climate change. Water quality will deteriorate as a consequence of climate change, e.g. because in cases where reduced runoff will lead to lower dilution rates or, on the other hand, in cases where a much higher runoff will cause higher nutrient loads.

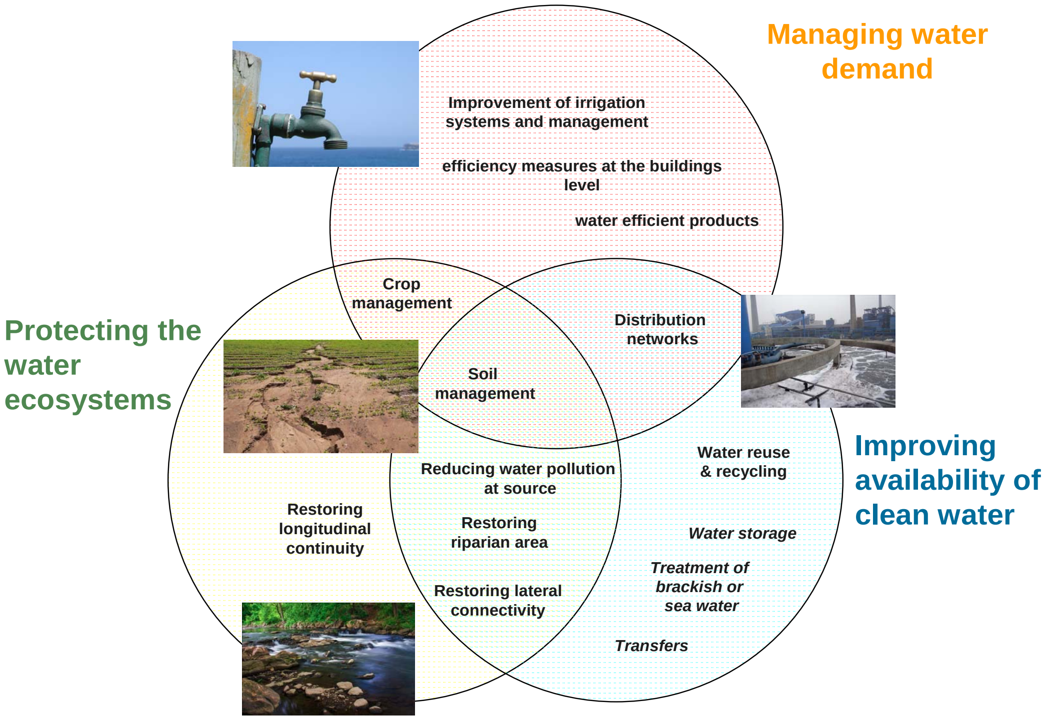
1.2. Hydro-economic modelling

In the context of the Impact assessment for the Blueprint, refining the result of ClimWatAdapt, the Joint Research Centre of the European Commission developed a baseline scenario bringing together climate, land-use and socio-economic scenarios and looking at the implication for water resources availability and use under different policy scenarios. The methodology and the results are described in the support study JRC, 2012. Service contract to support the impact assessment of the Blueprint to safeguard Europe's waters - A multi-criteria optimisation of scenarios for the protection of water resources in Europe, available on https://circabc.europa.eu/w/browse/5a1d878b-9734-46b1-8513-7b32adbd9349

[13] See an executive summary of the project and the reports on http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/climate_adaptation/climwatadapt_report/

2. ANNEX 2: DETAILED ANALYSIS OF MEASURES

The assessment of the state of Europe's waters and of the pressures and drivers at the basis of these status (main report and Annex 1) demonstrates that there is a need for further implementation of water resource management measures in all sectors to improve water resource efficiency and sustainability (see DPSIR figure). The scheme below explains how these measures cover qualitative and quantitative water aspects. It also reflects the choices to be made to reduce water stress, between reducing demand and increasing the availability of clean water:



This annex describes the measures mentioned in the main report and provides detailed information on:

– Information sources, including studies done in the context of the Blueprint

– Key information on the cost-effectiveness, benefits and side-effects

– Barriers for implementation (Market failures, Financing sources, Regulatory support, Concrete rules or definitions, Lack of coordination, Societal, Political, etc.)

– Degree of implementation as reflected by the RBMPs

– Key EU policy instruments that would unlock / guide the implementation (integration, funding, knowledge base, governance issues)

2.1. Measures for controlling diffuse pollution, protecting ecosystems and promoting natural water retention

2.1.1. Description

The WFD environmental objective of good ecological status includes a holistic assessment of the aquatic ecosystems, including hydro morphological aspects. Healthy aquatic ecosystems are necessary to maintain and improve the ecological functioning of ecosystems and thereby also increase biodiversity. Around 70% of the habitats and species protected by EU nature legislation are water dependent. A well-functioning aquatic ecosystem provides services such as self-purification and water retention through connection with its natural floodplain, and proves/shows the maintenance and improvement of water quality and quantity, increasing its resilience to natural or man-made alterations.

Economic activities such as hydropower generation, navigation, agriculture, forestry, land drainage, urban sprawl and flood protection have physically altered the aquatic ecosystems across the EU, reducing their capability to function properly and their ability to host a rich biodiversity and reducing the delivery of valuable ecosystem services. The information provided by Member States in their RBMPs shows that more than 40% of the water bodies in the EU are affected by significant hydromorphological pressures and impacts.

Measures to restore ecosystem functionality are key for achieving the WFD environmental objectives of good ecological status and to restore ecosystem services. The objective is to work with nature and not against it. Some of these key measures focus on:

– Restoring the riparian area of water courses, which provides a natural barrier for pollutants (e.g. nutrients and pesticides), increases biodiversity linked to the aquatic environment, improves resilience and prevents erosion by providing bank stability.

– Restoring the longitudinal continuity and lateral connectivity of water courses by dismantling existing unused barriers and incorporating appropriate fish passes /ladders for migratory species, by removing artificial embankments, lowering river banks, and reconnecting the flood plain with the river, as well as habitat restoration (by restoring bed and bank structure) and establishing minimum ecological flow. These measures are necessary for achieving GES.

– Restoring the natural flow regime of the river (reconnecting meanders or side cut off arms and re-meandering of formerly straightened water courses,), and other flow management measures construction of retention basins, operational modifications of hydro peaking, floodplain and wetlands restoration.

Measures for preventing and controlling diffuse pollution at the source (in synergy with the Nitrates directive and good agricultural practices) include regulating fertilizer and manure spreading, conversion of arable land to grassland, buffer zones, plant cover, crop rotation, woodland creation and wetland restoration. These measures target diffuse pollution but have multiple benefits.

It has been increasingly recognized that these measures, also have a strong capacity for increasing natural water retention and most of them can be classified as Natural water retention measures (NWRM). NWRM aim to safeguard and enhance the water storage potential of landscape, soil, and aquifers, by restoring ecosystems, natural features, and characteristics of water courses and by using natural processes. They are adaptation measures aiming at reducing vulnerability of water resources to climate change and other anthropogenic pressures. They use nature to regulate the flow and transport of water so as to smooth peaks and moderate extreme events (floods, droughts, desertification, salination) and they are relevant both in rural and urban areas. They include forestry measures (Continuous Cover Forestry, riparian forests, afforestation), sustainable agriculture practices (buffer strips, crop practices, grasslands, terracing, green cover, no/reduced tillage, early sowing), sustainable drainage systems (SuDS) (i.e. filter strips, swales green roofs) with a focus on urban areas but also partially applicable to other land uses, and measures that focus on increasing the storage in catchment and alongside rivers (i.e. restoration of wetlands, restoration of flood plains and lakes, integration of basins and ponds, river re-meandering and natural bank stabilization).

2.1.2. Key information on the impacts of the measures

The measures focusing on restoring ecosystem functionality, controlling diffusion pollution and promoting natural water retention deliver multiple Ecosystem Services (ESS), such as flood hazard reduction, water flow regulation, water quality regulation (i.e. purification), water provisioning, soil quality regulation (improvement), provision of habitat (regulation of the biotic environment) and cultural services, and atmospheric regulation (i.e. air quality improvement, climate regulation). Most of them can be regarded either as component of Green Infrastructure or as measures supporting Green Infrastructure, contributing to integrated goals dealing with nature and biodiversity conservation and restoration, and sustainable landscaping. Their multi-functionality contributes to their cost-efficiency and renders them good candidates for sustainable climate adaptation measures. Quantification and Valuation of the ESS they provide is important for assessing their cost-effectiveness even though in many cases the benefits cannot be monetized.

NWRM have direct impacts on hydrology and water retention related to improving soil's water storage capacity, limiting soil erosion, increasing groundwater recharge, conserving water in natural systems decreasing flow velocity, controlling runoff and reducing flood peaks. NWRM and measures traditionally implemented with a focus on the protection of ecosystems have impact on water quantity regulation and on physico-chemical, hydro morphological, and biological quality elements contributing to WFD objectives. Restoring riparian areas of surface waters (either with protected vegetated buffer zones or the establishment of riparian forests) goes beyond the concept of buffer strip to provide a natural fully functional barrier to protect water bodies. This measure provides water purification services and improves river quality by reducing pollution caused by of nutrients, pesticides, and suspended solids, flow (mass) regulation services by regulating erosion and sediment transport in addition to leading to runoff control and ultimately flood hazard reduction. It contributes to the achievement of GES and it improves both the aquatic and the terrestrial ecosystems as it provides ecological corridors providing habitat services (STELLA (2012), WRC et. al. (2012), River Basin Network (2012)).

In addition to the establishment of riparian forests, sustainable forestry practises such as Continuous Cover Forestry and well- designed afforestation of arable land have significant benefits on reducing flood hazard reduction by slowing the flow (increasing evapotranspiration and infiltration) and improving significantly downstream water quality, while delivering multiple ecosystem services such as carbon sequestration, regulation of biotic environment (i.e. habitat provision), and cultural services.

Other measures addressing water protection in agriculture have multiple physiochemical, ecological and hydrological effects (WRC et. al. (2012), River Basin Network (2012)) providing water quality and flow regulation services as well as contributing to regulation of the biotic environment (STELLA (2012), WRC et. al. (2012), River Basin Network (2012)).

Hydromorphological measures (i.e. re-meandering, natural bank stabilization) have multiple benefits, improving all aspects of GES including improvement/regulation of hydrological regime (regulating river flows, improving the hydrological balance, increasing groundwater recharge and summer low-flow, increasing water exchange between the surface and the subsurface environment, and improving chemical and biological status). The improvement of GES leads to increasing clean water availability and providing a water provisioning service (STELLA (2012), River Basin Network (2012)) in addition to the regulation of the physical environment. In addition they contribute to improving the landscape and creating recreational opportunities providing multiple cultural services. However in order to better valuate these measures it is essential that the environmental and resource cost is properly taken into consideration in cost recovery systems.

Related measures for increasing storage alongside rivers such as restoration of lakes, wetlands and floodplains, and creation of buffer basins are amongst the most effective measures for natural water retention. They play an important role in reducing flood hazard reduction, storing water as well as increasing water availability. They improve quality of ground water and surface water acting as natural filters and are valuable for habitat provision. Benefits related to floodplain /wetland restoration have been quantified /monetized in terms of ESS in various case studies (Grossmann 2012).

Sustainable storage Systems provide significant water flow regulation services by contributing to groundwater recharge, runoff control, and consequently flood and pollution risk reduction. They provide a natural water purification service and this can be quantified,

As the benefits of these measures target all the population and not the land-users /owners, it cannot be expected that these measures will be financed by the land users. There is a need for either funding these measures through different mechanisms or providing the means for compensations (i.e. PES). Selection of the measures on local and national level should be performed taking to consideration their cost-effectiveness, accounting both for their positive and negative impacts in economic, environmental, and social terms.

Environmental Impacts

Most of the proposed measures **mitigate soil degradation processes** and have significant impact on **soil quality and function improvement**. Forests (and related measures i.e. afforestation of abandoned land, CCF) improve soil quality as a result of increased organic matter, the action of tree root complexes, the presence of soil fauna, which leads to a macro-pore structure that can result to a "sponge effect" i.e. higher infiltration rates (Nisbet and Thomas, 2006) . Most agricultural measures (including no-tillage and crop practices) have a direct impact on soil quality increasing organic carbon stock, improving biological activity and soil structure, and reducing erosion (EC-JRC 2009). Crop rotation leads to decreased soil erosion reducing soil losses; for example a rotation involving corn, hay, and pasture corps may reduce soil losses by 30 % compared to continuous corn crops (WRC, 2012). These benefits have positive impacts both in terms of agricultural production and hydrological regulation. Urban measures that lead to decreased soil sealing (i.e. filter strips and swales) also can significantly improve soil quality and functioning; for example infiltration rates can be increased up to 87 % by grass filter strips (STELLA, 2012).

These measures contribute **to the regulation of flow and reduction of water resource vulnerability** to CC (and other pressures); natural water storage increase in the soil, landscape, and aquifer result in increased water availability and mitigate flood events by decreasing runoff. The **flow regulation impact** of certain measures **on flood reduction** is more pronounced in smaller scales but not within large basins (Nisbet and Thomas (2006)). It was concluded in a pan-European study involving hydrological data from catchments spanning a wide range of forest types, climate conditions and soil/geology that forestry can have a significant effect on flood flows at the small catchment scale forest growth could result in a 10-20% reduction in peak flows in headwater catchments, while forest drainage and felling could have the opposite effect. (Robinson *et al.* (2003)). Wetlands are one of the most effective measures in terms of flow regulation as they increase water storage, contribute to groundwater replenishment and attenuate run-off.

One possible negative impact **on water availability** is that afforestation could under certain conditions result in low dry season flows depending on the species used and the climatic conditions because of the increased water use (Calder et al. (2007)). In order to fully assess this "forest cover- water yield debate" the effect of afforestation on the regional water cycle needs to be taken to account considering potential of increased evapotranspiration and temperature moderation to contribute to increase precipitation cycles (Ellison et al. 2012). More over even though the soil structure in forests areas favours groundwater recharge, there is evidence that in semi-arid area catchments and in drought periods forests (including dense riparian canopies) could result in lower stream flows and decreased groundwater recharge (STELLA 2012). Finally the effect of afforestation on the water balance is affected by vegetation used (i.e. coniferous vs. deciduous forests) and on whether the previous land-use required irrigation.

A well designed combination of agriculture related measures can have a great impact **on runoff reduction** and **on increase of groundwater recharge**. For specific sites it is estimated that conversion of cropland to grassland the average reduction in peak run-off will range from 50-55 % and 40-45% for a five and 25 year 24-hour recurrence (WRC et al 2012). A 10 % conversion of arable land to permanent grassland for a catchment in Czech Republic was estimated to have 20 % reduction on the surface runoff and an 11% increase on the ground water recharge. No and reduced tillage promotes water uptake and infiltration, while reducing evaporation; it can lead to soil-moisture increase of up to 300 % and 35 % respectively (EC-JRC 2009). Urban natural water retention measures can lead to run-off reductions that can be significantly higher than when using conventional systems; green roofs for example retain 40-90% of rain water, depending on their design (STELLA 2012). Moreover they contribute to recharge groundwater and aquifers in areas under water supply stress.

The reduction of field erosion attributed to agriculture and forestry measures, and reduction of bank erosion as a result of riparian management and river restoration measures leads to an **improved hydromorphological status** of surface water bodies. More over most measures improve the hydrological regime by increasing the connection to groundwater and regulating flow capacity and dynamics Hydromorphological measures such as bank structure restoration, and river re-meandering can reduce stream velocities and improve connectivity with groundwater reducing hydrological response times in high flows effectively leading to a decreased flood risk. Other measures that increase storage along-side rivers include wetland /lake restoration, buffer ponds. These result in **increased water availability** at the landscape as well as reduced flood risk.

These measures can have significant contribution to the improvement of **physico-chemical status of surface and ground water bodies**. Agriculture related measures reduce the need for fertilizer application, and limit leaching of pesticides and nutrients improving both surface and groundwater quality. Conversion of arable land to grassland can result in 22 % decrease of N-loads and 21 % decrease of N concentrations. Catch crops target primarily Nitrogen leaching, leading to a 25 -50 % reduction, depending on soil type and other conditions; targeting an area of 140.000 hectares in a Swedish catchment catch crops let to reduced N loading of 11-16 kg N ha^{-1} y^{-1} (River Basin Network (2012)). The scenarios modelled in PEER 2012 report, illustrate that relevant cap greening measures can lead to significant nutrient (i.e. for Nitrogen ranging from 40% to 94 %) and that restoration of floodplains and wetlands can decrease Nitrogen loading in European seas by 7 % (PEER 2012).

Most of the measures lead to improvement of **biological status of surface water bodies.** Measures addressing hydromorphological pressures lead to improved fish access to upstream sprawing habitats , enlarge the potential of habitat size, strengthening their natural life cycle; a hydropower by-pass can significantly increase total area nursing grounds (i.e for salmonids by 20 %) in Sweden, bed structure restoration can lead to increase of fish types (i.e from 10 to 20) threefold fish density and annual production increase and increase in benthic invertebrate taxa (i.e. from 202 to 273), bank structure restoration and re-meandering lead to increase of macrophytes (WRC et al., 2012). Measures that improve water physico-chemical status and regulate water flows have beneficial effects on the biological status. Besides the improvement of biological status which benefits aquatic ecosystems these measures provide **habitat benefits** for different ecosystem types (STELLA 2012, IEEP et al (2012a)) .

Some of these measures (wetland restoration, forestry measures, urban measures, and agricultural practices) have a positive impact on **air quality improvement and climate change mitigation increasing the sinks for greenhouse gases.** Conversion to Cropland to Grassland for example can lead to soil organic carbon stocks increase by 19 % and sequestration of 332 kg C/ha y for a few decades (WRC et al., 2012).

Ambient temperature and precipitation can be affected by certain measures such as forestry and urban green infrastructure and **water temperature** is also influenced by certain measures for example riparian forests.

Economic impacts

The costs of implementing green infrastructure projects and natural water retention measures have been estimated by a number of recent studies. In a study carried as support of Green Infrastructure Strategy (IEEP 2012a) the costs of green infrastructure schemes at project level were identified based on an analysis of 50 initiatives. The range of project costs varies considerably, depending on the scope and local conditions. For freshwater and wetlands management and restoration the average project costs was 575.5 € million, with a minimum cost of about 128,000 € and a maximum cost of over 4€ billion. Multi-functional farmland

and forestry projects tend to be much cheaper with an average cost of 115.5€ million and a minimum cost of only 50,000 €.

The cost associated with implementation of these measures is a major factor to be considered. The NWRM study provides indicative average EU unit investment and operating and maintenance costs (including opportunity costs) as shown in table below:

Measure	Investment unit cost (€/ha)	Operation and maintenance unit cost (€/ha/year)
Riparian forests	7,527	502
Aforestation /Reforestation /CCF	3,310	500
Urban (swales)	163,174	30,024
Urban (infiltration)	783,234	73,211
Urban (permeable surfaces)	705,589	5,222
Urban (Green Roofs)	537,512	14,132
Grassland	0	371
Buffer strips (along rivers/ arable land)	48	509
Soil conservation crop practices	0	110
No/ reduced tillage	0	31
Green Cover	0	144
Traditional terracing	0	10,818
Early Sowing	0	61
Buffer ponds	53,360	58
Wetland (restoration /creation)	15,776	348
Floodplain restoration	258,647	25,865
Re-meandering	610	2

Investment costs include land requirements (acquisition and compensation) and construction and rehabilitation (investment, design and contingency). Operational costs include operation and maintenance and administrative costs (enforcement costs, monitoring, extension of networks) and other costs (i.e. possible income loss).

The largest impact of these costs would be potentially on the affected land users, mainly farmers. They would need to go through a learning process and adapt their land practices; decreasing operating income and potentially increasing operational costs or they could sell their land and relocate. The extent of these impacts and the impact on the internal market will depend on the availability of support from a land compensation scheme or service payments. The increased adoption of green infrastructure could negatively impact the construction sector, by shifting away from grey infrastructure. One important aspect to consider is that the implementation of NWRMs upstream to reduce run-off can reduce the need for grey infrastructure projects downstream, thus saving costs as Green Infrastructure measures are often low cost solutions. In France, the economic benefits of natural water storage were calculated in terms of the replacement costs of building grey infrastructure like dams. Several studies indicate benefits ranging from € 37/ha/year to € 617/ha/year[14].

As discussed in this study different types of sources (scientific, case studies) recognise that these measures provide a wide range of benefits for flood control and provision of other ecosystem services especially water provision and purification. A cost-benefit analysis found that natural measures lead to flood protection benefits of around €740 million (all actualised benefits 2010-2100), recreational benefits of around €22 million and provide ecosystem services to the tune of around €130 million (Morris and Camino 2011).

Floods and associated damages is a serious concern for Europe. The baseline flood hazard damage, based on the 2010 GDP of the EU (€12,268.4 billion), is estimated for Europe in the following table (STELLA,2012)

Reference	**Flood damage**	
	(% of GDP)	**€ billion/year**
Annual average flow	0.08	9.8
10 year flood period	0.15	18.4
20 year flood period	0.2	24.5
50 year flood period	0.25	30.7
100 year flood period	0.3	36.8

Flood protection and hazard reduction, a direct result of runoff reduction, is one of the most important benetics that can be valuated. Different measures have proven to make significant contribution to flood hazard reduction. Estimations for the marginal values of flood protection benefits for inland wetland restorations range from €37/ha/yr to €617/ha/yr (IEEP et al (2012a) and for coastal wetlands are estimated up to £ 2498 /ha/year for (Morris and Camino 2011). In terms of EU-wide scenario modelling performed by the JRC (JRC 2012) in the context ofthis Impact assessment effective regional NWRM measures can reduce flow peaks (averaged out for 21 RU regions > 3000 Km for a 20 year return period) by 1- 4 %. The impact is evident at the local level where these effects are pronounced: urban natural water retention measures for example in dense European cities can result in flood peaks reduction of up to 20 %, crop practices can lead to a reduction of flood peaks in certain sub-catchments (in Danube area) of up to 15 %. Site specific analyses can provide more detailed information for the impact of certain measures on specific catchments with local reductions of up to 50 % (WRC et al. 2012).

[14] Schéhérazade et al., 2010 in IEEP, 2011

Increasing the storage capacity in the soil, landscape, and aquifers can lead to higher water availability in general (both in terms of groundwater and surface water), but especially to a more balanced situation in dry Summer months (JRC 2012). Urban Natural water retention measures for example can result local increase of low flows up to 20% in areas near Paris and London.

Beyond flood hazard reduction, water flow and quality regulation and is also associated with the increase of clean water availability which can have important economic benefits in terms of **water stress reduction and water provisioning**. In terms of benefits relating to increase of water availability the NWRM study (STELLA (2012)) estimates and groundwater recharge benefit to be proportionate to the groundwater abstraction cost (€0.055/m^3). The increase of **clean water availability** can influence positively different sectors of the economy. Beyond the impacts that reduced water stress can have on agricultural and fisheries production, this can have significant impacts on industry and tourism. This impact is analysed with the hydro-economic modelling performed for this impact assessment.

There are positive and negative impacts for **agricultural production**. In addition to reduced water stress and the soil improvement impacts of certain agricultural related measures can result **in increased soil fertility and improved agricultural production**: Crop rotation and catch crops contributes to improving the health status of grown plants lead to a reduced need for N fertiliser application on the crops and/or a higher yield for the succeeding crop(s). For example N fertiliser is not needed for legume crops. Yields for a crop grown in rotation with other crops are usually 5 to 15% greater than for continuous monoculture of that same crop (WRC et al 2012, River Basin Network 2012)). More over certain measures can result in **decrease production costs.** Catch corps (in Southern regions) can lead to reduced irrigation needs and water consumption (River Basin Network (2012)). However certain measures that result in decrease of the arable land (even if CAP consistent) could result in decreased production It is therefore important to properly evaluate the impact of agriculture related measures that when performing CBA analysis the sustainability constraints are taken to consideration. Reduced tillage can also be driven by the cost reductions (e.g. fuel, equipment, and labour reduction). A case study in the Uckermark area, Denmark estimates cost savings of €28-70/ha/year or an average of €49/ha/year (EC-JRC 2009.

The improvement of water quality and quantity can have significant **Avoided water treatment (drinking water) costs.** "High levels of nitrogen can result in increased costs for drinking water production and can result in missed revenue derived from recreation in and around waters (Elsin et al. 2010). A frequently used method of estimating the value of changes in land use or the results of river and wetland restoration consists of estimating the averted costs of water treatment (La Notte et al. 2012). These averted costs are a portion of the benefits that result from an improvement of the water quality as expressed by a reduction of nitrogen concentration. Cost savings are a social benefit and a straightforward way to link water quality changes to particular economic outcomes (Elsin et al. 2010)." (PEER 2012)

The reduction of runoff especially in urban areas with SuDS can lead to **reduction of drainage infrastructure cost**. In terms of infrastructure SuDS construction costs can be as low as 1/4 of conventional drainage costs; for example £61,400 (for SuDS) as compared to £272,600 (conventional drainage) were required to reduce runoff at a UK school-site to greenfield rate. Beyond drainage infrastructure SuDS can reduce costs of **waste water treatment infrastructure** and can lead to **avoided waste water treatment costs** for areas with combined sewers systems. Retrofitting SuDS in urban areas involves disconnecting drained areas from sewer systems and using natural water retention to reduce both sewers overflows but also needs for treating rain- water in waste water treatment plants in Urban areas which can significantly decrease the investments and operational costs required for waste water treatment. (For conventional waste water treatment the operational cost of waste water treatment is on the average **€ 1.9**/m^3 (JRC 2012) and the capital investment is USD 593-741/m^3 per day (**€474 – 593**/m^3 per day). (OECD, 2012)).

These green infrastructure related measures under consideration can create **opportunities** for recreational activities which can lead to business developments and green job development which relates to social benefits. By improving cultural heritage Green Infrastructure projects increase the recreational benefits of an area, which enhances a region's ability to attract tourism. A green infrastructure initiative in central England targeting has resulted in 20 new tourism attractions, and attracts 8.7m visitors annually, bringing tourism revenues of €321 million to the local economy (Naumann et al., 2011).

Social Impacts

Beyond the avoided costs and job opportunities that can be created the social benefits related to these measures can be viewed within the context of Green Infrastructure. As a result of access to green space and recreation opportunities include improved levels of physical activity, promotion of health and mental well-being, and facilitation of social interaction, inclusion and community cohesion. (Forest Research, 2010). In addition social impacts arise from an increase in temporary jobs due to project implementation and in full-time jobs for maintenance and from increased tourism opportunities and local recreation opportunities.

Social impacts related to job creation are highlighted by anecdotal evidence and serve as an indicator for potential impacts:

- Improved employment and labour markets:
- The restoration of riverside areas in Lyon, France created between 60-120 temporary jobs in 17 companies (Naumann et al., 2011).
- In the UK for every €1million spent on agri-environmental measures under the Environmental Stewardship scheme one Full-time job is supported (Mills, et al., 2010 in IEEP, 2011).
- An IA of promoting GI over grey infrastructure for flood management found that investments in ecosystem based solutions reduce jobs in sectors focusing on conventional flood management but an increase in jobs through GI projects negatives the loss and overall net effect as neutral (IEEP, 2011).
- Improved job quality: According to IEEP (2011), GI enhance labour productivity through improved health as a result of better air quality, green views, and increased outdoor recreational activities. IEEP references a 2009 Study of a forest project in England, which estimated annual net benefits of £20,000 as a result of reduced sick days, as well as annual cost savings of £13,000 as a result of improved health through physical recreation. In addition, the study found that better air quality resulted in net annual benefits at £116,000 due to less air pollution (Regeneris, 2009 in IEEP, 2011).

For many of the measures involving site restoration and environmental protection, existence value is an important "non-use" social benefit. This can have different origins including moral, spiritual, cultural heritage, and aesthetic reasons (Dana 2004). The Willingness to Pay (WTP), an estimate of what society is willing to pay for restoration actions can be an indication of value that individuals place on certain measures that focus on ecosystem protection. According to PEER (2012), a study in Danish catchment for WTP for ecological status improvement, concluded that the WTP for improving ecological status of lakes and fjords which originally have "poor" status to good / very good, ranged from 68.59 € person-1 year- to 128.77 € person-1 year. These values can be further affected by the individual income and distance to the water bodies. Similarly based on UK studies for estimating the non-market benefits, the average WTP for ecological status improvement of rivers and lakesis £55/household/year (Morris and Camino, 2011). A meta-analysis on WTP for wetland conservation provided an estimated function of WTP in terms of scope, income, and distance decay, for the EU-27 which ranges from €2 - €27 (annual per person) (Grossmann, 2012).

On the other hand, there are potential negative social impacts in case land users would abandon their land or would suffer from losing operating income/increased operating costs which are not compensated for.

Overall the impacts that are attributed to these measures can be summarized in the following table:

Impact / Measure	Environmental	Economic	Social
Measures for controlling diffuse pollution, protecting ecosystems and promoting natural water retention	Improvement of chemical status of surface and ground water bodies Improvement of hydro morphological status of surface water bodies Improvement of biological status of surface water bodies Improvernt of quantitative status of groundwater bodies Regulation of flow and reduction of water resource vulnerability to CC (and other pressures) Habitat improvement Soil quality and functioning improvement Air quality improvent (sink for greenhouse gases) Positive influence on temperature and precipitation	Reduce flood hazard costs Reduce water stress and increase water availability benefits activities in different sectors (agriculture, fisheries, industry, tourism) Reduce waste water treatment costs (by reducing treated runoff) Reduce drinking water treatment costs (by improving water quality of ground and surface sources) Promote green growth (eco-tourism, and recreational services, eco-engineering and eco-design (i.e. SuDS) Carbon offsets	Improved access to sufficient and high quality water Reduce stress related to impacts of extreme events (scarcity and floods) Provide a healthier /pleasant living environment Provide access / proximity to nature with recreational opportunities Existence value (moral, spiritual, cultural, aesthetic…)

2.1.3. *Barriers for implementation*

Market failures:

As discussed above cost effectiveness of the measure is not always evident (especially since certain ESS can not be accounted for). Certain measures require a large investment. Because of the scale of measure applicability there is the issue that different stakeholders bear the costs and different stakeholders receive the benefits. Thus financing becomes a key issue.

Also implementation of these measures could lead to loss of revenues as they often provoke land-use changes, involving the extensification of farming practices, losing productive land and decreasing productivity. In addition, land with economic value would be necessary to implement the measures and to restore or connect the landscape (STELLA (2012)). Payments for Ecosystem Services based on private initiatives could be an effective tool for resolving conflicts, and compensating market failures to address these loses, but there is still need for a wider methodological framework for its application and this tool is not always feasible for application by non private entities.

Financing sources

So far these measures have been implemented to some degree through co-financing of EU funds, such as the LIFE Programme, but these funds are not enough for a wide implementation of these measures. Other EU funds such as the Structural and Cohesion funds are being used for fairly large investments (tens or hundreds of million euros) of man-made measures such as dikes, have not yet been utilized natural retention water measures investments (STELLA (2012)). Some of the EU policies, such as the CAP, provide subsidies to compensate for losses related to land use / practice changes. The EU's rural development policy has been rather more successful at channelling funding into investments in ecosystem protection (as well as into annual payments serving similar objectives) – though there have been obstacles to doing so (e.g. the limited duration of rural development programmes, the need to find match-funding from national / regional budgets, other objectives competing for funding).

Regulatory support

Certain barriers in terms of integrating these measures with other policy implementation actions can attributed directly to regulatory support in the EU and MS level. There is lack of binding targets in EU policies (and funding instruments) and prospects for supporting the measures only through voluntary measures resulting in lack of motivation, discretionary power to MS can lead to low uptake of the measures (i.e CAP, Cohesion, Structural).

The measures may simultaneously impact stakeholders representing different sectors leading to potential conflicts of different land users especially if their multifunctionality is not properly exploited. This is more complicated because while the "burden" of these measures in terms of cost (and land use management) are quantifiable in a local level the benefits are often fully quantifiable in a larger scale (even though there are local benefits). EU policies influence LU with different constraints (WFD, FD, Nature and Biodiversity, Cohesion, CAP), but spatial planning is decided on MS level. Even though the objectives of different policies could be simultaneously achieved under these measures, that are multifunctional by nature resulting in decreased land demand on a national scale, the implications on the local scale and stake-holders need to be addressed and resolved with an integrated spatial planning that accounts for these requirements.

Lack of concrete rules or definitions

The lack of concrete rules /definitions in relation to these measures, or the scope of existing rules, can lead to reduced uptake of these measures, and/ or reduced efficiency of the implemented measures.

The timing of guidelines issuing in relationship to policy implementation can also be crucial. For WFD for example Climate change was introduced in CGD24, published in 2009; therefore it was too late to be included in most of the first management cycle of River Basin Management Plans (RBMP), and is recommended for the second management cycle of the RBMPs (2015) and the Flood Risk Management Plans in 2015.

As more information becomes available through further investigations, hydro morphological measures should be defined and described in the river basin management plans (e.g. their geographical extent, technical details). Methods used to define minimum ecological flow requirements (national or regional methods) should be clearly indicated in the plans. On EU level, there is a need for more standardised methods and development of a common understanding for setting minimum ecological flow. In the Member States, monitoring programmes should target stretches where minimum flows are applied, to gain further knowledge on the specific effects of minimum flow application on biological quality elements. In combination with lack of guidance, training and tools that would lead to wider implementation of these measures at EU level, the lack of skilled personnel in particular posts, or lack of NWRM knowledge and skills in certain sections (forestry/agriculture), In some cases the main obstacle for the implementation of measures (i.e. early sowing/filter swales) is that they are unknown /or that their effectiveness is underappreciated . More over regional authorities do not have tools or capacity to implement the climate check and take to account climate change in planning programs of measures (STELLA (2012)).

Technical barriers that hinder the development of concrete rules include:

– Lack of tools for quantification of certain benefits (i.e. correlation of measure's impact to specific ESS indicator). This can be cumbersome for certain ESS i.e. provision of habitat or impact on water quality (IEEP et al. 2012a)**.**

– Lack of practical economic valuation tools and comprehensive CBA methodologies especially for valuation of benefits and assessment of trade offs (IEEP et al. 2012a Ecologic Instituted and GHK Consulting 2011) are not mainstream (still need development)

Lack of coordination

Implementation of these measures requires co-ordination between different levels of authorities (national, regional, local) and broad range of stakeholders (i.e. farmers) representing different sectors. This would require dynamic, flexible, and well integrated and efficient governance structures.

Coordination is also important for the long-term maintaining proper measure implementation. Certain measures (i.e. SuDS) require commitment for continuous management / maintenance of public areas which bring additional costs and administrative burden on local management authorities (Northern Ireland Environmental Agency 2011). Maintenance can be crucial for other measure effectiveness for example if riparian forests are not maintained properly they could have adverse impacts on floods ((STELLA (2012)).

In addition to long-term action, certain measures i.e. establishment of terracing require collective action in order to become most effective, therefore requiring some formalized form of commitment which would also need regulatory support (i.e. requirement in the CAP for large scale action for certain payments).

With respect to hydromorphological measures, RBMPs should be precise on the expected effects, especially on the way they are expected to improve the GES/GEP at water body level. Moreover programmes of Measures should distinguish between hydromorphological measures proposed for natural and for heavily modified or artificial water bodies. The linkage between specific water uses, types of hydromorphological pressures and specific hydrohydro morphological measures should be detailed in the river basin management plans.

Societal barriers

Beyond legislation requirements, the objective of achieving good ecological status is not considered as a priority by society. This can be attributed to the fact that its is taken out of its broader social and economic context, and in order to be more appreciated by stakeholders the linkage to the societal benefits needs to be demonstrated. (Everard 2012)

More over respect to reducing vulnerability to extreme events, there is difficulty for the society to accept the impact that soft measures may have, and as a result there is lack of willingness to support them (STELLA (2012)).. This difficulty is partly related to the lack of knowledge regarding using nature's capacity and natural approaches for protecting environmental resources and reducing their vulnerability, and minimizing related risks. There are misconceptions about technological / grey infrastructure solutions being always superior and necessary to deal with environmental problems and CC related risks and extreme events and lack of awareness to the potential of ecosystem services to provide the solution or to be part of the solution. (For example the removal of hard bank stabilisation could be rejected by riparian populations due to fear of losing control over floods.)

Overall there is lack of prioritization for nature conservation in general and long-term water resource protection. Society is mostly interested on immediate impacts rather than long term impacts that, so there is resistance to change practices if the problems are not pressing, or if it is not evident that the solution will have an immediate and effective response. To this, it is important to involve – at all stages - farmers on the definition and planning of measures ensuring a common understanding of objectives. It is necessary that farmers are absolutely committed to the implementation of measures – including the acceptance of pricing policies.

Societal resistance is also related to the lack of incentives (i.e. financial) for promoting such soft measures. However even if compensations are offered, there is resistance to change practices if the problems to be solved by the land use management concerns a different group of stakeholders (i.e. downstream) in which case incentives need to be stronger.

Finally land owners believe they should have freedom for deciding management practices that will provide them biggest returns and resistance can be attributed to insecurities that related to potential loss of income.

Political barriers

Despite the ambitious targets of WFD, the main problem against action is lack of political will for establishment of binding targets in particular to mandatory measures for land users. The political will could be adversely affected by all other barriers, in particular societal, financial, and timing. One major characteristic of these measures is that they are often cross-sectoral and this can lead to different type of barriers i.e. opposition to specific leadership focus.

Timing barriers can reduce political will. Some measures (i.e. forestry) benefits are not immediate, they start becoming effective after certain years for example in CCF project it took 30 to 40 years for the diversity of structure to become apparent. This can lead to measures loosing societal interests and political influence

These barriers can be tackled with different responses. Knowledge base for technical barriers (and other) and societal, Integration for spatial, timing, financial, Governance for institutional, and timing, Economic Incentives for financial and societal and political will can be affected by all types of responses.

2.1.4. Degree of implementation as reflected by the RBMPs

Certain measures that promote natural water retention and protect the ecosystems by targeting diffuse pollution, and improving ecological status and potential are included in the RBMPs (measures for restoring hydromorphological conditions, agricultural measures,), but their scope and timing are often unclear and exemptions are foreseen. There is therefore scope for a wider implementation of these measures, with a larger perspective.

A significant proportion of RBMPs include **measures to restore hydromorphological conditions** of surface water bodies (e.g. buffer strips, restoration of wetlands or floodplains) or measures ensuring the continuity of the river body for fish migration or sediment transport. However, the high proportion of exemptions applied by the MS indicate that the expected level of implementation of these measures is far from that needed to achieve good ecological status. As regards protected areas, 60% of the plans include measures to **protect water bodies** used for the production of drinking water, including safeguard zones, which are also NWRM.

NWRM measures were implemented in some countries as part of climate checks of RBMP (STELLA (2012)). In Ireland a climate check was carried out when elaborating the Programmes of Measures; for example the Western River Basin District River Basin Management Plan (RBMP) has gone through a climate check and proposes no-regret measures and win-win measures including establishing buffer zones of agricultural land to reduce diffuse nutrient pollution, ecological improvements for increasing the water retention capacity of soil and helping against increased flood risk, altered and the creation of buffers around water bodies to improve the soil and subsoil water retention and reduce the flood risk. In Germany the River Elbe RBMP refers to the catalogue of measures published by the Working Group Water of the Länder (LAWA), and has already integrated no-regret measures into its planning that promote restoration of typical run-off and natural retention. Another example is the Tisza River's RBMP, which covers parts of Ukraine, Romania, Slovakia, Hungary and Serbia. This RBMP states that aquatic ecosystems are more resilient to the impact of climate change when they are healthy and well maintained stating that any action geared towards more resilient ecosystems is a no-regret measure. Overall however this Green Infrastructure approach for reducing vulnerability of water resources is currently still under-exploited. The environmental impacts of forestry are acknowledged in certain cases but they are not necessarily linked to WFD objectives.

Several RBMP from other countries also mention no-regret measures to some extend. According to the preliminary analysis of RBMP,(WRC et al 2012, EC 2012c) hydro morphology measures have been introduced in water management, for example re-meandering is measures are proposed in 32 % of the plans and natural bank stabilization (removal of structures) in 70 %.

In 40% of RBDs (48 of 119 RBDs reported by Member States), no clear links were reported between uses, pressures, and hydromorphological measures but there is partial information on links between uses and measures or between pressures and measures. For example, a plan may indicate the number of fish passes proposed to restore river continuity at specific barriers, but the water uses which these barriers serve are not stated (e.g. navigation, hydropower etc.).

In the case of hydropeaking which is a pressure related to the use of water for hydropower, the ecological status of water bodies can be improved through operational modifications (e.g. downstream "buffer" reservoirs) that reduce the volume and frequency of artificially generated abrupt waves and avoid extreme water level fluctuations. In RBDs which report the interruption of longitudinal continuity (dams, weirs, impoundments) due to hydropower use, fish ladders, bypass channels or removal of structures have been proposed as measures in different combinations. In RBDs with HMWBs designated due to hydropower (91 out of 119 RBDs), relevant measures proposed to deal with hydropower-related pressures are varying. In ca. 65-70% of these RBDs, removal of structures and fish ladders are proposed, but only 30% of these RBDs propose operational modifications of hydropeaking.

With respect to targeting diffuse pollution the Member States have all included agricultural measures in the programmes of measures with a great variety of technical, non-technical measures or economic instruments relevant to water protection in agriculture. The measures that have been applied in different river basins of various member states included establishment of Wetlands, Buffer Strips, cover crops and catch crops, crop rotation, conversion of arable land to grass land, and woodland creation ((WRC et al 2012, River Basin Network 2012). However it remains unclear to what extent the measures will deliver and will enable the river basins to reach the good status of water. The scope of the measures (e.g. type / number of farms targeted, geographical coverage expected), the timing and the financing are often unclear. In particular the link with the Rural Development Programmes is often missing (only present clearly in 60% of the RBMPs). Moreover the hydromorphological impact of agriculture is not always sufficiently acknowledged and addressed in the plans, and the potential of these measures for nature water retention is not fully exploited. Finally there was little involvement of the farmers in the preparation of the first RBMPs and in the practical selection of the measures (the level of involvement has been assessed as significant in 18%, moderate in 30% and basic in 30% of the RBMPs.

2.1.5. Key EU policy instruments that would unlock / guide the implementation

Integration

The new greening component of the CAP legal proposal for Pillar I has potential for supporting these measures provided that the implementing rules support these actions. The maintenance of permanent pastures is important for measure "Restoring Meadows and Pastures" as long as the baseline selected for preservation target is not distorted by the time the measure enters to effect. The ecological focus areas could be applied for traditional terracing, afforestation of agricultural land, riparian forests, basins and ponds, buffer strips along water courses and arable land, and certain Sustainable drainage systems for example filter strips and swales. Restoration of riparian areas is important in agriculture landscapes, and is at the expense of a very small percentage of land (less than 0.5% according to EEA estimates). The Ecological Focused Area proposed by the Commission in the CAP pillar I proposal, if used wisely along water courses (i.e. in a contiguously), together with the EAFRD, can play a very important role in promoting the restoration of riparian areas in the agricultural context.

Concerning cross compliance the agriculture NWRM could be supported through different GAECs (buffer strips, soil conservation crop practices, nor or reduced tillage, early sowing, and traditional terracing). Moreover, WFD in cross compliance as an SMR has the potential to include NWRM though in a preliminary stage it would only include basic requirements.

Streamlining with other environmental policies is important. The links of WFD with Nature directives were recently highlighted in the FAQ (http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/biodiversity_water/faq-wfd-bhd_20dec2011/_EN_1.0_&a=d) and in a discussion paper on the synergies of Water, Marine, Biodiversity, and Nature objectives agreed by the water directors(http://circa.europa.eu/Members/irc/env/wfd/library?l=/framework_directive/thematic_documents/biodiversity_water/biodiv-water-marine/_EN_1.0_&a=d). The Common Implementation Framework of Nature and Biodiversity policy is developing a framework on ecosystem and ecosystem services mapping, and a no net loss initiative. Synergies with these initiatives will be explored. Similar efforts are on-going for streamlining of monitoring and reporting of monitoring results under the NiD, WFD and SoE. Most natural water retention measures can be regarded as a component of Green Infrastructure contributing to integrated goals dealing with nature and biodiversity conservation and restoration, landscaping, etc. and therefore should be supported by the up-coming Green Infrastructure strategy, which could contribute to resolving integrated spatial planning conflicts. Finally it is expected that these measures will be supported by the Climate Adaptation Strategy since they are adaptation measures.

Funding

The Common Strategic Framework (CSF) funds, and more specifically the EARDF, ERDF, and Cohesion funds, could be exploited for funding these measures.

With respect to EAFRD there are possibilities to fund these measures through several rural development articles including investments in farm improvements, forest area developments, afforestation and creation of woodland, prevention and restoration of damage to forests, investments for the resilience and environmental value of forest ecosystems, Agri-environment- climate commitments, Natura 2000 and Water framework directive payments, forest-environmental and climate services and forest conservation., In the scope of agri-environment-climate payments there could be scope to clarify the possible relevance of these payments to water through delegated acts implementing the rural development regulation. Related capacity building could be enhanced using the knowledge transfer and information actions, the farm advisory services, and the co-operation actions, can help promote this green infrastructure approach and help overcome certain barriers. In the CAP legal proposal it is stipulated that the WFD should be considered in the Farm Advisory Services in the next CAP. The LEADER action provides additional opportunities for public-private partnerships and inter-territorial and transnational co-operation and this can receive support from other CSF funds. According to the Commission's proposal for rural development policy for after 2013, Member States / regions would have to analyse their water-related needs within the system of strategic programming and, if appropriate, choose measures to address those needs

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These measures can play a positive role in sustainable development (urban and rural) and create employment opportunities. Exploring funding possibilities through Cohesion and ERD funds is encouraged as they can relate to the different investment priorities including (promoting low-carbon strategies for urban areas, supporting dedicated investment for adaptation to climate change, addressing the significant needs for investment in the water sector, protecting and restoring biodiversity, improving the urban environment). Again the degree of to which these measures will be supported with the Cohesion and ERD funds depends highly on the investment priorities that are included in the operational programs for each Member State but also to the selection of investments that is made to support these priorities. It is up to the MS to decide for example if grey or green infrastructure investments will be made for flood protection (considering flood protection is set to as a priority). Another inhibiting factor is the lack of tangible indicators related to these measures. As it is required that the operational programs identify specific indicators for monitoring purposes, it is crucial for NWRM and other measures related to ecosystem protection to be correlated to quantifiable and clear indicators.

The multifunctionality of the measures renders them possible for integrated territorial investments (ITI) for the ERDF and Cohesion Funds, as they can be related to more than one priority axis of one or more operational programmes. For example investments in Continuous Cover Forestry (to substitute clear-felling systems) can deliver objectives under protecting the environment priorities – addressing the needs of water sector (improving groundwater quality and quantity) and protecting biodiversity and soil protection and promoting ESS (positive impact on habitats, improved soil structure and organic content) but also in promoting climate change adaptation and risk prevention and management (flood hazard reduction). It will be however essential for the MS to have access to information, tools, and guidance to identify and select measures that provide optimum benefits for several areas and sectors. More over the essential governance structures for effective collaboration between sectors will need to be in place.

Knowledge base

The "LIFE+ Environment Policy and Governance guidelines" indicate favourable recommendations under the listed themes (e.g., forests, water, soil, climate change, etc.) and to some degree projects in line with the concept of natural water retention were funded. In the

2012 call there are specific references and opportunities for NWRM in the Life Environment. Moreover opportunities are provided for Development best practice examples for integration of WFD concerns into sector policies (including improving fish migration, habitat restoration, reducing eutrophication sources) and green / blue infrastructures.

Under the new regulations for 2014-2020 opportunities for funding could be feasible both under the Climate Action and the Environment Action subprograms. Under the Climate Action possible funding is expected thought the Climate Adaptation Priority Area, as these measures target reducing vulnerability of water resources to CC, and under the Environment Action funding is expected both under the Environment and Resource efficiency and the Biodiversity priority areas. However even though the scope of LIFE funding is expanded to certain degree with the inclusion of integrated projects the budget is small compared to other instruments, allowing for a small number of integrated projects. The instrument is mostly indented to provide best case examples with demonstration and /or innovation aspects. Projects that try to fill in knowledge gaps, demonstrate applicability, and provide tools for overcoming barriers would be good candidates. This can assist policy development, however it funding through this instrument cannot provide the investments needed for un-locking these measures.

Research funding mechanisms i.e. FP6, FP7 have supported research projects in environment related thematic areas filling in the knowledge gaps that are be related to certain technical barriers, as well as projects development of knowledge brokerage tools (i.e. WISE-RTD[15]). Other science Policy interfacing activities, such as the ad-hoc Science-Policy Interfacing Activity under the WFD Common Implementation Framework also contribute to accelerating research results dissemination and improving transfer and usability of relevant research outputs. The European Innovation Partnership on Water (EC COM(2012) 216 final) also has the potential to support partnerships and innovative ecosystem-based solutions that involve measures described above.

Governance issues

In relationship to the WFD, NWRM could be further promoted for the program of measures (for both basic/supplementary). They can contribute to achieving WFD environmental objectives, safeguarding water quality, reducing diffuse pollution, enhancing hydromorpological conditions, ensuring GW recharge, reducing water resource vulnerability to CC, and serving as CC adaptation measures in relation to water management.

In addition to GD12 and GD24, new guidance documents could be developed for identifying the role of these measures for achieving WFD and FD objectives. (or thematic guidelines for different group i.e. forest measures, SuDS, etc.). In terms of "unlocking" the measures their implementation this can be done within the scope of any future activity that focuses on implementing the ESS with RBMPs, NWRM can be an example of applying the Ecosystem Services Approach.

15 http://www.wise-rtd.info/en

2.2. Measures improving water availability

2.2.1. Description

Desalination is the specialised treatment method used to remove dissolved minerals and mineral salts (demineralisation) from the feed-water (fresh water, brackish water, saline water, but mainly from sea water) and thus to convert it to fresh water mainly for domestic, irrigation or industrial use. In Europe, several countries have turned to desalination technologies, especially in the southern more water scarce areas. Several Member States use desalination as an **alternative water supply** source to remedy water stress situations. In 2008 Spain had the largest desalination capacity in the EU with up to 713 Mm3/day. Malta had a desalination capacity of 14 Mm3/day (more than 45% of its total water needs), while Italy reached around 0,75 Mm3/day, and Cyprus around 0,093 Mm3/day (TYPSA 2012). More and more Northern European Countries also use this option. For example, in the UK, the company Thames Water has built a desalination plant for meeting the future water demands of the London metropolitan area.

Water transfers – are used to transfer water from one river basin where water is considered abundant to another one where water is scarce. The interbasin transfer of water, when implemented on a large scale, is one of the most significant human interventions in natural environmental processes. Water transfer has potential for substantial beneficial effects through alleviation of water shortages that impede continuing development of regions without adequate local water supplies. But transfer also has potential to limit future development of the area of the transfer's origin and to produce other negative effects.

Groundwater recharge is a hydrologic process where water moves downward from the soil surface towards groundwater. Recharge occurs both naturally (through the water cycle) and man-induced (i.e. artificial groundwater recharge), where rainwater, surface water and/or reclaimed water is routed to the subsurface. Artificial groundwater recharge aims at the increase of the groundwater potential. This is done by artificially inducing large quantities of surface water (from streams or reservoirs) to infiltrate the ground. It is commonly done at rates and in quantities many times in excess of natural recharge. The number of aquifer recharge and re-use schemes in Europe, and around the world, has expanded in recent years. The primary driver for this expansion has been the increasing demand for water to meet agricultural, industrial, environmental, and municipal needs. In southern Europe, the uptake is predominantly motivated by agricultural and municipal water needs, whereas in Northern Europe groundwater recharge is mostly found in densely populated areas for use in households (e.g. Berlin, The Netherlands).

Dams and reservoirs for **water storage** can be potentially used in most water scarce areas, where water efficiency measures can't fully resolve the problem. A dam is a barrier that produces changes in the hydro-morphological and physico-chemical conditions of the impounded river. River damming is one of the most ancient techniques used for water supply. Large dams have long been promoted as providing "cheap" hydropower and water supply, reducing also flood impacts to populated floodplains. A reservoir is natural or artificial pond or lake used for the storage and regulation of water. Reservoirs may be created in river valleys by the construction of a dam or may be built by excavation in the ground or by conventional construction techniques. These measures, in general, are considered more expensive and might have significant negative impacts to the environment

There are two types of **water re-use**: direct and indirect. Direct wastewater re-use is treated wastewater that is piped into a water supply system without first being incorporated in a natural stream or lake or in groundwater. Indirect wastewater re-use involves the mixing of reclaimed wastewater with another water supply source before re-use. The mixing occurs for example when the groundwater is too saline and needs to be improved by the treated waste water. Re-use of treated wastewater is a valuable resource for water supply in areas where water is limited. It has the potential to become an alternative source of water after relevant treatment. It could be used for irrigation in agriculture, industrial uses and specific uses in buildings provided that all relevant safety standards are respected. Re-use of treated wastewater is an accepted practice in several European countries with limited rainfall and very limited water resources, where it has become already an integral effective component of long term water resources management. However, only a few countries developed comprehensive reuse standards. Strict quality controls to minimise the risk of environmental contamination and human health problems due to water re-use. In addition, proper household metering and water pricing strategies are important drivers for the implementation of water reuse systems.

Rainwater harvesting is the process of collecting, diverting and storing rainwater from an area (usually roofs or another surface catchment area) for direct or future use. This is a technology that can be used to supply water to agriculture, households and industry.

2.2.2. Key information on the cost-effectiveness (risks and benefits)

In theory alternative water supply options, especially desalination, can deliver unlimited amount of water. In practice all the options have a lot of limitations in terms of costs and negative economic, environmental and social impacts. Cost-effectiveness of the options is as follow:

Desalination plants involve high capital costs, maintenance and operational costs and recurrent costs, because of its reliance on high energy requirements and if its location is far from urban areas a distribution network needs to be installed to transfer desalinated water to the mains water supply. It affects the cost-effectiveness of desalination bringing high desalination costs (0,21 – 1,06 Euro/m3). Distribution costs of desalinated water: to transport 1 m3 of water is estimated at 0.037 € per 100 m of vertical transport and 0.043 € per 100 km of horizontal transport. Other costs, related to the pre-treatment and the concentrate disposal, has to be also considered within the desalination process. Miller (2003) estimates pre-treatment costs to account for up to 30% of O&M costs while Younos (2004) estimates the costs of brine disposal between 5 to 33% of total desalination costs (Ecologic, 2008).

Development of the water transfer infrastructure involves very high costs. Example from England: the capital cost of water transfer infrastructure (to meet demand for water in south east England) is estimated to be between £8 million to £14 million per megaliter, which is 4 times more than developing new resources in south east. To transport 1 m3 of water is estimated at 0.037 € per 100 m of vertical transport and 0.043 € per 100 km of horizontal transport (EA 2006).

Concerning water recharge costs of water supply are lower than in the case of desalination or water transfers. It is mainly owing to lower investment, treatment and distribution costs. In the Belgian case study cost of producing water from ground water recharge was estimated to be 0.5 €/m³, which was cheaper than transferred water from outside the region (0.77 €/m³) (in

2007) (TYPSA 2012). There is no need of large storage structures to store water. Structures required are mostly small and cost-effective and less evaporation losses are produced. An extensive and expensive tertiary treatment is required for using waste water to recharge ground waters (although in most situations in the EU these are in place in any case). Strict quality controls to minimise the risk of environmental contamination and human health problems are needed, what entails costs, which should be taken into consideration.

Costs effectiveness of storage reservoirs seems to be the most expensive water supply option. In UK costs of winter storage reservoirs are calculated as follows: lay-lined reservoirs: €3.20/m^3 to 6,70 EUR/m^3, Reservoirs with a synthetic liner: 4,90 EUR/m^3 to 15,80 EUR/m^3, including energy (CO2) from pumping twice (from borehole/river to reservoir; and from reservoir to field) (BIO 2012). In Australia case study expanding reservoir capacity costs were estimated on AUD 2,40/ kL (OECD 2011). However overall benefit (to farmers) of moving to irrigation reservoirs is estimated at 14 EUR/m3 to 27 EUR/m3 as well as additional (non-monetised) benefits associated with improved security and flexibility of supply (case study from UK) (BIO 2012). Those benefits should be taken into account while considering water supply alternatives.

One of the most cost promising water supply alternatives is water recycling. The capital costs are low to medium for most wastewater re-use systems and are recoverable in a very short time. Experience from Australia: cost of recycling urban storm water (for non potable) – AUD 1,20-2,00 /kL; (for potable) – AUD 1,30-1,70 /kL; recycling treated sewage water – non-potable AUD 1,90/kL; potable AUD 2,50/kL (OECD 2011). Costs of waste water irrigation even tend to be lower than for groundwater irrigation, because the pumping effort needed is lower. However wastewater re-use may not be economically feasible if it requires an additional distribution network and storage facilities. Strict quality controls to minimise the risk of environmental contamination and human health problems are needed, what entails costs, which should be taken into consideration.

Total treated wastewater life cycle cost converted into €/m3 (TYPSA 2012):

Reuse alternative	Recommended treatment process	Annual costs (€/m³)a, b
Agriculture	Activated sludge[16]	0.16-0.44
Livestock	Trickling filter	0.17-0.46
Industry and power generation	Rotating biological contactors	0.25-0.47
Urban irrigation – landscape	Activated sludge, filtration of secondary effluent	0.19-0.59
Groundwater recharge – spreading basins	Infiltration – percolation	0.07-0.17

[16] Could also be natural low-cost treatment systems such as stabilisation ponds, constructed wetlands, or other like trickling filter, rotating biological contactor.

Groundwater recharge – injection wells	Activated sludge, filtration of secondary effluent, carbon adsorption, reverse osmosis of advanced wastewater treatment effluent	0.76-2.12

Cost effectiveness of rain water harvesting is related to the need of financing the capital investments and operation/maintenance costs for relatively large storage tanks in situations where there is a poor rainfall distribution. These cost are relatively high as presents experiences from different countries: Australia - cost of rain water tanks – AUD 3,75/kL (OECD 2011); in Belgium a RWHS for private households requires a large investment and the price reaches the value of around €1.8 to 4/m³ of RW used. The regulation specifies minimum requirements that aim at a cost-efficient introduction of RWHS. On the other hand, the savings amount to €1.7/m³ for avoided use of mains water. As with current regulations, the costs for sewage and sewage treatment are recovered on the basis of m³ of mains water used, the RW user benefits from an additional €2/m³ for avoided costs for sewage and sewage treatment; in Malta the estimated cost of using the water produced by a RWH system reaches the value of €5 to 11/m³ depending on the varying construction costs.

According to expertise the water saving potential for measures which are associated with rain water harvesting (rain water flowing from a roof is transferred via a pipe to a container in order to be used, for example, for gardening or car wash activities) is expected to meet up to 80% and 50% of households needs in France and UK, respectively (ACTeon et al., 2012). Concerning water harvesting in agriculture the overall benefit (to farmers) of moving to irrigation reservoirs can be estimated at 14 EUR/m3 to 27 EUR/m3 (discounted over 25 years at 4%), or annualised benefits of 0,80 EUR/m3 to 1,55 EUR/m3 per year (BIO 2011).

Economic impacts

- Provision of adequate and reliable water supply in urban areas encourages general economic development;
- Guarantee of water supply during peak water demand periods (e.g. the tourist season), and because of its reliability it can support other and new economic activities;
- High investment and O&M costs related to treatment and distribution.
- In case of water storage reservoirs the need to devote a land, which otherwise could be used for some economic activities should be considered. The location of desalination plants also implies land-use planning issues: they are mostly located in coastal zones (already densely populated), and have impact on the value of land – "not in my back yard".
- In case of water reuse there are some additional positive economic impacts:
    - Reusing the total volume of treated wastewater in Europe could cover nearly **44.14%** of the agricultural irrigation demand and avoid **13.3%** of abstraction from natural sources (Defra 2011). In Israel of all sewage that is treated, 75.5% (358 Mm³) is used for irrigation, representing 40% of the total water use in agricultural irrigation. Recently assessments point that the percentage

had risen to 87% by 2007 and the objective is to reach 95% of reclaimed water by the end of the decade (Defra 2011).

- use of the nutrients of the wastewater (e.g. nitrogen and phosphate) resulting to the reduction of the use of synthetic fertilizer and, reduction of treatment costs (reclaimed water, can be used for agricultural irrigation, landscape irrigation, industry, and non-potable urban uses). However there are some technological restraints related to crop type, presence of chemicals/nutrients not synchronized with crop requirements in using treated wastewater

The potential of the water reuse source hasn't been exploited so far in Europe: by 2006 the total volume of reused treated wastewater in Europe was 964 Mm^3/yr, which accounted for 2.4% of the treated effluent. The treated wastewater reuse rate was high in Cyprus (100%) and Malta (just under 60%), whereas in Greece, Italy and Spain treated wastewater reuse was only between 5 % and 12 % of their effluents. Nevertheless, the amount of treated wastewater reused was mostly very small (less than 1%) when compared with a country's total water abstraction (TYPSA 2012).

Water reuse and desalinisation require a continue enhancement of technologies in order to lower the use of energy and minimize environmental impacts on the aquatic environment. This is, therefore, an area for investment in innovation to ensure the cost-effectiveness of measures. Unlike water transfers, that increase water supply in one basin, at the expense of other basins, desalination has the advantage of decoupling water production from the hydro-meteorological cycle.

Rainwater harvesting can have strong economic impact by reducing water costs paid by households, agriculture or industry to pay for mains water supply. The economic potential of this supply option is estimated very high. Rainwater harvesting could save 20 to 50% of the total potable water use in a standard home, whereas grey water recycling could save 5 to 35%, as seen in the UK experience (Bio Intelligence et al., 2012). In Bedfordshire, one of the drier parts of England, the MAAF study showed that one hectare of roof area might theoretically provide sufficient water to irrigate 2,5 hectares of potatoes (at 80% efficiency).

Environmental impacts

All alternative sources of water supply reduce the demand on mains water supplies and reduce pressure on environment.

Most of alternative supply options are related to the intensive use of energy. Among them the most energy consuming is desalination. If the energy is from using the use of fossil fuels, this will increase GHG emissions. This is linked to the higher amounts of energy needed to desalt water (between 3.5 and 24 kWh/m3 according to the technology), especially with thermal processes. On the basis of an average European fuel mix for power generation, it has been estimated that a revers osmosis plant produces 1.78 kg of CO_2 per m3 of water, while thermal multi stage flush leads to 23.41 kg CO_2/m3 and multiple effect distillation to 18.05 kg CO_2/m3 (Ecologic 2008)

Example from Spain: it was estimated the desalination installation at Carboneras – Europe's largest RO plant - uses one third of the electricity supplied to Almeria province. The more than 700 Spanish desalination plants produce about 1.6 million m3 of water per day. According to the estimates (1.78 kg of CO_2 per m3 of water) on CO_2 production from desalination, this translates into about 2.8 million kg CO_2 per day. It can be argued therefore that desalination is contributing significantly to Spain's overall GHG emissions, which have been skyrocketing to +52.3% in 2005 compared to 1990 levels – moving Spain well beyond its European burden sharing target of +15%. This may be a foretaste of the dilemmas that will face other Member States in future years as the impacts of climate change are felt increasingly widely (Ecologic 2008).

Other environmental impacts of desalination varying severity depending on local conditions are on the aquifer and on the marine environment as a result of the concentrated brine management and water treatment and plant maintenance activities, water intake activities, and noise.

Water transfers and water supply projects, such as the construction of reservoirs and dams or irrigation schemes have significant negative environmental impacts in terms of biodiversity, wetlands, water availability and environmental flow. There are big uncertainties regarding how much water will be able to be transferred in the future.

Additionally construction of reservoirs and dams or irrigation schemes, can have negative consequences on biodiversity, especially in water scarce areas. As an example, planned irrigation schemes in the water poor Ebro basin in Spain were linked to significant declines in bird distribution (ACTeon et al., 2012). It is contributing as well to the discontinuity along the river, impeding fish species to reach their spawning grounds and is responsible for blocking of sediment transport to the sea is the main responsible of deltas and beaches regression.

Groundwater recharge reduces the threat of over-exploitation of existing aquifers, and decreases the risks of seawater intrusion into aquifers at or near the coast. It guarantees available for both the economy and the environment surface and groundwater resources during summer and drought periods. Fewer evaporation losses are produced, contrary to dam or impoundment alternatives, that in southern countries could reach levels up to 1m/year (TYPSA 2012). In the contrary it reduces pressure on water bodies from reduction in summer abstractions

Waste water reuse not only reduces the demands of freshwater, but can also reduce the pollution of rivers and groundwater by nutrients; From another side if there is no strict quality controls, there could be the risk of environmental contamination and human health problems (water-borne diseases and skin irritations).

The direct waste water reuse in households results in increased GHG emissions in existing homes, whereas its installation in new homes, alongside with other water efficiency measures, shows net carbon benefits. Different biological and bio-mechanical systems apply to single residential dwellings, commercial buildings or multi-use buildings. These systems have different operational energy and carbon intensities. For grey water reuse, the latter range from 0.6 kWh/m^3 for short-retention to 3.5 kWh/m^3 for small membrane bioreactors (Bio Intelligence et al., 2012).

The same environmental impact concerns rain water harvesting. The need of construction and maintenance of the necessary infrastructure may lead to negative energy/treatment/GHG impacts. The retrofitting of household rainwater harvesting results in increased GHG emissions in existing homes, whereas its installation in new homes, alongside with other water efficiency measures, shows net carbon benefits. Different biological and bio-mechanical systems apply to single residential dwellings, commercial buildings or multi-use buildings. These systems have different operational energy and carbon intensities. For rainwater harvesting, the latter range from 1.0 kWh/m^3 for direct feed to 1.5 kWh/m^3 for header tank (Bio Intelligence et al., 2012). For water harvesting in agriculture the same negative effects should be taken as those identified for water storage (dams and reservoirs).

The positive environmental impact of rain water harvesting is the reduction of the amount of urban storm runoff due to its buffering effect on storm events, which in turn reduces the amount of pollutants being washed into surface waters that are used to recharge shallow groundwaters.

Social impacts

In general alternative water supply alternatives provide adequate and reliable water supply in urban areas and encourage general economic development and job creation.

Water transfers provide right distribution of benefits between the area of transfer origination and area of water delivery. However by contributing to the development of regions without adequate local water supplies it may limit future development (economic productivity) in the area of the transfer's origin. It can cause problems of inter-regional or international fights for water rights, as drought extreme events are complex to manage.

Water storage change land use in the region, which can lead to low social acceptance

The general public or specific groups may refuse to consume products that are associated with the waste water re-use – the so called "yuk" factor.

There is the potential for impacts on health arising from these options (which would be stronger with a regulatory approach). These impacts would depend on whether building standards included requirements for re-use of water within the buildings (which would, therefore, need to be subject to subsequent IA if this were proposed). Reduced water flows can result stagnate in pipes, leading to microbial growth, although this concern is largely theoretical at present and currently design and control have reduced this problem. With regard to rainwater harvesting and to grey water reuse health issues are linked especially to installation, maintenance and operation of these sources. Stored rainwater can be contaminated with Enterococci (EUREAU 2011b). Also, back-wash systems (as part of the design of a reuse system for maintenance and cleaning) could contaminate drinking water supplies.

Having said this, public perceptions of possible health impacts are a barrier. Actions to control water quality include health codes, procedures for approval of service, regulations governing design and construction specifications, inspections, and operation and maintenance (US EPA, 2004) and standards have been adopted in national law (e.g. France, Spain and UK) for rainwater harvesting and grey water re-use to address this issue.

Poorer families will not have the financial resources to invest in the technology of water harvesting, and reap the benefits of lower water costs. The same concerns tenants who will not have the opportunity to reap the benefits of lower household water costs, as landlords do not benefit from this type of investment.

2.2.3. Barriers for implementation

Market failures, regulatory and policy support

There is the lack of the application of best practices in integrated water management by water managers at a national or basin level to produce RMBPs that are coherent and cost effective.

In general at a national or basin level the institutional or administrative structures are not in place. It causes problems in the development and implementation of an integrated water resource management plan for the administration, management, protection and sustainable development of the raw water resources at a basin and water body level.

The existing RMBPs hardly apply the principles of: polluter pays, cost recovery, cost-effectiveness and disproportionate costs. It means that they do not meet society's overall water objectives for quality and quantity i.e. a RBMP that is harmonized with socio-economic development objectives resulting in water bodies that will achieve good ecological status.

There is the lack of coherence between the RBMPs and other sectorial plans resulting in inability of basin mangers to fully evaluate the costs and benefits between measures in order to select the most cost effective ones for society. For example: there is lack of sufficient linkage with related policies such as CAP, land-use planning; artificial water storage very often is not in line with rural development rules and existing legislation (too strict existing standards).

There is a general lack of clear institutional roles between water resource managers (responsible for quantity and quality) and competent authorities for environment whose focus is on water quality and the environment. The efficient and cost effective management of water resources requires the management and implementation of measures that are for the common and cost effective good of multiple users and are not solely linked to one user or user group. This requires an institutional framework with the capacity to administrate, evaluate, select and manage the implementation of common water resource.

Lack of full cost recovery of water services, including financial, environmental and resource costs makes difficult to take economically and environmentally sound decisions on the choice of best water supply option.

There is lack of guidelines or criteria for water reuse taking into account regional characteristics. The absence of an EU regulatory framework presents a significant barrier as standards commonly agreed terminology are the basis for the success of water reuse projects. The lack of standards has caused administrations to take a rather conservative approach and has led to mistrust and misunderstandings regarding users who do not have of trust, credibility and confidence, especially in the agricultural sector. In some countries the governing standards put unnecessary limits on the use of the treated waste water or led to illegal uses.

Lack of financing is considered the single most significant barrier to wider use of reclaimed wastewater.

Reclaimed water is not the only source available for groundwater recharge, also water excess due to floods or wet periods are available to be naturally (ponds) or artificially (wells) injected. When treated wastewater (expensive tertiary treatment is needed) is used for groundwater recharging there is a need to have strict controls to ensure that no pollution problems to the groundwater bodies appear.

Financing sources

Lack of financial incentives and of sufficient information on the available techniques, best practices and the benefits of using treated waste water or harvested rain water put limits to the use of these alternative water sources.

Important barrier to the implementation of alternative water sources are the high costs associated with them. When current water supply is provided from cheap local sources (groundwater or surface water), water produced by desalination or ground water recharge are likely to be more costly. In these cases it is not financially obvious to introduce these water supply options, especially if the current water prices do not reflect all the economic costs, nor the environmental and resource costs. Costs per m^3 water produced may be very different for similar technologies or supply options in the different Member States that implies that the barriers for implementation vary country by country.

Lack of implementation and coordination

There is a need of a high quality monitoring system and quality assurance for consumer's acceptance (concerns especially water reuse, water recharge and rain water harvesting).

Desalination can be a replacement for potable water supply purposes, although its supply regime is rigid and inflexible, and so is best suited for supplying a fixed amount of water (according to its design specifications). There are, particular environmental and economic concerns about the high energy requirements of the desalination process, meaning that mitigation measures are needed to either improve efficiency or incorporate the use of renewable energy resources. In addition, there are also concerns about the impact on the environment of disposing brine – meaning that adequate mitigation measures have to be incorporated to deal with brine disposal. These concerns are an opportunity to develop new technologies, that more efficient, with less environmental impact.

There are problems to find available land for construction of big desalination plants.

Knowledge base

In the context of river basin planning, water reuse options tend to be excluded or forgotten as stakeholders are not well informed about the link between water supply and wastewater treatment. As such, research results from feasibility studies on water use have not been taken up in practice, especially in areas where water supply and wastewater are managed by different companies or agencies.

Interbasin water transfer proposals needs thorough evaluation to determine if they are justified considering all associated impacts. There are uncertainties concerning water availability in the future (how much water will be available to be transferred).

Investments in artificial water storage and the creation of new resources should be based on economic analysis. They usually bore high investment, maintenance and operation costs, long investment procedures and significant potential impacts on the environment that have to be taken into consideration. They should be considered as an option when other options to improve water efficiency, including the application of economic instruments have been implemented.

2.2.4. Degree of implementation as reflected by the RBMPs

The development or upgrade of reservoirs or other water regulation works is included in about 30% of the RBMPs, development or upgrade of water transfer schemes in 23%. Measures to foster aquifer recharge are included in 33% of the plans.

The development or upgrade of desalination plants (in about 1% of the plans) and the establishment of water rights markets or schemes to facilitate water reallocation (in about 2% of the plans) are the least considered.

There is little quantitative information on the waste water reuse. While at EU level water re-use amounts to less than 1% of the countries' total water abstraction, in Cyprus and Malta the treated wastewater reuse rate of their effluents is high (respectively 100% and 60%) (TYPSA 2012). This currently under-exploited measure has a high potential. Nevertheless treated waste water reuse and rainwater harvesting are not identified as main measures in the RBMPs. According to the preliminary analysis of RBMPs there were no measures related to WWR and RWH included in almost 50% of the assessed RBMPs

2.2.5. Key EU policy instruments that would unlock / guide the implementation

EU Policy instruments related to use of economic instruments

Economic incentives could help in "unlocking" the measures. This supposes the proper implementation of the WFD economic principles of polluter-pays principle, the principle of cost recovery, including environmental and resource costs. Alternative water supply is more costly than conventional sources, especially if water prices do not cover all costs. It may be difficult to introduce the measures without **economic incentives** such as temporarily applied subsidies.

While choosing the best water supply option economic analysis taking into account full cost recovery of water services, including financial, environmental and resource costs should be the base to take economically and environmentally sound decision.

EU Policy instruments related to governance and integration

To strengthen the "quantitative dimension" of the WFD implementation by establishment of systematic water balance assessment/water accounts at sub-catchment level and the dynamic modelling of water resources for the preparation of next RBMP. This will provide information on where and how water efficiency can be improved and which alternative water supply sources should be developed in a cost-effective way

Water reuse:

The key recommendation of the Mediterranean Component of the EU Water Initiative (MED EUWI) Wastewater Reuse Working Group is to develop a commonly agreed European and Mediterranean guidance framework for treated wastewater reuse planning, water quality recommendations, and applications.

Awareness raising campaigns and advisory services could improve the public and user awareness and acceptance of the water reuse. Improve implementation of cost recovery and provision of economic incentives to promote and make water reuse cost effective.

Other sources:

The application of desalination and artificial recharge could be facilitated by improving the political and public acceptance. Prior to starting such type of new investment an awareness raising campaign and extensive consultation with the stakeholders and public should be carried out. This should be combined with a high quality monitoring system for ensuring their safe use and improving consumers' acceptance.

Since desalination facilities might have significant negative impact on the environment the inclusion of these facilities under the scope of the IED (2010/75/EU) and EIA (85/337/EEC) Directives should be considered

EU Policy instruments related to funding

Implementation of alternative water supply measures requires high investment costs, so potentially they can enter to the scope of EU funds financing. As they can trigger substantial economic, environment and social impacts, there should be introduced strict assessment procedures to allow their implementation and financing, only while efficiency measures are fully addressed and can't resolve water shortage problems.

EU Policy instruments related to knowledge base

Further research and innovation activities:

– to get cost efficient and more environmental friendly techniques and technologies available for desalination technologies.

– to develop available techniques, best practices and the benefits of using treated waste water or harvested rain water.

– to adapt water markets

2.3. Water efficiency measures

2.3.1. Description

In water stressed/potentially stressed areas, **water efficiency measures** are required to improve the efficiency of irrigation systems and urban water distribution networks, where large amounts of water continue to be wasted through leakages. Water efficiency measures are also required in buildings, where building design or inefficient water use appliances do not promote water savings. In general terms water efficiency measures are measures that aim to eliminate the waste or the unnecessary consumption of water to obtain the same or improved socio-economic benefit with reduced water consumption. These measures should be given priority in water policy and should be supported by economic instruments that provide incentives for improved water efficiency. Within this category following types of measures can be identified:

Water efficiency measures in agriculture with specific options:

Technological and management measures

– Storage losses (on-farm dams & reservoirs) i.e. loss of stored water from surface water reservoirs through evaporation. Evaporation rates are affected by latitude of the water body (solar energy input), air and water temperatures, air pressure, wind velocity over the water surface and turbulence in the water. Efficiency measures concerns the use of covers and shades, monolayers or wind breaks on farm dams to reduce evaporation;

– Non-productive transpiration i.e. transpiration of unwanted vegetation (such as weeds). Efficiency actions concerns tillage and chemical weed control;

– Reducing productive transpiration i.e. transpiration of cultivated crops. Efficiency actions concerns deficit irrigation and partial root-zone drying;

– Evaporation losses. Efficiency actions concerns shift from surface and sprinkler irrigation to drip irrigation, shift from large rain guns / sprinklers to micro-sprinklers, proper timing of spraying;

– Wet soil evaporation losses. Efficiency actions concerns mulching, localised irrigation, sub-surface drip irrigation, zero tillage;

– Drainage losses. Efficiency actions concerns improved water application uniformity, irrigation scheduling, soil water holding capacity

Water regulation and allocation

Water regulation aims to organise water use among the users, by sensitising them to the scarcity of the resource. For example, farmers of Vila Cova (Portugal) are following rules, which include dates of start and end of the irrigation period, losses in canals, travel time of water, user sequence, and night turns (BIO 2012)..

Using water rights or permits to abstract water allows for abstraction of certain amount of water (e.g. as is the case in France or in the UK). It requires metering to be in place to monitor how much the farmer has abstracted compared to its allocated right. However, such monitoring requires compliance checks and may increase illegal abstractions to abstract sufficient water for the crops

Water auditing and benchmarking

Water audits include measurement tools that can help agricultural facility owners know their water footprint, learn where water is being wasted and tackle unrecorded water abstraction at the farm level. Benchmarking can help them identify which efficiency improvements will be most cost-effective, e.g. by comparing on-farm water use with industry norms and reasonable needs.

Consumer/ market pressure

Market and consumers are in an equilibrium of offer and demand, which varies slightly according to cultures and mentalities, level of life but also to fashions and information. Water footprinting and water use measures, as for carbon footprint, could be calculated and displayed to consumers.

Dissemination of best practice, training and awareness-raising

Benchmarking of on-farm water use has shown very different patterns of water use efficiency within same farm typologies. A range of knowledge transfer and outreach approaches have been used to disseminate and share best practice, including the use of demonstration farms, open-days, technical workshops, media productions, and information literature.

Agricultural water productivity/crop selection

With driving parameters such as the type of crop, growth stage of the crop and climate, the water consumption of crop can be predicted by month from the sowing date. The influence of crop type is important on both the daily and seasonal crop water needs.

Water pricing and trading

Water-pricing aim should be: to provide adequate incentives for users to use water resources efficiently, to recover costs invested in water supply systems and operation and maintenance (O&M) costs, to design an economic tool to raise the productivity of water use, by allocating the resource to the use that generates the highest economic value (e.g. high-productivity crops with low water demand), while at the same time establishing the use of water saving technologies, to promote efficient and careful use of water and to help securing water availability.

Water efficiency in buildings and households' appliances

Water efficiency measures concerning households include: water metering, water pricing and other economic incentives, green buildings, households' appliance efficiency measures, and awareness raising & education.

Water metering in buildings provides information to the user in terms of how much water their household consumes. The consumer is then likely to become more engaged in monitoring its water use, leading to more efficient water use, but also more active involvement in the identification of leaks

Water metering is reported to be also strongly linked to water pricing. It enables introduction of volumetric charges. Similar to water pricing in other sectors its aim is to provide adequate incentives for users to use water resources efficiently, to recover costs invested in water supply systems and operation and maintenance (O&M).

Environmental performance of the building sector concerns initiatives about green buildings, which aim to label a building according to certain certification criteria. Concerning water savings performance water metering, water efficient appliance, rain water harvesting and water reuse are taken into account.

Appliance efficiency measures in households concern different technologies in household devices, which can reach the same or similar effect with lower consumption of water.

Awareness-raising and educational campaigns should be sent through different communication channels, target different types of public, with differing interests, motivations, and approaches to policy issues: general public, potential users, children, environmental groups, regulators and/or regulating agencies, home owners associations, educational institutions, political leaders, business/academic/community leaders, etc., and finally to highlight different aspects: improving consumption habits and disseminating best practices, explaining the benefits of water-efficient products/retrofits or of water reuse/recycling, improving leak detection, informing about green building schemes, etc.

Water efficiency in energy sector and industry

Efficiency measures in energy and industry sectors are very similar to measures designed for households. They concern economic instruments, including water pricing and water metering, incentivising reduction of the use of water from one side and from another side they concern technological improvements and innovation in the production process driving to obtain the same production results with smaller amount of water used.

Leakage reduction in water distribution networks (urban and for irrigation purposes), describe. Differentiate urban and irrigation?

Significant leakage in water infrastructure in some parts of the EU causes significant waste of water which is problematic in areas which are water stressed, or at risk of becoming water stressed. As much as 50% of water abstracted is lost in distribution but with significant differences between Member States. While best practices on how to technically reduce water losses in distribution networks are well known and readily available, best practices on how to value water resources, in order to assess the costs and benefits to society from investing in leakage reduction, are not readily available (ERM et al., 2012).

Conveyance efficiency is generally a great concern for irrigation districts that supply a group of farmers. There are significant differences in conveyance efficiency depending on the type of irrigation network. For instance, in Greece, average conveyance efficiencies are estimated at 70% for earthen channels, 85% for lined channels and 95% for pipes. At EU level, potential water savings can represent up to 25% of the water used for irrigation. There are following actions designed to reduce leakage in water distribution networks: canal lining, replacing open canals with low pressure piping systems, channel automation, water measuring devices, and system maintenance (Bio Intelligence et al., 2012).

2.3.2. Impacts

2.3.2.1. Water saving potential and cost effectiveness

2.3.2.1. agriculture

Water savings can be achieved by improving the irrigation infrastructure and technologies (ACTeon et al., 2012):

Potential water savings from improving conveyance (distribution network) efficiency, such as open channels and furrows, can range from 10% to 25%. For example, in Spain it was estimated that potential water savings from improvements in the water transportation for irrigation purposes can reach the level of 20% and in France up to 300 million m3 per year with an estimated cost of 15 million Euros.

EEA (2009) reported typical efficiencies of around 55 % for furrow irrigation; 75 % for sprinklers and 90 % for drip systems. In the PACA region in France, modernisation plans of irrigated systems by converting gravity irrigation networks to pressurized systems have helped saving around 300 million m3 per year (Ecologic et al., 2007)

Additional water savings can be accomplished by improvements in the application efficiency. For example, at a global level a shift from surface irrigation surface to sprinkler or drip irrigation can lead to 15% or 30% savings of water use respectively. For example, in Southern Europe drip irrigation can save up to 60% water compared to the traditional surface irrigation. In France the cost from shifting from furrow irrigation to sprinkler, pivot and drip irrigation can range from 140Euros/ha to 5142 Euros/ha compared to furrow irrigation.

The adoption of contingency plan in Spain for irrigation improvement such as the implementation of new technology, automatic management of irrigation systems, efficiency enhancement measures to reduce water demand and abstractions required for the agriculture can lead up to 1162 hm3 of water savings, whereas its overall cost is estimated to be at the level of 2 344 Million Euros.

Significant potential water savings can also be obtained by the change of crop patterns and the use of more drought- resistant crops, up to 50% in France and changes in irrigation practices and awareness-raising and training, up to 34% in Turkey. For instance, in France the reduction in the production of high water consuming crops like maize and the switch from high water demanding crops to low water demanding crops to reduce the vulnerability to drought cases, can potentially lead to significant water savings

The implementation of new technologies for the re-use of sewage effluent such as sand filtration or reverse osmosis led to significant water savings up to 10% and 12% in Portugal and Italy respectively, whereas the overall investments ranged from 48 to 84 Euros/m3 and 151 to 191 Euros/m3, respectively.

2.3.2.2. Industry

Concerning industry (ACTeon et al., 2012) large amounts of water are used by pulp and paper, manufacturing, chemicals, textile, food, leather industry and transport. There is following evidence of water saving potential and cost effectiveness in industry:

From all industrial sectors in UK water savings range from 15% to 90% and are mainly driven by implementing water metering, recycling and the re-use of wash water.

Significant water savings (80%) in the transport industry occurred in Hungary thanks to the installation of a new water-saving wastewater treatment facility for wastewater resulting from the washing of vehicles. The initial investment cost was at the level of 80 000 US $, whereas the estimated period for recovery of the investments was 1.3 years.

Significant water savings (90%) in the leather industry occurred in Spain thanks to the installation of a new water-saving recycling wastewater technology.

Regarding the pulp and paper industry, several water saving measures such as the increased efficiency at the water purification plant in Sweden and aero-cooling towers in France, resulted in water savings which ranged from 15% to 62% respectively. In France, the investment cost for the installation of aero-cooling towers for the recycling part of the water combined with specific monitoring of flows and conductivity for optimizing water use in each step of the production process was at the level of 5 Million Euros. The investment is expected to lead to a reduction in water abstraction costs of 6 Euros/ton of paper, whereas the estimated period for recovery of the investment was 2 years.

With respect to the manufacturing industry, water savings ranged from 12.5% to 90% and were mainly driven by improvements in the monitor of flow rinse lines and implemented water saving measures in offices and washrooms in the UK electronics and furniture sector (12.5% and 45% respectively).

Significant water savings in French metal surfacing and car industry (90% and 35% respectively) were attributed to the implementation of rainwater harvesting measures.

In the UK textile sector the installation of a hot water boiler for more efficient warm water scouring, a computer-controlled management system to perform routine metering and analysis of electricity, gas, water and effluent and additional measures to reduce the pollution load from effluents led to significant reduction in water and energy consumption, whereas the cost savings were estimated to be more than 1 Million £.

With respect to the food industry, significant water saving measures such as the re-use of wastewater in the dairy sector in the Netherlands, the repair of leakages and the installation of a new defroster in the fishing industry in UK, resulted in water savings of 67% and 58% respectively.

The adoption of the above measures will eventually result in significant savings in water bills, however, information on costs and benefits remains inadequate, maybe due to confidentially aspects which are of great importance for the industry sector.

2.3.2.3. Energy

Thermoelectric generation plants (ACTeon et al., 2012) produce almost 80% of the total electricity production therefore being the largest water consumer among other production activities like hydropower, nuclear, wind and solar plants. Traditional cooling techniques of thermal power plants are totally water intensive as they require large amount of water from ocean, sea and rivers.

The implementation of advanced cooling technology such as dry cooling, evaporative cooling and hybrid cooling can reduce the dependence of power plants from natural water resources and therefore, can lead to reductions in water use and consumption. An economic analysis regarding the different costs of cooling systems showed that dry cooling systems can become profitable and thus can be justified economically if the cost of water is expensive and/or the cost of power is cheap.

Other water savings measures that can be applied in the thermoelectric generation is the use of recycling of cooling water. For example, in Latvia the introduction of this cooling system led to a substantial reduction in water consumption, from 30 Million m3 per year to 3.1 Million m3 per year. Similar projects are in progress in thermoelectric power plants in other countries such as in Poland, Ukraine and Hungary.

Improvements in energy efficiency of new thermoelectric plants like natural gas combined-cycle plants, can reduce both the amount of water abstracted and water consumption per MWh and hence can result in water savings up to 60%. Energy savings in the mining and preparation of coal for use in thermoelectric generation can also reduce the water used and therefore increase the availability of freshwater resources, while the production of electricity from other resources that require little water such as solar and wind should be further promoted.

Concerning the hydropower sector the use of water to produce electricity interrupts the river continuum. This is caused by the construction of dams that reduce the water flow of a river and create artificial lakes, and therefore increasing the surface area and evaporation. An increase in evaporation combined with changes in climate conditions such as temperature and precipitation can change the timing and magnitude of the river flows. As a result, the ability of hydropower plants to use water resources will be affected and thus, the production of electricity. Increasing the efficiency of utilization of dam reservoirs for instance by reducing water losses can lead to water savings and thus, can be promoted, whereas the refurbishment and upgrade of existing hydropower plants needs to take into account the impact on water resources and the function of ecosystems.

2.3.2.4. public water supply and use

Water efficiency measures (ACTeon et al., 2012) are in general less costly than alternative measures that involve the creation of new resources or artificial storage however most still require investment costs.

Appliances

Significant potential savings in different household technologies can reach the level of 50%. Up to 25% savings can be achieved by improving the technological performance of household devices. For example, in UK water saving devices and more efficient household appliances for toilet flush and shower can potentially lead up to 55% and 44% savings respectively, whereas for bath, taps and washing machines can reach up to 26%, 15% and 33%, respectively. In Germany, the overall expected savings from the water devices can potentially be at the level of 25%, while in Europe it has been estimated that the expected water savings from the use of efficient dish washer machines can be up to 40%. In Denmark, a campaign targeting unnecessary consumption and habits alone was estimated to allow a reduction in water consumption by up to 15%. Yet, some experiences show that awareness raising campaigns sometimes failed in reducing water use, although they may have raised awareness of a certain share of population. It is assumed that 3% of water will be saved at EU level with stand-alone awareness-raising and education campaigns (ACTeon et al., 2012).

The level of water savings from the implementation of water efficiency at the product level are summarised in the Table below.

Table. Water savings potential of water using products (Bio Intelligence et al., 2012).

Water Using Product	Water savings
Low flush toilets	• Use of 3 to 4.5' L/flush instead of 6 to 12L/flush; • Water saving of 30 to 170 L/property per day • In Australia, 22% of water savings from efficient toilets and urinal compared to conventional ones (in the WELS context).
Water-saving showerhead	• Use of 6 to 7L/min instead of about 25 (6L/min instead of 16 in the UK) • Water saving of 25.2 L/property/per day • Water saving of 8% compared to total household water consumption.
AAA rated dishwasher	• Water saving of 5 000L/yr water saving of 0.2% compared to total household water consumption
AAA rated front-loading washing machine	• Water saving of 90L compared to conventional top loaders, i.e. about 16 000L per family per yr. • Water saving from 0.9% compared to total household water consumption. By 2021 in Australia, 34% of water savings from efficient washing machines compared to conventional ones (in the WELS context
Faucet aerator	• Water savings between 12 and 65L/day at home; reduced flow up to 50% in municipalities • Water saving of 7 to 11.6% compared to total household water consumption.

A study on the benefits of the European Ecolabel – which sets specifications for certain water using appliance – estimated the following potential water savings based on potential sales data:

i) For washing machines, savings were forecast to be approximately 396 312 300 litres per year (based on 5% uptake), 1,585,249,200 litres/year (based on 20% uptake) and 3,963,122,900 litres per year (based on 50% uptake) (ACTeon et al., 2012);

ii) For dishwaters, savings were forecast to be approximately 20,185,400 litres/year (based on 5% uptake), 80,741,800 litres/year (based on 20% uptake) and 201,854,400 litres/year (based on 50% uptake) (ACTeon et al., 2012).

Based on the technical expertise from a real estate association, the costs of the installation of efficient WuPs and renovation at building level for the residential sector have been assessed:

Replace 4 to 5 taps or shower heads: 50 to 200 €

Replace toilet flushes or toilet equipment: 200 to 2.000 €

Install a low pressure water system: 500 à 1.000 €

Replace 1 or 2 WUP in furnished rented homes: 350 to 1.500 €

Replace bathtubs (with shower, or smaller bathtubs): 1.500 to 5.000 €

Install water efficient cooling system: 800 à 3.500 €

Install grey water treatment & distribution system: 10.000 to 30.000 €

Install rainwater collector & distribution system: 5.000 to 15.000 €

Install water heater (close to the tap) to prevent cold water waste (cost not evaluated)

Replace or repair water pipes to prevent leakages in plumbing system 10.000 to 30.000 €.

Table source: (Bio Intelligence et al., 2012).

The payback period depends mainly on the investments costs and water tariffs which differ from place to place. For example An Australian study mentions a payback time of about 7 years through savings in the water bill, based on a cost of 500€ per household for the installation of a combination of water-efficient appliances, including a AAA showerhead, a drip irrigation system for the garden, flow restrictors and water-efficient front loading washing machines. Calculations for water saving (changing toilet, shower fitting and adjusting behavior) a normal detached villa in Sweden (2 adults, 2 children) show that 45 m^3 could be saved per year, which results in 675 SEK (77€) for the water (based on 15 SEK/m^3 (1.7€/m^3)) plus about the same amount for heating of the water, thus in total 1,200 SEK/year

(136€/year). The investment cost to obtain these savings would be ca 2,000 SEK (226€), highlighting a payback time of less than 2 years (Bio Intelligence et al., 2012).

In Germany the replacement of existing showerheads, toilets and taps with more water-efficient ones to achieve 30% water reduction would cost €400 per flat owner, i.e. more than €10 billion for Germany as a whole. Water savings and costs of implementation will vary greatly depending on the level of use, the specific water savings measures, the plumbing arrangements and the architectural finishes, etc. The UK Waterwise programme shows a wide variation in the cost of retrofitting per property, which ranges from €46 to €270 per property. This might make the replacement of water-using products by more efficient ones a costly effort for the tenants. The cost efficiency of the measure depends on the associated savings and the payback time (Bio Intelligence et al., 2012).

Once efficient water using products are introduced, after the initial investment cost, the water consumption and consequently the water costs would be reduced. For example, while investment costs will incur (currently simple water saving showerheads cost about £35 (€42), see section on capital costs), in the UK, changing a showerhead and toilet, could result in annual savings of 67 m^3 water, that is £225 (€270) for a household with a standard occupancy of 2.4 persons. Adding to the costs of the water saved, savings in the energy costs will also apply. In the Waterwise programme, the cost of energy saved in the trials range from €1.5 to 50.3/property/year (Bio Intelligence et al., 2012).

Buildings

Implementing labelling or minimum requirements will incur costs while building or refurbishment, and for the certifier to verify compliance, but also to set up the scheme against which the building is audited (i.e. determining the standards and thresholds). In case of mandatory labelling and minimum requirements, the constructors will bear compliance costs. A water audit for a 10-floor office building in the USA costs around $5,000 (around €3,560). Green Star and LEED cost between €4,000 for buildings smaller than 2,000 m^2 and €24,000 for 50,000 m^2 and more (BIO 2009).

In terms of return on investment, costs premiums for obtaining a LEED certification in silver or platinum levels are respectively around 2 and 6.5% of the life-cycle costs (LCC) (i.e. costs over the whole lifetime of the buildings, including construction, use, refurbishment and end-of-life). The net value of the related savings over 20 years - with a discount rate of 5% - is over 3 times larger than the minimum initial cost of 2% of the LCC. Setting minimum requirements comparable to a silver LEED certification would then be in compliance with adopting a lowest life-cycle cost approach (as promoted in the Ecodesign Directive).

Besides, utility charges, which are usually among the most costly expenses for buildings, are considered lower than usual in green buildings. A study finds overall operating costs to be lower by 8-9% for green buildings compared to conventional ones (Bio Intelligence et al., 2012).

In case of mandatory labelling and minimum requirements, the constructors will bear compliance costs. A water audit for a 10-floor office building in the USA would cost around 5 000$ (around 3 560€) according to an American consultancy. Green Star and LEED cost between 4 000 € for buildings smaller than 2 000 m^2 and 24 000 € for 50 000 m^2 and more. Green building may include costs not only for the certification itself but also for planning and construction. The extra cost includes more time for architects and engineers to plan the construction. The cost will decrease over time (as is the trend at present). Studies by USGBC show that LEED-certified buildings cost from 0.66% to 6.8% more in planning and construction, depending on certification level aimed for (Bio Intelligence et al., 2012)..

The potential water savings depend on the type of buildings within which water using products are installed. For non-residential buildings, in the USA, water savings are greater for offices and schools than for restaurants (about 40% greater), and much lower for laundries, hospitals and healthcare facilities (for each, about 6% of the water savings from both offices and schools), since offices, schools and restaurants are high water users. Residential buildings are likely to integrate more water using products, as showers or washing machines are less often found in non-residential buildings (apart from hotels) (Bio Intelligence et al., 2012).

The capital costs of metering are likely to be borne by the owners of buildings. The price of an average meter device ranges from 35€ to 350€, depending on its properties in terms of maximum flow capacity and accuracy of output data. Since more than one metering device is often needed in a household or dwelling (for instance, a hot water and a cold water one), this may be costly for the owner/inhabitant. In many MS, buying two 100€ meters would actually more than double the annual water bill (Bio Intelligence et al., 2012).

In the UK, water metering is estimated to be able to achieve average water saving of 10-15% per household (35-52 L/d assuming 147.8 per capita consumption and a 2.36 occupancy rate). A study undertaken in Spain shows that 10% of water savings can be gained with metering via a better localisation of water leakage in the building, leaving the possibility for the landlord as well as for the tenant to directly address the problem. 10% of the residential buildings water consumption in Spanish cities represents 9,760 hm^3/year. These results seem to be consistent with what has been observed in Austin (Texas) where sub-metered apartments use 15.3% less water than multi-family buildings in 2008 (Bio Intelligence et al., 2012).

Leakage

Public water supply efficiency measures concerns leakage reduction in water distribution networks, whereas public water use efficiency measures concerns efficiency measures in buildings and water appliances. For both these types of measures including households, public sector and small businesses, water savings potential for different measures usually range from 20% to 50%.

The leakage reduction program can potentially result in the reduction of water losses from 29% to 20% in England and Wales and by 52% in Italy (ACTeon et al., 2012). The cost of reduction of loses in distribution networks rises while network efficiency goes up. Therefore it is economically valuable to increase efficiency of water distribution network to the point of achievement of its Sustainable Economic Level of Leakage (SELL) where environmental, social and resource costs are fairly included. Because physical, financial, legal, institutional, regulatory and socio-economic context is different for each water utility, operating in its specific water body(s) and basin, within its national policy and legislative framework, there is no common level of SELL, which should be determined case by case (ERM et al., 2012).

2.3.2.5. Economic impacts

Appliances

Changing product requirements can result in costs both for buying the device and for its installation (e.g. by a plumber). Building owners and/or users will variously pay for the installation of fixed fixtures (taps, toilets) and other types of devices (showerheads, washing machines, dishwashers) and bear those capital costs.

Costs will also be incurred to manufacturers who have to develop more efficient products, leading to increased innovation. In case of mandatory labelling and minimum requirements, compliance costs will also arise.

Depending on the policy instrument used, the costs will be different. Indeed, through voluntary and mandatory labelling schemes, the customers decide whether to introduce products in their buildings, deciding whether it is cost-effective for them or not. In the case of minimum requirements, the costs will be imposed to customers, but on the long-term, through the competition occurring between constructors, the costs – initially higher for efficient WuPs than for traditional ones - are expected to decrease over time.

Awareness-raising campaigns will incur costs. They will help the customers decide whether the products are cost-efficient for them, but are not expected to raise customers' costs. Financial incentives will have an important impact on financial return on investment, and will thus highly impact the decisions by customers to introduce products or not, but are also costly.

Administrative costs will be associated with the establishment of certification schemes or labels and/or the determination of performance thresholds. Public authorities have to face additional costs, on top of the related administrative burden, to control the good enforcement of the labels and building certification schemes and ensure the compliance with potential minimum requirements. Those costs will be higher in case of minimum requirements, than for mandatory labelling, and lower for voluntary labelling (which still involves some control). Any launch of financial incentives will come from public budgets, which will lead to costs, and will need to be administratively monitored in order to check proper implementation. Financial incentives will promote water-efficient products, buildings and certain harvesting and reuse systems, thus balancing the relative prices by promoting environmentally-friendly goods.

Tax abatements can be used at national level to promote the purchase of water-efficient products. Financial incentives have been tested in the UK, with the Enhanced Capital

Allowances (ECA) scheme. The scheme is managed by Defra and enables businesses to claim 100% first year capital allowances (i.e. tax relief) on investments in technologies and products that encourage sustainable water use. Businesses are then able to deduct the whole cost of their investment from their taxable profits of the period during which they make the investment. The objective is to encourage businesses to invest in water-efficient technologies and provide key information to accompany them in their decision process. Indeed, the water-efficient technologies that are supported by the ECA scheme are listed to inform businesses of which efficient fixtures are targeted.

Buildings

Decrease water use will contribute to reducing global energy and financial costs, through reducing the need for pumping, heating and treating water. Hot water use is identified as a key issue from the building sector as it directly relates to the energy consumption of building. Heating water represents around 22% of household energy use in the UK (Bio Intelligence et al., 2012).

In most cases water efficiency measures, in order to be effectively implemented must be accompanied by training, monitoring and other support actions, which can create considerable additional cost. Implementing labelling or minimum requirements will incur costs while building or refurbishing the building to meet the standards, and for the certifier to verify compliance, but also to set up the scheme against which the building is audited (i.e. determining the standards and thresholds).

Costs will be incurred by setting up a certification scheme. A large-scale rollout allows for certification schemes to capture economies of scale. However, a one-size-fits-all scheme will not be suitable because different types of commercial and institutional buildings have technologies and operating systems that are specific to their activities. This results in the need to adapt the certification systems and therefore additional costs. Several certification initiatives offer building schemes specific to the building usage, e.g. LEED for home (with 15 water credits to be awarded), LEED for new construction (10 water credits), LEED for commercial interiors (11 water credits), LEED for schools (11 water credits), BREEAM New Construction, BREEAM refurbishment, etc). Therefore, a certification programme at EU level would require the development of several parallel schemes that each covers particular types of buildings. The setting up of the different schemes would incur higher costs than a single scheme, but as all schemes would be based on a common broad scheme it would still be less costly than fully developing a scheme for each different types of buildings.

A survey on the UK financial and business services sector showed that tenants would be willing to pay 10% more rent if the building was designed and constructed to increase water efficiency. That is consistent with the fact that green buildings may contribute to economic benefits for the owner with increased occupancy rates (+8%), higher rents (+6%) and higher commercial building values (+35%). The EU FP7 project SuperBuildings indicate that value of a building increases to up to 10% if assessed as green. For the moment no evidence of increased rents were identified in real cases. According to real estate stakeholders, this information remains questionable and does not reflect the actual market (Bio Intelligence et al., 2012).

Administrative costs will be associated with the determination of performance thresholds. Public authorities have to face additional costs, on top of the related administrative burden, to control the good enforcement of the labels and building certification schemes and ensure the compliance with potential minimum requirements. Those costs will be higher in the case of minimum requirements, than for mandatory performance ratings, and lower for voluntary performance ratings (which still involves some control). Any launch of financial incentives will come from public budgets, which will lead to costs, and will need to be administratively monitored in order to check proper implementation. Financial incentives will promote water-efficient products, buildings and certain harvesting and reuse systems, thus balancing the relative prices by promoting environmentally-friendly goods.

The implementation of product labels and minimum requirements will increase innovation in products, to provide customers with more efficient products. It will also bring employment to green building businesses, through the development of the standard and advice to be given to companies to improve their ratings/meet the standards. However, it will require the education and training of skilled workers

With the assumption that about 25% of the EU population would introduce meters, around 7 billion Euros are foreseen based on the information in the UK (Bio Intelligence et al., 2012).

Leakage

Higher costs for water distribution resulting from significant leakage may be met by the utility, but these costs may be passed on. Depending on the financing model, customers may have to meet all of these costs via water bills or public authorities may meet these costs.

Apart from the economic impact on utilities, leakage has other economic costs. Major leaks can cause local flood damage (e.g. with costs to business, insurance companies, etc.) and repairs to these leaks can cause significant disruption to road users. The leaks can undermine the ground into which the water percolates, thus resulting, for example, in costs for road repairs.

Leakage reduction may require the spending of public money (where utilities are public or public spending is otherwise justified) or spending by the private sector (where utilities are in the private sector). The options do not prescribe any level of spending (by defining a level of leakage reduction). However, a robust determination of the economic justification for leakage reduction (e.g. based on the Sustainable Economic Level of Leakage) through the guidance/tool option can justify the allocation of financing (whether from public budgets or from consumer pricing) and it ensure that spending delivers the most appropriate level of spending reduction compared to other alternatives for water efficiency or development of new water supply options. This option, therefore, provides the basis for increased efficiency of spending.

The funding option would provide financial support from EU funds to reduce these impacts where spending is otherwise difficult or not available. Therefore, the option would reduce negative economic impacts of leaks. The exact nature of the economic impacts will depend upon the extent of Regional Fund spending and the particular circumstances of the locations where those investments are made. Funding through Cohesion Policy would deliver economic benefits from leakage reduction only in the Member States eligible for such funding. It is, therefore, not possible to set these out in detail.

The increased availability of financial support from the Regional Funds has the potential for more efficient and effective spending. The timing of infrastructure spending can be an important factor in determining its efficiency and effectiveness. Delays, for example, can result in spending on short-term emergency repairs or smaller projects which are less cost-effective. Therefore, increased availability of funds can improve the economic efficiency of the spending of utilities, provided the finance is correctly prioritised and targeted.

The option clearly has an impact on the EU budget. However, it does not impact on the level of that budget, but rather the priorities to which that budget is applied.

It is not possible to provide a cost for an individual project. These costs would depend on the size and complexity of the distribution network to be repaired, the nature of the system (e.g. depth of pipes), methods of repair (e.g. complete replacement, lining existing pipes, etc.), labour costs and other factors. Furthermore, specific costs would also reflect whether the leakage reduction project was part of a wider project on water distribution.

The increased availability of finance (from private sources, EIB, etc.) has the potential for more efficient and effective spending. The timing of infrastructure spending can be an important factor in determining its efficiency and effectiveness. Delays, for example, can result in spending on short-term emergency repairs or smaller projects which are less cost-effective. Therefore, increased availability of funds can improve the economic efficiency of the spending of utilities, provided the finance is correctly prioritised and targeted.

Impacts concerning all efficiency measures:

Encouraging the development of water-efficient technologies and products stimulates the market and increases the competitiveness of European industries which is a positive economic impact. Tangible jobs can be directly traced and have been estimated (e.g. 60000 in DE) (ACTeon et al., 2012).

Efficiency targets will likely increase the investment into research and innovation in water saving technology and application, and will likely increase cooperation between research/academy and the industry and private sector. To maintain the incentive for innovation, the efficiency criteria will have to be periodically revised; in order to prevent that superseded standards act as a barrier for further performance improvement

Administrative burden will depend on how water efficiency targets are implemented. If water efficiency targets are specified for individual appliances or technologies, then control is limited to controls at the level of the industries producing relevant equipments. Defining water efficiency targets at the level of individual river basins is expected to lead to larger administrative burden.

Administrative costs will be associated with the set-up of certification schemes or labels and/or the determination of performance thresholds. Public authorities have to face additional costs, on top of the related administrative burden (e.g. red tape), to control the good enforcement of the labels and building certification schemes and ensure the compliance with potential minimum requirements,

The inefficient management of water resources results in reduced water availability which, in areas of water scarcity and drought, has a direct negative impact upon EU citizens and economic sectors such as agriculture, tourism, industry, energy and transport. This may in turn affect competitiveness and the internal market. Climate change will exacerbate these negative impacts in the future with more frequent and severe droughts expected across Europe and neighbouring countries

Reductions in per capita potable water demand could result in a change in the average wastewater content that is received at treatment plants, with increased biological oxygen demand (BOD), Suspended Solids (SS) and ammonia levels. Indeed, due to lower flow, more concentrating effects would be observed in the effluent to be treated. Such changes might have an effect on the performance of treatment processes.

The cost of appliances and production techniques in compliance with the efficiency targets may increase initially, and thus, potentially large investments will be needed (especially in agriculture). Depending on the level at which water efficiency standards are set, significant costs might apply even in river basins with moderate water deficit and where water efficiency lower than proposed standards and BAT would be sufficient. Thus, over-costs might apply in river basins with medium to moderate water imbalance.

Specific regions or sectors: The regions impacted by the “water efficiency” policy area will depend on the sectors implementing BAT in water efficiency. For example, regions with a higher share of water abstraction for industry as compared to other sectors will benefit more from increased uptake of BAT water efficiency if BAT water efficiency is the target of the sector-specific agreements or regulation. If all sectors and efficiency components are targeted at the same time, impacts will follow the relative importance of water abstractors in individual river basins.

2.3.2.6. Social Impacts

Appliances

The implementation of product labels and minimum requirements will increase innovation in products, to provide customers with more efficient products. The impact on businesses will depend upon their ability to address these requirements, with innovators expanding and others that cannot react contracting. Trade opportunities may expand some companies. All these impacts would affect employment – positively or negatively. The strength of the impact would be greater for a mandatory option than a voluntary one. Overall, EU manufacturers may react more quickly to new standards than importers, but this cannot be guaranteed. Overall, the number of manufactured products is not predicted to change and, therefore, although there would be both job creation and job loss, the net social impact is likely to be marginal in the private sector.

Furthermore, public administration would be needed to ensure the good application of the certification schemes and of any accompanying financial schemes, possibly increasing public jobs. Synergies with administrations controlling energy-using products may be fostered.

Improved efficiency of appliances would be expected to provide benefits to households in terms of reduced water bills. This would be particularly important in low income households. The impact would depend on the correct use of metering, the relative pricing of water, etc. Furthermore, where low income groups are in rented accommodation, use of water efficient appliances may be dependent on landlords.

Where water efficient appliances are used these can help reduce the impact of water scarcity through more efficient use of water overall. In such cases, the necessity to reduce certain types of water use during droughts may be reduced, thus providing additional social benefits. Health impacts from these options are not expected.

Overall, households might see their water bills reduced. A case study in France found that water saving measures can reduce household water bills by 240€/year. In some cases, water efficient appliances will deliver direct benefits to households as a result of reduced water bill and related reduced electricity bill (because of more limited use of energy for heating water – see below). Additionally, an increase in water efficient products resulting from mandatory efficiency requirements (the new legislation approach) are likely to create more competition within the market and provide more choice to the consumer compared to voluntary approaches (Bio Intelligence et al., 2012).

Buildings

Building standards would apply to new buildings and to some retrofit buildings. The acceptance of the standards would be largely not one for consumers, but (if voluntary) for construction companies). As with appliances, the ability to accommodate the new standards within construction companies will vary and this would affect their viability. However, the options would not affect the overall levels of construction and, therefore, the overall employment rates.

Low-income households tend to be hit hardest by rising water bills, as they proportionately pay more than twice as much for water usage in the home compared to high-income households. More water efficient buildings should, therefore, result in lower water bills, which would disproportionately favour lower income households (Bio Intelligence et al., 2012).

The use of smart-metering could gender issues related to the use of (and related access to) personal data. Water utilities would have to have clear customer policies and controlled procedure to ensure that any abusive exploitation of such data is banned.

In the longer term an increase in demand-side savings will mean that less water has to be treated and can lead to reduced consumption and costs for consumers. In the absence of defined carbon reduction targets, which can inform on the regulation, some water utilities had their meter installation programmes cut back by the Water Services Regulation Authority in England and Wales (OFWAT) within the framework of the 2009 Price Review. In the face of rising energy prices, water metering alone could reduce customers' water and energy bills by between £40 and £160 per year (Bio Intelligence et al., 2012).

Public acceptance of water saving initiatives highly varies between types of housing. In the UK, the Waterwise programme shows uptake rates between 6% and 22% in general housing whereas social housing (i.e. dedicated to lower-class population) show significantly higher uptake rates (between 45% and 60%). Yet, once involved in a water-efficiency project, 65% and 78% of customers from respectively general and social housing save water. The uptake of water-efficient devices has been shown to depend on the credibility of the body offering the retrofit and the communication about the new water saving equipment. The high uptake rates noted in social housing areas has mostly been due to the involvement of a housing association in the facilitation, planning and execution of water efficiency retrofitting projects. A 2001 UK assessment of the effectiveness of promotional campaigns on water-use behaviour highlighted the difficulty to engage the public, especially when it does not consider the amount of water as a priority issue due to the absence of noticeable shortages (Bio Intelligence et al., 2012).

The use of water-efficient schemes can also be perceived as a compromise on the comfort of use and therefore not be well-accepted by the consumers. That could be partly explained by the use of innovative water using products that did not comply with a multi-criteria performance assessment. Water-efficient showerheads could therefore be associated with customers' dissatisfaction due to pressure issue or to the need to increase the water temperature. As highlighted by the Ecodesign Directive for energy-related products, the promoted products should not have a direct impact on the consumer behaviour.

Leakage

Loss of water and costs of emergency repairs can result in increased costs to consumers. Higher utility costs disproportionately affect those social groups on lower incomes. Where costs are met from the public budget, these costs either have to be met through general taxation (usually local taxes), the distribution of which to social groups varies, or through a diversion of spending from other areas of public expenditure, which could impact on other areas of social welfare. It is important to note that leakage reduction programmes also result in expenditure, but such spending is planned and the impacts can be managed.

Leaks also cause disruption, such as to road users, as this can have negative social impacts, such as for commuters. Local flooding can damage property, causing distress to those affected.

Where leakage allows for bacterial contamination of drinking water supplies this can cause illness to those affected consumers.

For the general public, high leakage levels in water distribution networks are often viewed as examples of waste and inefficiency by utilities (public or private), in particular if consumers are asked to restrict water uses during times of drought or long-term water scarcity. Failure to address leakage can, therefore, be viewed as a governance failure. Addressing leakage, i.e. achieving the required efficiency, can be achieved when the distribution is achieving its SELL - where environmental, social and resource costs are fairly included in the calculation of SELL.

The options addressing leakage in distribution systems can each contribute to addressing these social impacts. The social impacts of the option to provide a robust tool to calculate SELL would depend on the level of those current impacts, the degree to which the tool is used and funding available to apply the results of the tool for changes to distribution systems. The option itself does not result in direct social impacts, in that it is the development of a methodology understanding the extent of water leakage. The option does not mandate any particular actions on tackling leakage or on how this should be funded. However, where utilities have insufficient tools to understand the extent of water leakage, then the option can provide a firmer basis for more efficient and cost-effective decision making for investments in water distribution infrastructure. With more efficient and cost-effective decision making, the following social benefits may arise:

- Robust methodologies to help decision making which are transparent will assist in improved public acceptability of the decisions of utilities.
- A clearer, robust determination of the economic justification for leakage reduction (e.g. based on the Sustainable Economic Level of Leakage) can help acceptability of pricing consequences for consumers.
- More efficient (targeted) use of available funds will ensure that disruption from leakage and leakage repairs is minimized.

Of course, where lack of an adequate methodology to understand the extent of leakages and the economic justification for different levels of investment, investments may not be made and consumers will not be asked to pay for them, which has larger consequences for those in lower income categories. However, in this case communities will still suffer from the negative social impacts of leakage.

For the funding option, the impact would depend again on the level of those current impacts and the size and distribution of the funds available. Funding through Cohesion Policy would deliver social benefits from leakage reduction only in the Member States eligible for such funding. It is, therefore, not possible to set these out in detail. However, the degree to which social impacts are affected by individual project choice could be included in the decision making for project selection through both Regional Funds and EIB loans.

Agriculture:

This could particularly affect young and small farmers. Historical production patterns and crop types may also be lost as a result of reduced irrigation, thus potentially impacting cultural heritage. Preventing the construction of water supply projects in disadvantaged areas could also reduce job creation and the demand for labour. Local projects carried out under Cohesion Policy have often led to local employment and led to an increase in qualifications of local works and companies to carry out such projects in the future (ACTeon et al., 2012).

Low income groups (be it households or farmers) might face difficulties in investing in the most expensive water saving technologies and devices, requiring potentially dedicated “financing support”.

Impacts concerning all measures

Costs of efficient measures will be translated in better ecosystems overall (supposing that reductions in water abstraction are allocated for environmental needs) that will benefit all sectors, thus leading to an overall net-benefit for society in the mid-long term, that will likely compensate the short term costs. The likely net economic benefit also increases political acceptability of water efficient measures that may just result in water use restrictions. Water tariffs might change because of new water saving technologies and efforts. However, increase in water tariffs is expected to be limited and compensated by reduction in water abstraction or water demand (depending on the point at which water saving takes place – water supply companies or individual households).

Increase awareness will lead to positive social impacts through the creation of new jobs for water experts and better access to education.

2.3.2.7. Environmental impacts

Appliances

Through the adoption of voluntary or mandatory appliance standards, options are aimed at saving water, and/or reducing the pressure on water bodies. The level of impact would depend on the degree of uptake, which would be likely to be greater under a regulatory approach and the impact would also depend on the level of local water scarcity.

Water saved may be used by ecosystems and help reach the WFD good status as well as increase availability for other water users.

Water savings lead to potential reductions in the abstraction of water for water supplies, thus reducing drought and scarcity impacts, in particular with knock-on benefits for biodiversity. Reduced water use also results in reduced energy consumption for the movement of water and for its treated, with consequent reductions in GHG emissions and, depending on the energy source, air pollution emissions. However, these impacts are small compared to other policy initiatives in this area. Reductions would be directly proportional to the percentage of water saved

Thus, saving one cubic meter of water in Spain or the United Kingdom in the household sector is expected to deliver energy savings that are double the additional energy requirements of producing one additional cubic meter of freshwater through desalination. For Malta, the value is even three times as high. As for agriculture, potential energy savings per cubic meter are marginal in all three case studies.

A Study from Australia indicates that the use of water appliances with a rating 1 point higher for water and ½ point higher for energy can amount to annual savings of 80,000 tonnes of CO2 and 22ML of water. Using less water or water more efficient will also increase the resilience of urban areas and companies against climate change (ACTeon et al., 2012).

An assessment of the water consumption of household appliances indicates that setting water efficient standards for these appliances could result in a potential 20% reduction in water heater use, or .59% of total EU primary energy supply. Introducing mandatory water saving measures would therefore correspond to yearly CO2 savings of approximately 2.89 MtCO2eq if these water appliances are replaced with more efficient ones (ACTeon et al., 2012). The measure is also an adaptation measure towards climate change.

According to the Waterwise programme:

0.747 tCO2eq is saved per ML of water saved (when distinction between hot or cold)

8 tCO2eq are saved per ML of hot water saved

44,000 kWh of energy is saved per ML of hot water saved

Buildings

Through the adoption of voluntary or mandatory building standards, options are aimed at saving water, and/or reducing the pressure on water bodies. The level of impact would depend on the degree of uptake, which would be likely to be greater under a regulatory approach and the impact would also depend on the level of local water scarcity.

Water is currently addressed in several national green building (voluntary) certification programmes. Within the HQE programme in France, the reduction of water use can vary from 5 to 45%. By 2010, 535 buildings or operations (part of a building) had been certified. Since 2008, the aim is to have 20% of its new constructions certified HQE or HPE. The number of certifications in the UK from the BREEAM programme increased from about 500 in 2004 to about 3,000 in 2009 for commercial buildings. BREEAM has also rated more than 100,000 residential buildings**Error! Bookmark not defined.**. Based on these numbers, Bio estimated that each year 500 commercial buildings and 15,000 residential buildings are rated in the UK. Extrapolated to the EU-27, that would represent a 1% uptake per year in commercial buildings, and a 0.05% uptake per year in residential buildings (Bio Intelligence et al., 2012).

Mandatory rating would be expected to increase the awareness of the public more easily than for voluntary labelling. However, information campaigns may be required to ensure that the public understands the meaning of the scheme. Additionally, negative publicity has decreased public trust in the scheme, resulting in reduced benefits from the scheme than expected.

Minimum requirements would be implemented for new and to be renovated buildings, targeting only a small part of the buildings in the EU, but reducing the water used compared to constructing buildings that are lower performers. In addition, while the improvement may seem low since it targets a low number of buildings, it will increase in time with more buildings being built or refurbished, bringing higher benefits in the longer-term.

The impact these options could have on water use is highlighted in the table below (including also the potential savings with an accompanying information campaign and/or financing programme).

Building Level Policies			Residential building : 25% savings			Non-residential building: 40% savings			Total Water Savings (%)*
			New	TBR	Existing	New	TBR	Existing	
Voluntary Rating/auditing	Alone	Building Uptake (%)	0.2	0.2	0.2	2	2	2	0.17
		Savings (%)	0.05	0.05	0.05	0.5	0.5	0.5	
	+ info c.	Building Uptake (%)	0.4	0.4	0.4	4	4	4	0.34
		Savings (%)	0.1	0.1	0.1	1	1	1	
	+ info c. + fin. inc.	Building Uptake (%)	0.6	0.6	0.6	6	6	6	0.51
		Savings (%)	0.15	0.15	0.15	1.5	1.5	1.5	
Mandatory Rating/auditing	Alone	Building Uptake (%)	5	5	2	5	5	2	0.52
		Savings (%)	1.25	1.25	0.5	1.25	1.25	0.5	
	+ info c.	Building Uptake (%)	10	10	4	10	10	4	1.04
		Savings (%)	2.5	2.5	1	2.5	2.5	1	
	+ info c. + fin. inc.	Building Uptake (%)	20	20	8	20	20	8	2.08
		Savings (%)	5	5	2	5	5	2	
Minimum requirements	Alone	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	
	+ info c.	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	
	+ info c. + fin. inc.	Building Uptake (%)	100	100	5	100	100	10	1.5
		Savings (%)	10	10	1.25	10	10	2.5	

Options would enable to ensure side energy savings and make potential synergies with energy performance schemes. In 2008, a General Services Administration survey revealed that the LEED-certified office buildings performed 29% better on energy use than the national and regional averages from a Commercial Buildings Energy consumption Survey (Bio Intelligence et al., 2012). Buildings would also gain energy and carbon through the water savings, but also would require modifications in existing buildings that would result in energy and carbon costs; for new buildings some carbon costs could be incurred, but are expected to be counterbalanced during the lifecycle of the building. The energy and carbon saved would be linked both to the water saved and the need to introduce new products and systems.

Agriculture

Water abstraction for irrigation can negatively impact the physical and chemical characteristics, including the biodiversity, of the water bodies (IEEP, 2000). For example, if irrigation abstraction of groundwater exceeds the natural recharge rate of the aquifer, water tables can be lowered as well as impact the interchange between groundwater and surface water. This is especially the case in summers, where precipitation does not recharge surface water and groundwater (ACTeon et al., 2012).

There is also a like to water quality problems, as reduced flow can lead to reduced dilution of pollutants such as nutrients coming from agriculture fertilization. Preventing new water supply and irrigation schemes to be constructed in water scarce areas should help to prevent these problems. Salinization of water and soils as a result of irrigation is also a major issue, for example in Greece, Spain and Portugal. This is especially a problem in Greece where 25% of existing irrigation land experience salinization (ACTeon et al., 2012)

Impacts concerning all measures

Water saved may be used by ecosystems and help reach the WFD good status as well as increase availability for other water users.

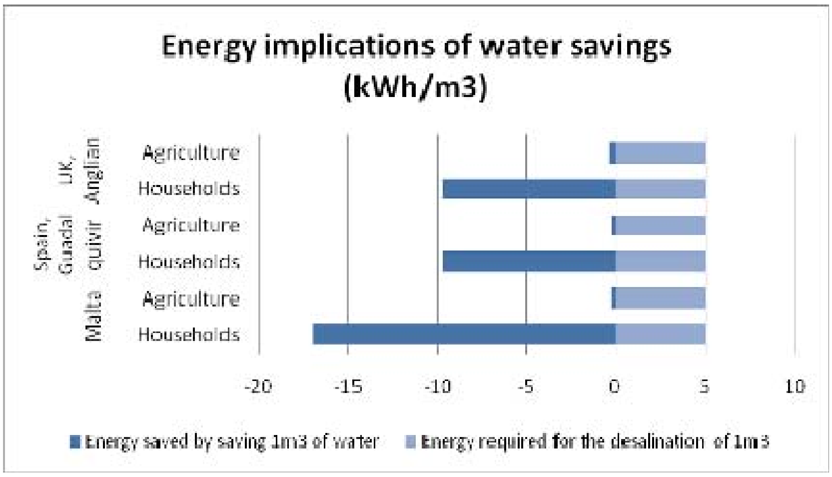
The greatest environmental benefits from implementation of water efficiency measures will clearly be on water resources. Water abstraction from surface or groundwater can reduce the quantity of water if it is not regulated well and if a water balance is not maintained.

Reducing water use will positively impact various aspects of the environment. In terms of climate, reduced water abstraction and pumping of water will result in less energy use, leading to less CO2 emissions. For example approximately 5.8% of total electricity demand in Spain is due to the water sector. Irrigated agriculture is one of the Spanish water sectors that show the largest growth in energy requirements. Investigations in the US found that if 1% of American households retrofitted their houses with water-efficient fixtures the country would save 100 Million kWh of electricity to year and reduce GHG emission by 75,000 tons. Following table presents energy consumption related to water use in each point of the water cycle (ACTeon et al., 2012).

Component of the water cycle	Description	Energy consumption

		(kWh/m^3)
Source	Groundwater abstraction (100m well depth)	0.407
	Surface water abstraction	0.045
	Desalination seawater (pumping included)	6.833
	Desalination brackish water (pumping included)	3.083
	Rainwater harvesting	0
	Water reuse (treatment and distribution)	0.212
Water treatment	Groundwater	0.031
	Surface water	0.370
Transport – Supply	Distribution public water net	0.289
Use	Agriculture – Irrigation	0.111
	Household - Hot water	24.271
	Household - Average (share of hot water = 35%)	8.495
Wastewater	Treatment	0.340
	Transport	0.289

The figure below present estimate of energy saving, comparing it to the additional energy requirement from producing one cubic meter of desalted water (Ecologic, 2008).



Moving to full water metering across England and Wales could potentially reduce annual emissions by 1.1 to 1.6 million tCO_2eq/yr from current levels. Moreover, achieving full household water metering could deliver a significant emission reduction, equivalent to 27-40% of the Carbon Reduction Commitment (CRC) target (Bio Intelligence et al., 2012)

Efficiency measures will lead to significant amount of water saved/conserved in some river basins. The effect on the groundwater and drinking water quality and availability will then be very positive. However, depending on the levels at which BAT and water efficiency standards are set, water efficiency gains might not be sufficient for achieving water balance in river basins with severe water deficit today. For example, in some river basins in France, reduction in agricultural water demand by 80% are required to re-establish E-Flows, a reduction that cannot be achieved by any water efficiency improvement in irrigation systems (ACTeon et al., 2012).

Land use: Indirect impacts on land use are possible given that measures to enhance water us efficiency in agriculture can lead to changes other pressures in water scarce basins (e.g. as a result of shifts in farm practices), thus impacting the overall environment. It is unclear, however, whether such changes would be beneficial or negative. This will clearly depend on the natural context and the types of farming systems targeted by water saving measures.

2.3.3. Barriers for implementation

Market failures, regulatory and policy support

Similarly to artificial water storage or the creation of new resources measures barriers to the implementation of these measures are as following:

There is the lack of the application of best practices in integrated water management by water managers at a national or basin level to produce RMBPs that are coherent and cost effective.

In general at a national or basin level the institutional or administrative structures are not in place. It causes problems in the development and implementation of an integrated water resource management plan for the administration, management, protection and sustainable development of the raw water resources at a basin and water body level.

The existing RMBPs hardly apply the principles of: polluter pays, cost recovery, cost-effectiveness and disproportionate costs. It means that they do not meet society's overall water objectives for quality and quantity i.e. a RBMP that is harmonized with socio-economic development objectives resulting in water bodies that will achieve good ecological status.

There is the lack of coherence between the RBMPs and other sectorial plans resulting in inability of basin mangers to fully evaluate the costs and benefits between measures in order to select the most cost effective ones for society.

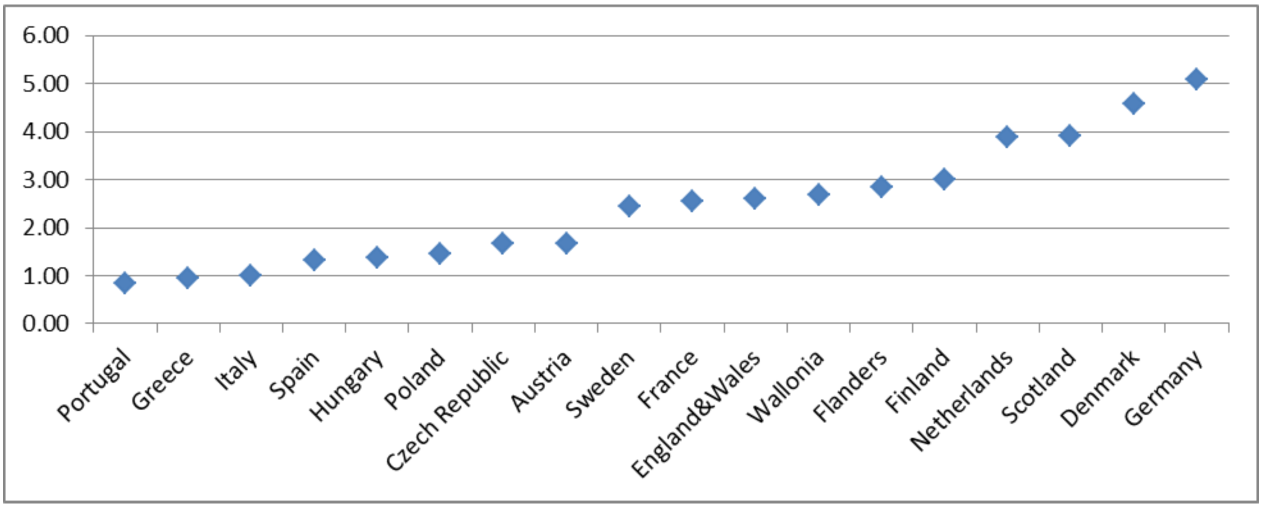
There is a general lack of clear institutional roles between water resource managers (responsible for quantity and quality) and competent authorities for environment whose focus is on water quality and the environment. The efficient and cost effective management of water resources requires the management and implementation of measures that are for the common and cost effective good of multiple users and are not solely linked to one user or user group. This requires an institutional framework with the capacity to administrate, evaluate, select and manage the implementation of common water resource.

Lack of full cost recovery of water services, including financial, environmental and resource costs makes difficult to take economically and environmentally sound decisions on implementation of water efficiency measures.

In addition to the above barriers:

There are concerns about efficiency of water pricing, especially in agriculture sector, because of low elasticity of demand. At present, limited data are available on the relationship between increases in water prices and variations of consumption levels; available figures, however, suggest that higher water prices are actually effective in regulating (reducing) domestic consumption (EEA, 2009). It is important to stress, however, that current water prices vary significant across EU Member States, as shown in the graph below:

Water prices across EU member states (2008) (Polymedia, 2012).



This means that significant increase in water tariffs or the application of new (or higher) abstraction charges would be expected in countries with domestic prices still below EU average and without full recovery of O&M and investment costs (e.g. most of Mediterranean countries).

It represents below table:

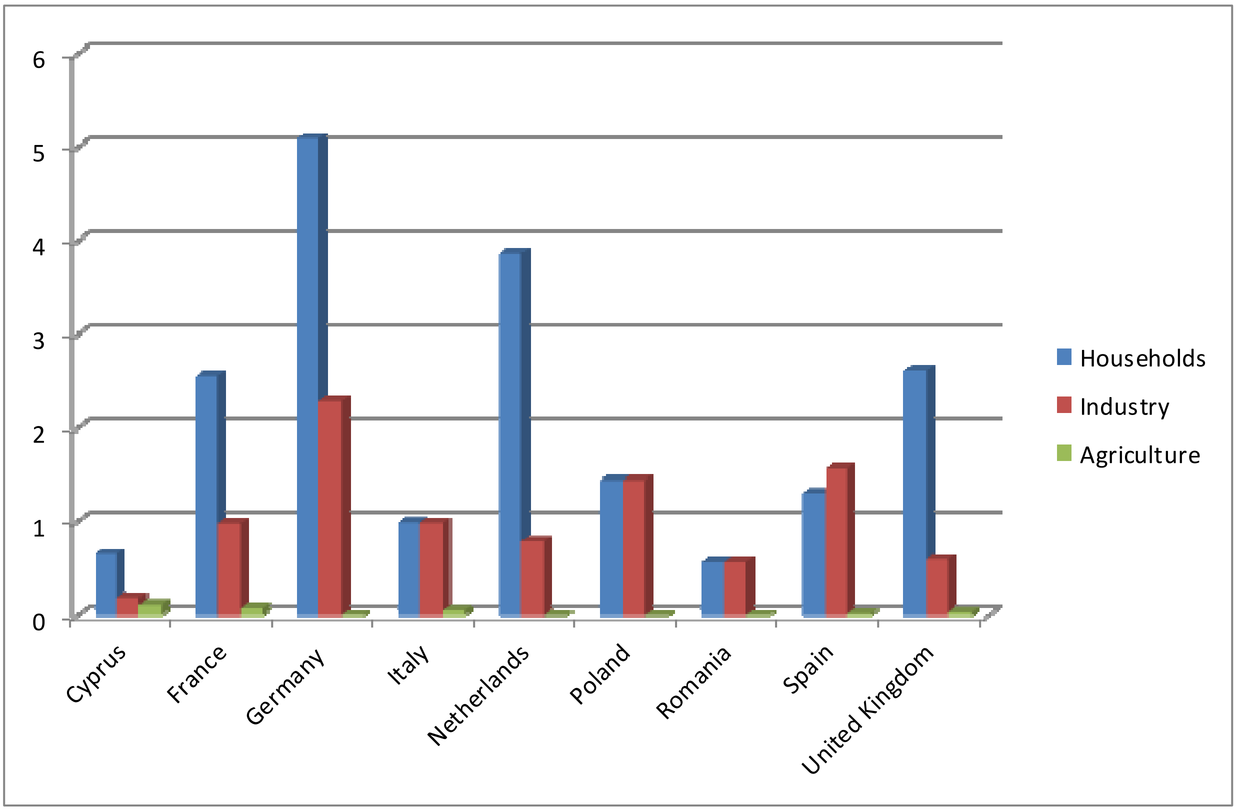
Price elasticities of residential water demand across Europe (Polymedia, 2012).

Region	Price elasticity of residential water demand
North and West	• 0.187
East	• 0.271
South	• 0.402

It is a commonly held view that increasing irrigation water prices will lead to a reduction in the volume of water used in agriculture, and that underpricing is the major cause of waste. In this sector, water savings can be achieved through various farmer responses, such as for example improving irrigation efficiency, reducing the irrigated area or modifying agricultural practices. Agriculture is a crucial sector for the implementation of water pricing policies because irrigation water prices are normally much lower than water prices applied to the domestic and industrial sector, as shown in the figure below:

Prices of water in chosen Member States by sector (industrial prices concern prices paid to water provider)[17]:

[17] Source: Polymedia, 2012, OECD 2008, BIO 2012, Bio Intelligence et al., 2012, examples of actual prices of water providers



In France, in Adour-Garonne River Basin District current pricing policies seem to have a rather limited impact on water savings, as a decrease in the irrigated area has not resulted in a decreased demand for water. Water allocation policies, in contrast, proved to directly affect farmers when water use is restricted;

In Cyprus a combination of water policy, allocation policy and technical measures was adopted to face water scarcity situations. Technical measures, however, proved to have a greater impact than pricing policies (Arcadis et al., 2012).

Considering pricing policies as an important instrument to reduce water consumption in agriculture, provided that these policies are implemented in conditions where water is on demand and farmers can actually adjust consumption as a response to changing prices or, in other words, when two fundamental pre-requisites are met

As flat rates are quite common in the EU, some water gains can already be achieved by introducing binomial rates, including a fixed component covering the 'fixed costs' of the system and a variable component based on actual consumption: it was shown, for example, that in the Guadalquivir basin those districts with binomial tariffs consume, on average, 10-20% less than district with flat rate pricing, regardless of the level of the flat rate (Rodriguez-Diaz, 2004, in EEA, 2009); another study observed that volumetric rates led to a 25-35% decrease in water use as compared to a flat rate (ACTeon et al., 2012).

In the Duero region in Spain, where limited crop types are available, it was found that price increases can have an impact on water demand only if farmers' income decreases by 25% to 40% (ACTeon et al., 2012).

In general the principle of full cost recovery is not implemented across the EC. Generally either resource costs or asset renewals costs are not adequately included or neither are included in user tariffs. If resource costs and asset renewals costs are not recovered in user tariffs it is unlikely that a water service provider will achieve optimum levels of leakage reductions for its water distribution network. Water Service Providers aim for full cost recovery where this means recovering the resource costs, operations costs and asset renewals costs from consumers, where the 'resource cost' is included in the Water Service Providers' internal costs and is not treated as an external cost item that is passed directly on to consumers like a tax as if it were external to the Water Service Providers operational influence. Entire Elimination of leakage is an unrealistic goal because of the costs involved, but optimising leakage reduction is a crucial part of water demand management. Leakage reduction goals should be based on Sustainable Level of Leakage (ERM et al., 2012).

Despite a number of activities launched at the EU level, and fully acknowledging the indirect impacts on water use achieved by Ecodesign label of energy related products, no labeling or certification scheme is directly related to water. In addition, attempts to initiate a water scarcity related scheme in the framework of the European Alliance on Corporate Social Responsibility (CSR) have not been further pursued.

Experiences with *Water Footprinting*, have been limited, and this is mainly due to issues still concerning the clarity, transparency and reliability of such indicator. Certification and labeling schemes appear to be a more appropriate approach to promote sustainable water management than Water Footprinting.

There is a need in increasing advice and scheduling for farmers (actually it is organised only on regional scales). Advice and scheduling shown to deliver good results, as it answers farmers demand, and many RBMP identify advice as an important means to show ways to improve water performance of farmers, and to ensure that the efficient techniques introduced are used to their full potential.

There is low public awareness of importance of water saving and its influence on the environment and climate changes. There is also low public knowledge of water saving devices in buildings.

There is lack of unified water saving standards/ norms for water appliances in buildings and in agriculture.

Financing sources

Several initiatives have been taken to incorporate financing to water savings in EU policies (e.g. Regional and Cohesion Funds, CAP and legal proposals for direct payments). Moreover, the European Investment Bank adopted a new lending policy for the water sector. All three funds have taken steps to enhance effective water management. However, with respect to regional and cohesion funds it is still unclear whether objectives have been met.

There are major research efforts which have been promoted and financed at the European level. However, except of the project "Evaluation of effectiveness of economic instruments in integrated water policy" water scarcity was not the object of articulated research project, but it was rather tackled, together with other issues, by different projects within the 6th and 7th Framework Programme and European Territorial Cooperation programs. It is not clear, at this stage, whether this apparent fragmentation has led to coherent, integrated and exhaustive results, nor whether the necessary linkages among projects were established and provided input to the policy needs.

With the exception of the CAP, it s unclear that efforts undertaken at EU level for improving conditions for EU and national funds to ensure the financing of water savings measures are translated into action at Member State level. This is highlighted by the lack of response for using regional, cohesion and EIB funds for MS WS&D programmes and actions.

An Australian study stated that the most frequently mentioned barrier to install efficient appliances in households was financial. According to an economic newspaper from Germany, the replacement of existing showerheads, toilets and faucets with more water-efficient ones to achieve 30% water reduction would cost 400€ per flat owner, i.e. more than 10 billion Euros for the whole of Germany (Bio Intelligence et al., 2012).

Lack of implementation and coordination

Many initiatives were taken at the EU level aimed at improving land use planning, especially in the context of the set of legal proposals designed to make the CAP post 2013 a more effective policy; other sectors of intervention include biofuels and climate change adaptation (White Paper). Progress has been made to better incorporate water quantity issues into the CAP, although this progress is uncertain to continue considering the current proposal for the CAP. Concerning biofuels, the objective has technically been achieved, but more effort could be made to incorporate water management issues into biofuel development.

In 2008 MS were commended to develop a water tariff policy by 2010, in line with the requirements of the EU WFD. Very limited initiatives have however been taken by MS in this field. Despite efforts taken at EU level, water pricing is slowly being implemented in MS. It seems that neither the objectives of full implementation of the WFD in terms of water cost recovery or the implementation of the 'users pay' principle have been reached so far.

Knowledge base

The common barrier for all types of measures is a general lack of knowledge of water balances, water accounts, efficiency measures and supporting economic instruments.

There is no consistent methodology for calculating the Sustainable Level of Leakage in water distribution networks promoting the implementation of the operational objectives and economic principles of the WFD.

Specific barriers to water efficiency measures in agriculture include (BIO, 2012)**:**

Sub-measure:	Barrier (s)
• the improvement of irrigation systems	Generally applied only to high value crops
• the application of deficit irrigation (Can reduce up to 15% of water use, can improve water productivity	Generally applicable only to certain types of crops; requires training and developed monitoring systems; can decrees yield up to 28%; costs depend on the type of deficit

between 5% and 36%)	irrigation system applied.
• reduction of evaporation during storage (Can reduce evaporation losses by up to 80%)	High investment costs; methods are not sufficiently developed and field tested and more research is required.
• decreasing soil evaporation (Can reduce water use by 4% - 9%)	Further research needed on polymer use
• Irrigation scheduling (Can reduce water use by 9% - 20%)	Requires a high level of knowledge among farmers about local crops, soils, weather and hydrological flows to be efficient. High costs: costs of tensiometers (450 to 1 800 EUR, used for 6-10 years), 380 EUR per year for climatic data. Irrigation scheduling could be used in every river basin.
• Water table management	Limited geographical use; requires important drainage system and monitoring (costs)
• Changing planting dates	Very limited applicability (requires very specific conditions); requires a high level of knowledge amongst farmers

2.3.4. Degree of implementation as reflected by the RBMPs

In 82% of the RBMPs assessed there are measures such as: ecological reconstruction; use of best available techniques in industry, trade and agriculture to save water; improve knowledge on future water demands and needs or to put in coherence the authorizations of abstractions with the needs of the aquatic environment.

A similar percentage of RBMPs (up to 72%) include the reduction of losses in urban distribution networks, as a proposed measure.

According to RBMPs assessment volumetric pricing is in place only for 63% of water uses and water metering is in place for 53% of water uses. Lack of metering and volumetric pricing concerns mainly agriculture but also households and industry. Future modification of the water pricing system to foster a more efficient use of water (in 58% of the RBMPs), the improvement of the efficiency of water agricultural uses (in 58% of the RBMPs), measures to enhance water metering (in 54% of the RBMPs), binding measures related to performance of buildings (37 %) or measures to increase treated water reuse (53%) are reported in the RBMPs.). Restrictions to new water-demanding developments (urban, irrigation) are planned in 24-29% of the assessed RBMPs.

Regarding water metering: the coverage of metering is lower in agriculture than in households and industry, although there are large differences between countries. Water metering for permitted abstractions in agriculture is at least obliged in Belgium (Flanders), Bulgaria, Czech Republic (above a certain threshold), Denmark, Estonia, France, Malta (groundwater), Lithuania, Romania and Spain. It is of note that the list may not be exhaustive, as some other EU Member States also apply volumetric charges which necessitates some type of water metering.

RBMPs in general are not coordinated with physical/socio-economic plans for water quantity management in order to fully incorporate sustainable water balances and apply the principle of cost recovery in order to promote water resource efficiency.

2.3.5. Key EU policy instruments that would unlock / guide the implementation

EU Policy instruments related to use of economic instruments

Economic incentives could help in "unlocking" the measures. This supposes that proper implementation of the WFD economic principles of: the polluter-pays principle, the principle of cost recovery.

EU Policy instruments related to governance and integration

Strengthening the “quantitative dimension” of the WFD implementation (be it in monitoring, assessments, definition of targets or selection of measures), which currently focuses on water quality issues and does not adequately address quantity issues. This supposes that ‘Quantity Management is clearly introduced into the RBMP aiming to ensure that the water balance between supply and demand in all water bodies in a basin is both statically and dynamically in balance. This will require the establishment of systematic water balance assessment/water accounts at sub-catchment level and the dynamic modelling of water resources for the preparation of next RBMP. This will provide information on where and how water efficiency can be improved in a cost-effective way.

In relation to water distribution networks it is not recommended that targets for water efficiency are set at EU level as physical, financial, legal, institutional, regulatory and socio-economic context is different for each water utility, operating in its specific water body(s) and basin, within its national policy and legislative framework

Awareness raising campaigns and advisory services:

- to improve the public and user awareness and acceptance of the water reuse,
- importance of water saving and its influence on the environment and climate changes,
- improve knowledge of water saving devices in buildings

EU Policy instruments related to funding

Structural and Cohesion Funds provide support to least developed regions among which are often facing significant water scarcity. It is imperative to ensure the consistency of actions financed from the CSF Funds with RBMP. One of the "priorities" of rural development policy would explicitly include improving the EU farm sector's water-efficiency. As in the current programming period, support for technical infrastructure investments (including irrigation facilities) would be maintained.

In parallel, specific efforts (financial as well) will be required to assess and then monitor water use efficiency in new projects and developments.

EU Policy instruments related to knowledge base

Application of well-defined efficiency targets for different water use sectors and components of the hydrological cycle (e.g. targets for conveyance efficiency in irrigation systems, for water use efficiency in buildings, etc.).

Specific research and benchmarking (within sectors) is required on BAT water efficiency for all types of measures. Research on maximum and optimal water efficiency will be performed at different scales (Europe, MS, river basins, sectors or sub-sectors) for different types of context. This will help supporting the definition of target(s) and possible BAT water efficiency standards.

Development of a harmonised method for determining the Sustainable level of water leakage at EU level and engage Member States and the water industry in a process to integrate it into their water management and share best practices on leakage reduction.

Building a robust monitoring & evaluation systems for WS&D, strengthening the quantitative dimension of the WFD

Strengthening the knowledge base on water balances, water accounts, efficiency measures and economic instruments

Increase support for advice and scheduling for farmers to ensure that the efficient techniques introduced are used to their full potential.

3. ANNEX 3: STAKEHOLDER AND PUBLIC CONSULTATIONS

3.1. Stakeholder and public consultation for the policy reviews supporting the Blueprint

Stakeholder and public consultation took place in different contexts:

3.1.1. Assessment River Basin Management Plans

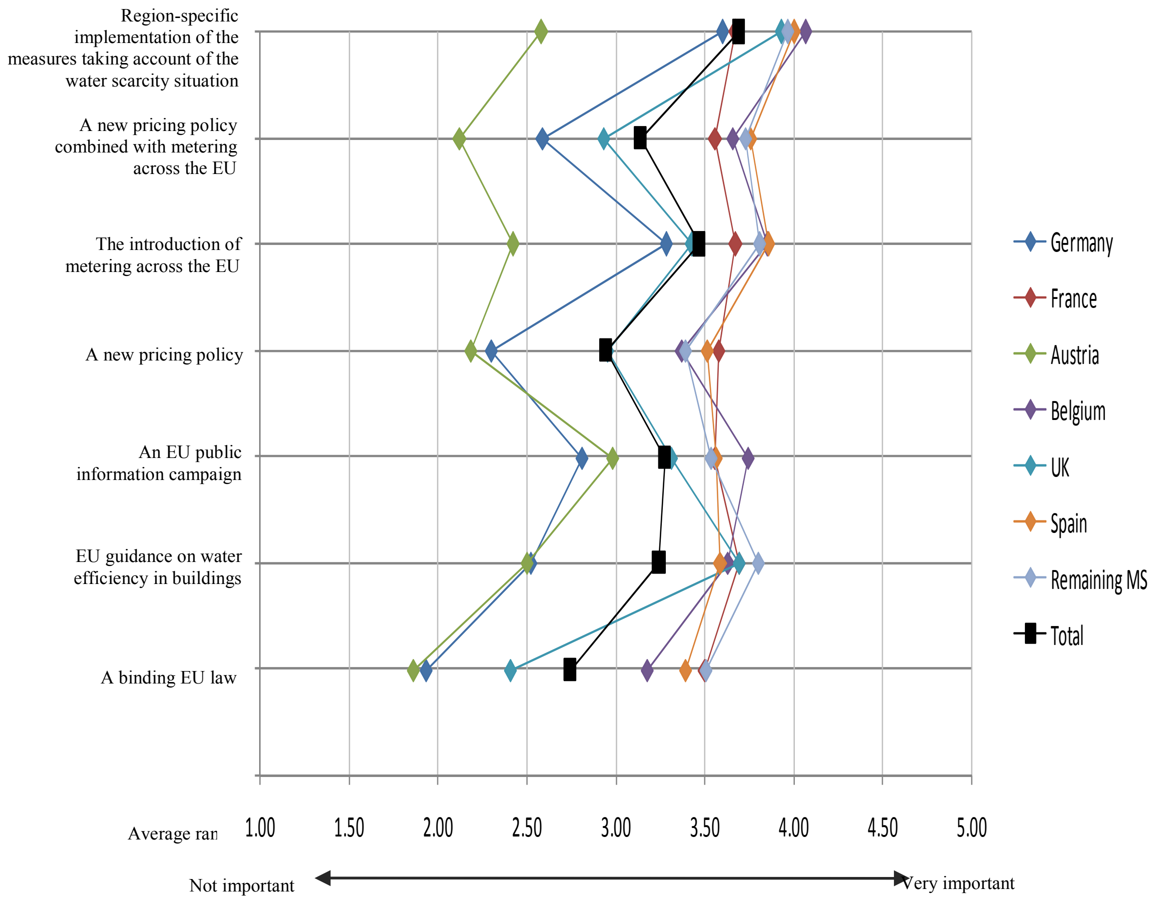
Bilateral dialogues took place with Member States in the context of the assessment of the Plans.

Targeted stakeholder workshops (hydro morphology, cost-benefits analysis,) took place in the context of the Study on Pressures & Measures.

3.1.2. Review Water Scarcity & Droughts policy

A stakeholder consultation took place in the context of a discussion on options for water savings in buildings from 16 November 2011 until 8 February 2012. The consultation received 465 contributions from 24 Member States.

The figure below shows the summary of the results concerning the perceived usefulness of different EU measures to increase the water efficiency of buildings. An average rank has been used to display the results.



Conclusions:

- - The high score for region-specific measures shows that respondents recognise the differences in water availability across the continent and perhaps emphasises the notion that citizens in water rich regions should not be subject to the same use restrictions as those living in areas of scarcity.

- - The measure to introduce metering across the EU scores highly, presumably as most of the respondents already have meters in their homes and see no harm in this being standard practice for all European citizens.

- - Respondents from Germany and Austria rank each measure lower than their European counterparts. This could be due to the current water efficiency standards already in place within these countries.

- - On the whole, EU guidance, awareness raising and metering scored higher than the stricter measures such as a binding EU law and pricing policy.

Further consultation was embedded into the consultation on the Blueprint policy options.

3.1.3. Fitness Check

Given the wide range of issues that could arise in undertaking the Fitness Check, the Commission recognised the importance of ensuring active consultation with stakeholders throughout and that a range of mechanisms to obtain stakeholder views were needed. Therefore, a number of different consultation processes were undertaken, including web-based consultations, meetings and interviews and two workshops.

The scoping study included three web-based consultations during 2011. The first targeted National Authorities relevant for the high-level management and implementation of EU water policy. The second targeted representatives of river basin management authorities. The third targeted other categories of stakeholders such as experts from the industry, NGOs, international organisations and academia. In total 61 institutions from 26 Member States and from non-EU countries responded to the surveys.

In late 2011 a second web-based public consultation was held, which concluded on 28 February 2012. This sought views from as wide a range of interested institutions and individuals as possible, focusing on different aspects of the Fitness Check: the relevance, coherence, efficiency and effectiveness of EU freshwater policy. Questions considered different aspects of these four themes for the policies included in the Fitness Check as well as interactions with other EU water law, other environmental policy and other EU policies. In total 113 responses were received from 22 countries.

Main conclusions drawn from the consultation are:

- **Improvement of Europe´s waters**: For a very large majority (almost 88%) of respondents, the range of EU Directives adopted since the 1970s has brought significant improvements to the quality of Europe’s surface and ground waters.

- **Quality of policy framework:** Overall, respondents considered that the existing policy framework is good, comprehensive and adequate to tackle the majority of the challenges facing water management. Obstacles are: inconsistent implementation of certain measures, poor monitoring and lack of controls. The existing legislation has been most beneficial in relation to the protection of ecosystems and biodiversity, protection of human health and for the protection of river basins as a whole. However, concerning pollution from industrial activities, it was stated by several respondents that EU policy promotes end of pipe treatment rather than source control. The main gap identified by respondents in the existing policy is in relation to water efficiency. New challenges to address include water scarcity, innovation and climate change.

- **Success on addressing challenges facing water management:** Respondents considered that the Water Framework Directive is mainly successful to very successful in meeting the challenges facing water management. For the Groundwater Directive, most respondents considered it to be average to successful; however, lack of concrete controls may be a limitation. There were diverse views related to the Environmental Quality Standards Directive with comments on the list being too short, or delays in reviewing the list too long. The Urban Waste Water Treatment Directive and Floods Directive were largely considered to be successful to very successful. The Communication on water scarcity and droughts was considered by the majority to have limited, average or some success in addressing the challenges, being successful in increasing awareness among stakeholders. A number of respondents commented that the objectives in EU policy concerning water quality need to be revisited and adapted to modern challenges, but a significant amount of comments stressed that determining success or not for some instruments was too early as they are still being implemented.

- **Gaps in EU policy framework:** The respondents were evenly divided in their views on whether the EU policy framework has gaps in its coverage. MS stated that instead of new regulation, the European Commission should provide more guidelines and further support to implementation. The development of a common analytical tool was called for in order to improve the quality of reporting and monitoring. Most significant gaps were considered to be: Insufficient consideration of local issues, water reuse not being sufficiently addressed, lack of a common regulatory framework at EU level limits, does not address water use rights, their duration, revision etcetc., lack of obligations relating to water efficiency in buildings, lack of sufficient consideration of water quantity in River Basin Management Plans and gap in funding for infrastructure and cost recovery.

- **Climate adaptation:** consensus that in addressing climate challenges, the main necessity is the flexibility to act at the level where the pressures are the greatest and to balance water availability with changing pressures. There is a gap in integrating climate change adaption through the existing policies as water legislation was written before climate change issues had begun to be included in policies. The Floods Directive is perceived to be the best adapted to climate change, while the Urban Waste Water Treatment Directive does not take into account carbon implications. As the Communication on Water Scarcity and Droughts and the White Paper on climate adaptation are non-binding documents even if they do address climate change, this is seen as a drawback by some. A uniform, one-size-fits-all approach was widely criticised, in particular in relation to floods, droughts and water scarcity.

- **Balance between obligations set out at EU level and MS:** For a large majority of respondents, the balance between obligations set out at EU level and Member State action within the current water policy framework is correct. Furthermore, for many respondents, even though flexibility is desirable, some intervention at EU level is necessary to prevent Member States favouring local economic issues over environmental ones. It was noted that MS still need clear guidance at EU level to ensure compliance. But flexibility brings difficulty to compare Member States' compliance. Divergent answers were given on the current level of subsidiarity.

- **Coherence within policies covered:** Majority considered that there were either limited inconsistencies or no inconsistencies and, if yes, it may be due to the different timings when the different instruments were written. Big concern on details such as duplication of reporting and monitoring efforts, raising costs due to the multiplication of tasks. Incoherence in reporting cycles was commented by a number of respondents. The respondents from the energy producing sector called for a better prioritisation of the objectives.

- **Coherence with other EU law:** Overall, the majority of respondents reported that these legislative instruments were at least partially coherent with the remainder of EU water legislation. There is a missing link between the Drinking Water Directive and the protection of drinking water through water safety plans. Concerning the Marine Strategy Framework Directive, the main inconsistency was in relation to the determination of good status.

- **Coherence with other EU environmental policies:** The hydropower industry stated that there are difficulties to accommodate the renewable obligations under EU law and the requirement of EU water legislation, which can hinder hydropower development. The lack of integration with energy policy was more generally commented upon. Concerning chemicals, respondents stressed that more integration is needed in relation to chemicals and pharmaceutical products. Some respondents suggested a unified priority substance regime. Regarding biodiversity policy, respondents noted that there are different definitions and concepts within the Birds and Habitats Directives and the WFD. The EIA and SEA are seen as a heavy burden.

- **Coherence with other sectoral policies:** In nearly all the comments made by respondents, agricultural policy or energy policy were identified as the main obstacles to a successful water policy. Several areas of agriculture supported by the CAP are very detrimental to the environment. Problems identified are: unmonitored subsidised abstraction, no application of polluter pays principle in the agriculture sector. Some respondents also noted the impact of hydropower on water bodies and their hydro morphology.

- **Common Implementation Strategy:** A large majority of the respondents (77.2 per cent) agreed that the CIS fully or partially addressed the right issues, and the guidance produced was considered partially helpful by more than half of respondents. However, further clarity through the CIS is needed to enhance implementation and guidance documents would have been more useful if they had been made available earlier in the implementation. The one-size-fits-all approach is unsuitable and a better involvement of experts would be desirable.

- **Administrative coordination:** The respondents agreed by a very slight majority that effective co-ordination of administrations exists between national and river basin authorities and among river basin authorities in river basins across national frontiers. 61% considered that improvement for coordination between water management authorities and stakeholders is needed. Cross-border cooperation has improved as a consequence of the Water Framework Directive, and several respondents (e.g. industry) noted that the process can be improved further in the coming decade without amendments to EU legislation.

- **Planning:** For all the Directives, more than 40 per cent of the respondents considered the planning obligations to be fully clear and achievable. The Directives allow sufficient flexibility for Member States to develop plans which suit local circumstances and policy objectives. However, some stated (river basin authority, industry) that it is more questionable whether the obligations are achievable. Also the planning process for the WFD was considered to be hard to fulfil and the requirements and exceptions of Article 4 are too complex and not clear. What is perceived as problematic is the fact that planning obligations for the Nitrates

Directive and Urban Waste Water Treatment Directive are not synchronised. For the Floods Directive, comments highlighted room for improvement in terms of guidance. The analysis of the measures proposed in the River Basin Management Plans should focus on whether the plans helped to solve problems at their source (e.g. the control of pollution at source), sustainability and cost-optimisation of measures, etc.

- **Public participation:** A majority of respondents considered the requirements in EU Directives are a sufficient legal basis for public participation in water management. However, approximately one fifth of the respondents considered that the process of public consultation has not effectively provided for a possibility to influence water management, and that public participation in water management is not sufficient in their river basin/country. Regarding whether current guidance is sufficient to promote active participation, there was significant variation in the responses. Comments included that public information deadlines are too short for the large and complex set of documents to be reviewed, and that sometimes the documents are difficult for stakeholders to access and understand.

- **Monitoring obligations:** The majority of the respondents considered the monitoring obligations in the Water Framework Directive, Groundwater Directive, Directive on environmental quality standards and Urban Waste Water Treatment Directive as addressing the right issues. Regarding the Directive on environmental quality standards, comments included that costs of monitoring (especially concerning the persistent pollutants) are very high. Some of the obligations for the Nitrates Directive were not considered to be coherent with each other

- **Reporting obligations:** a majority considered that the reporting obligations fully or partially add value. It was noted that the reporting adds value if correctly analysed; one main concern is, however, the streamlining of the reporting obligations across EU legislation. Several respondents stated that the principle of "one out all out" in the Water Framework Directive, by which the poorest individual result drives the overall determination of status, needs to be reconsidered. Streamlining the reporting between the Water Framework Directive and the Nitrates Directive would also be welcomed. Some respondents considered that transparency could be improved.

- **Measures and obligations:** The majority of respondents considered the obligations under the Water Framework Directive, Groundwater Directive, and Floods Directive to be sufficient. One third considered the obligations under the Nitrates Directive are insufficient to obtain its objectives, and nearly 29 per cent considered the obligations of the Directive on environmental quality standards too excessive. Regarding the WFD, a high cost for achieving the goals was emphasised by several respondents (industry, national administrative bodies), especially in densely populated and industrialised Member States and it was noted that the objectives were too ambitious to be implemented in the time provided.

- **Costs and administrative burdens:** For all Directives, except the Floods and Nitrates Directives, the number of respondents considering the costs to be higher than the benefits was greater than those who considered the costs to be lower than the benefits.

- **Implementing EU water law:** The issues most commonly considered by respondents to be challenging were: insufficient finance; a lack of integration of water policy objectives in other policy areas; and poor coordination with other authorities (spatial planning, agriculture, economic planning, etcetc.). The aspects which seem to be least challenging were: a lack of legal status of River Basin Management Plans; insufficient ability to control water demands; objectives of EU water policy not properly formulated; too many bodies involved in water decision making; and poor coordination between river basin and national bodies.

- **Way forward:** Industry respondents, national administrative bodies and a river basin authority suggested that the Water Framework Directive should be given much more time to deliver its present goals before considering additional water related instruments. Several respondents suggested that the European Commission should take the opportunity of the CAP reform to better integrate water-related issues. Regarding development of new or improved guidance, industry respondents commented that water reclamation and reuse could benefit from EU guidance to encourage suppliers and users to apply water reclamation and reuse techniques. Guidance under the Water Framework Directive should also specify better harmonized measures to be implemented at local level. The European Commission could take a stronger focus on coordination between different stakeholders. More or better targeted EU funding could be achieved through:

  – Assessment and revision of (EU and Member State) funding for agriculture, transport, energy with regard to ecological values, environmental provisions and needs.

  – Targeting the maintenance of infrastructure in order to achieve greater performance rates. Increasing funding for innovation in the water sector.

  – Targeted EU funding for cross-sectoral measures, e.g. renewable energy plants and water conservation.

Meetings and interviews were held with a range of stakeholders and officials. Throughout the work on the Fitness Check approximately 50 meetings or interviews were held with Commission officials and a range of EU-level stakeholders. Within the scoping study, interviews were also held with relevant authority officials, sectoral interests and NGOs for five river basins: Scheldt, Danube, Guadiana, Po and Severn.

Two workshops were held. The first, on 10 May 2011, explored the preliminary conclusions reached in the scoping study. There were more than 80 participants, including stakeholders from national administrations, NGOs and sectoral federations. The feedback from participants was taken into account in finalising the scoping study.

A second workshop was held on 9-10 February 2012. There were about 45 participants invited from the Strategic Coordination Group of the Common Implementation Strategy of the WFD, including Member State officials, business associations, NGOs, etc. This workshop was structured to maximise participative discussion to obtain views on all of the key issues relevant to the Fitness Check.

Meetings with relevant stakeholders were organised:

- EUREAU on 2 February 2012
- WWF/EEB on 23 January 2012
- EUWMA on 26 January 2012

3.1.4. *Modelling of scenarios, measures and objectives*

Stakeholder meetings were organised in Brussels by JRC and ENV to discuss and obtain feedback on the approach and the first results with a focus on socio-economic assessment and prioritization of measures. Meetings took place in December 2011 (overall concept), March 2012 (application in pilot basins). A meeting took place September 2012 to discuss the draft results.

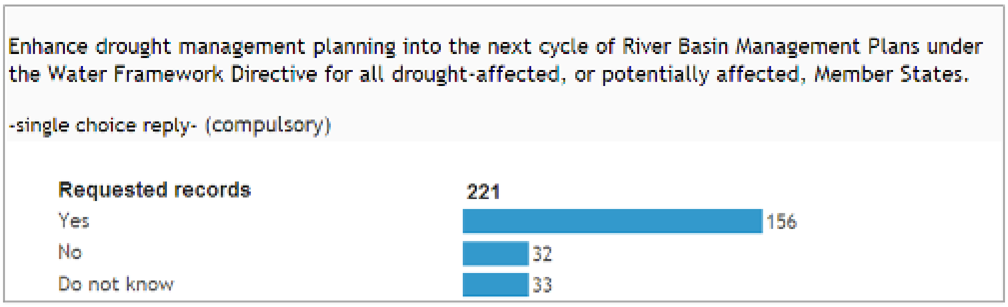
3.2. Public Consultation on policy options

A **public consultation** on the Blueprint policy options was launched for 12 weeks, from 16 March 2012 until 8 June 2012. In total, 221 responses were received from 24 Member States as well as Iceland, Norway and Switzerland and two non-European countries (Member States accounted for over 95% of responses). Almost 25% of respondents were from industry, with a similar share answering 'other'. Member State officials accounted for 20% of responses (counting both national administrative bodies and river basin /water management authorities), and NGOs, 19%.

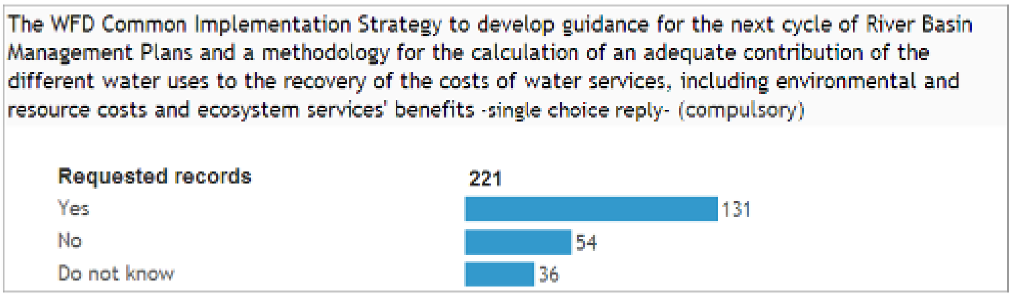
3.2.1. *Horizontal options*

Several horizontal options for *information, guidance and best practices* received support from a majority of respondents.

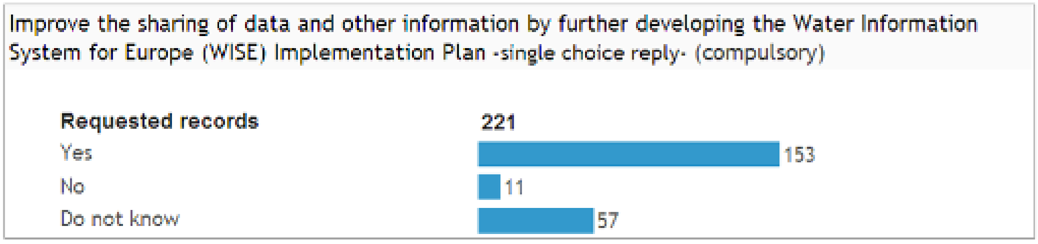
For the issue of water balances and targets, 50% of respondents were in favour of the development of CIS guidance on water accounting, e-flows and target-setting (Options 9a1 and 9a2). A strong majority of respondents – 71% – support enhancing drought management planning through the next cycle of river basin management plans.



A majority of respondents, 59%, supported CIS guidance on the recovery of costs (option 11a), including environmental and resource costs and ecosystem service benefits.

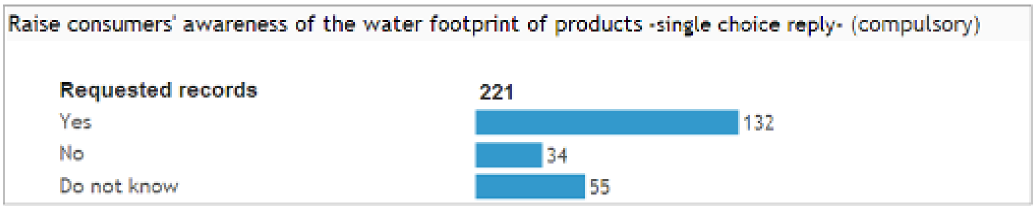


In the area of *knowledge base*, a majority of respondents (57%) are in favour of using remote sensing to address illegal abstraction (option 2a). A strong majority (69%) supported improved data and information sharing through the Water Information System for Europe.



Support is more limited, however, for the development of a fully interoperable, SEIS-based shared water knowledge system: while 45% were in favour, 38% answered 'Do not know' on this option (option 11.2).

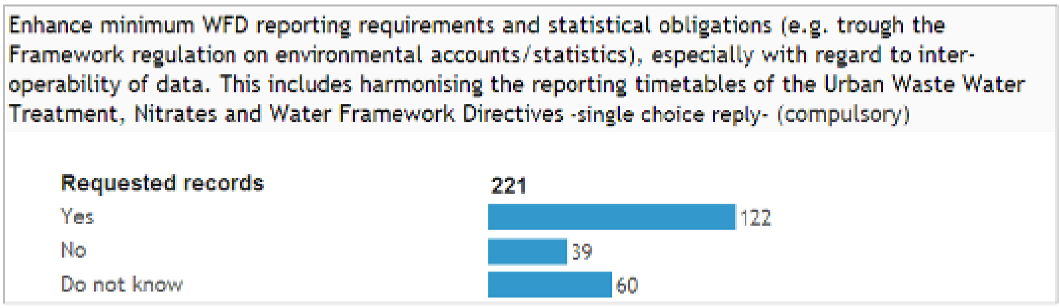
For *global aspects*, about 60% of respondents are in favour or raising consumers' awareness of the water footprints of products (option 3a).



The use of *regulation* for the horizontal packages did not receive strong support, except in the area of knowledge base.

About 50% of respondents were opposed to the adoption of technical annexes to the WFD on water accounting, e-flows and water efficiency targets. In addition, 59% of respondents were opposed to legislative action for drought management – specifically, the establishment of a directive requiring drought management plans. A similar share, 58%, opposed an amendment to the Water Framework Directive for a mandatory methodology on the recovery of costs. Mandatory labelling of water-intensive products, on the other hands, was opposed by 48% of respondents and supported by only 28%.

In the area of *knowledge base*, however, 55% of respondents were in favour of enhanced reporting requirements and statistical obligations, including the harmonisation of the reporting timetables for the Urban Waste Water Treatment, Nitrates and Water Framework Directives (option 11.1).

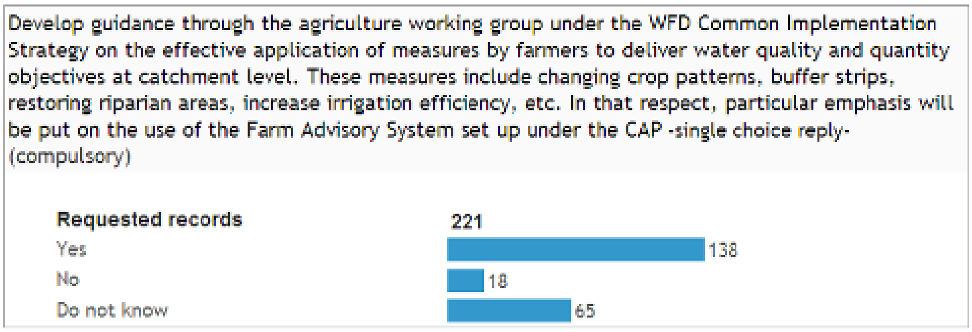


3.2.2. *Options unlocking specific measures*

Measures aimed at protecting ecosystems and natural water retentions measures

Consultation respondents strongly supported the use of *information, guidance and best practices* to support such measures: 58% of the respondents (128 out of 221) supported the definition and provision of an EU framework for green infrastructure, supporting natural water retention measures (cf. option 3.1).

In addition, 62% of the respondents (138 of 221) supported the preparation of guidance for farmers on the effective application of measures for water quality and quantity objectives (option 4b). Very few no answers – only 8% of the total – were given (though almost 30% of respondents indicated 'do not know' for this question).



The consultation did not ask about *regulatory options* or *conditionality* specifically for this area. (In other areas, however, a majority of respondents for the most part did not support regulatory options, though conditionality via the CAP, for example on water metering, did receive support from a majority.)

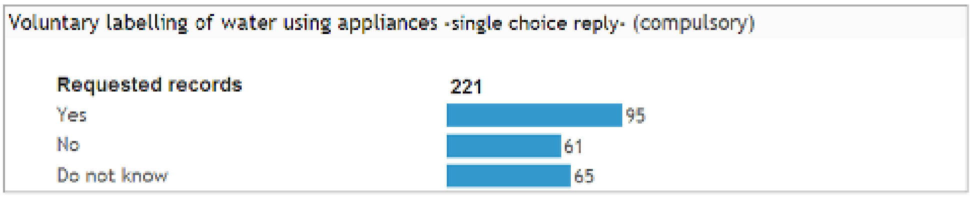
Artificial water storage or supply

The questionnaire did not include questions on this area of possible options.

Water efficiency measures

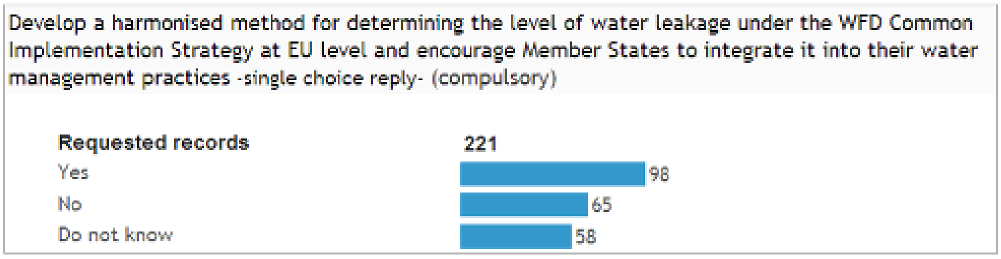
This area covers several issues, including water efficiency in appliances and buildings, the reduction of leakage in water infrastructure and economic instruments for water efficiency.

Responses varied concerning measures to promote water efficiency through *information, guidance and best practices*. Voluntary labelling of water-using appliances (option 5.1a) was supported by the largest share, 43% of respondents (almost 30% indicated ‘do not know’ for this question, and a similar share was seen in other answers for this area).



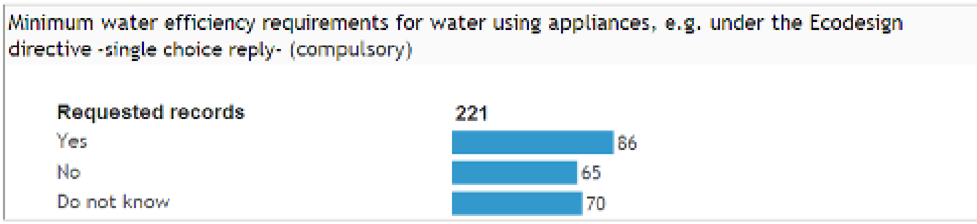
For voluntary performance ratings for buildings (option 5.2a), only 29% of respondents were in favour, while over 40% were against.

Regarding leakage in water infrastructure, the largest share of respondents – 44% – were in favour of developing a harmonised method under the CIS for determining the level of water leakage (option 6a).



A majority of respondents (116 out of 221, or 52%), however, were against the development of guidance and tools under the CIS to support trading in water rights, and only about 25% supported this (Option 8.2).

The majority of respondents did not generally support most types of *regulation* for water efficiency. For example, 41% of respondents opposed mandatory labelling of water-using appliances, while only 32% supported this (Option 5.1b1). Support was stronger for minimum requirements under the Ecodesign Directive (Option 5.1b2): here, 39% were in favour and 29% against – and a further 32% responded ‘don’t know’.

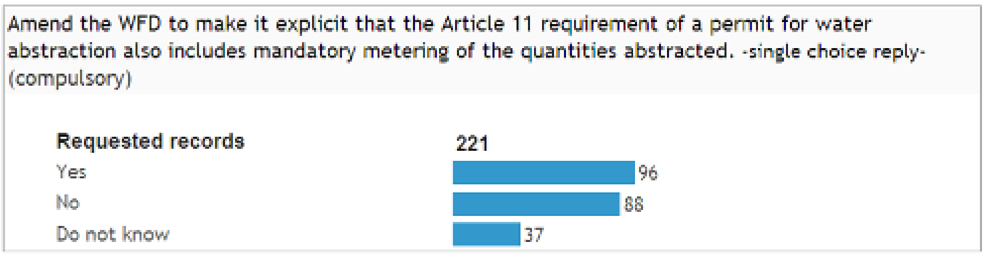


In contrast, 45% of respondents were opposed to a mandatory performance rating for buildings (Option 5.2b1).

For minimum water performance requirements for buildings (option 5.2b2), responses were evenly mixed, with almost equal numbers (about 34%) responding yes and no.

A possible directive on water efficiency requirements in buildings (Option 5.2b3) received a high level of opposition, with 49% of respondents indicating ‘No’.

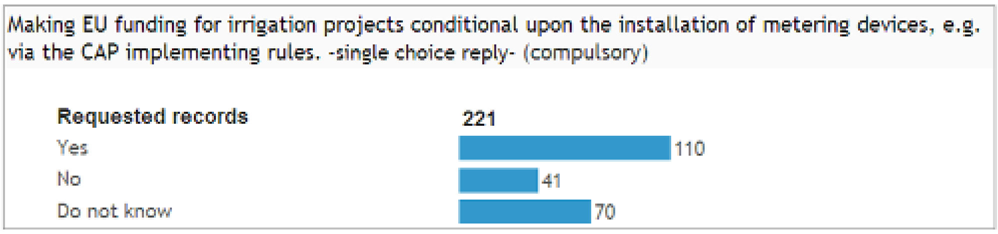
An option to amend Art. 11 of the WFD to require metering for water abstraction permits divided respondents (option 2b2), with 43% in favour and 40% against.

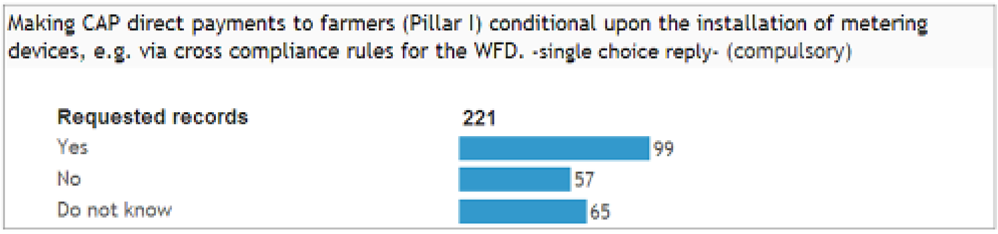


A separate option to amend the WFD and require metering ‘where relevant’ received less support, and 45% opposed this (Option 7.4).

The opportunity to establish *conditionality* for EU funding, and in particular to require metering on agricultural water use, received stronger support.

One-half of respondents supported requirements such as a condition for EU funding of irrigation projects (option 2c)[18], and about 45% supported the proposal for CAP direct payments (option 2b1).



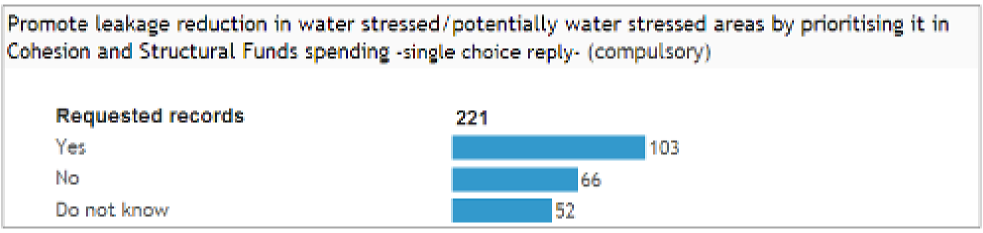


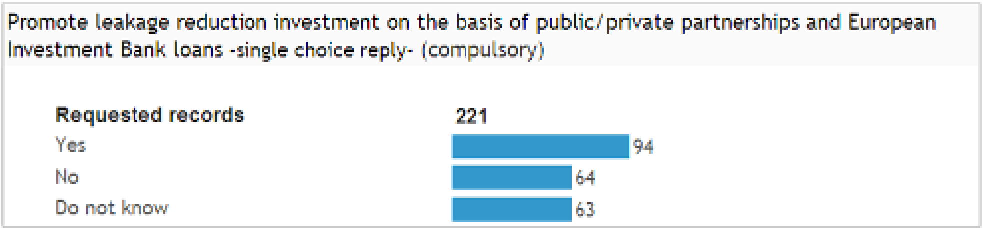
The option to include national water pricing obligations for farmers under the CAP cross-compliance rules (Option 8.1), however, received a high share of ‘do not know’ responses, 44%.

In terms of *funding support* to promote leakage reduction, 47% of respondents were in favour of prioritising actions through the Cohesion and Structural Funds in water stressed areas (and

[18] The option refers to both Rural Development and Cohesion Policy, while the consultation question only refers to the CAP.

only 30% opposed); 43% were in favour of loans from the European Investment Bank for leakage reduction.

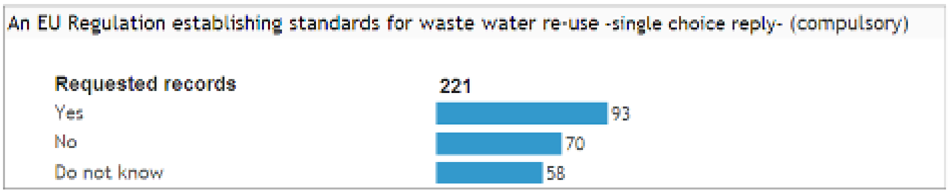




Wastewater reuse

The consultation asked about two options involving *information, guidance and best practices*. The first, on developing guidance on certification schemes for water re-use, was supported by 40% of respondents (option 7a1). The second, on the use of CEN standards (option 7a2), received slightly less support (about 38%): for this option, however, almost a similar share replied ‘Do not know’.

A proposal for *regulatory action*, specifically for an EU Regulation establishing standards received slightly higher support (option 7a2), with 42% responding ‘Yes’.



A thorough analysis of the results of the consultation will be published on the Europa website in the coming weeks.

3.3. Stakeholder Consultation on policy options

Discussions on the Blueprint policy options took place during three Water Directors meetings, on 8-9 December 2011, through an extraordinary meeting organised in Brussels on 29 March 2012 and a third one in Copenhagen on 4-6 June. Presentation of the Blueprint and discussions on the policy options took place during meetings of the Common Implementations Strategy group on 11-12 May 2011, 8 November 2011, 7 March 2012 and 10-11 May 2012.

Under the banner “The Water Challenge – Every Drop Counts”, Green Week 2012 was devoted to the discussion of water related issues. The presentations covered all aspects of current water policy aspects.

Integrated in the Green Week, the 3rd EU water Conference was organised on 24-25 May. The event served as a platform for consultation and debate between a large number of different stakeholders, Member States and the European Commission on the Blueprint policy options. A total of 214 participants attended the conference representing around 71 organisations.

The conference was divided in five sessions:

- Session I covered key problems and challenges by considering the status of Europe's water and key tools which may be needed for the sustainable management of water resources

- Session II looked into ways of unlocking the most promising measures

- Session III looked at economic incentives to achieve targets

- Session IV focused on governance and knowledge base as cross-cutting conditions for sound decision making and effective implementation

- Session V addressed the global aspects and issues related to innovation.

The sessions included introductory presentations on the session themes, moderated panel discussions with panellists from Member States, stakeholders and River Basin District authorities (in Sessions II, III and IV) and discussions with the audience.

The main key messages/conclusions of the different sessions within the presentations and/or panel discussions were the following:

Session I – Status of Europe's water and challenges for water policy

- A growing world and urban population, and the effects that climate change will have on the accessibility of water, water scarcity and access to clean water have become key challenges.

- Innovation and scientific evidence are key instruments for the development of effective and correct actions which should be part of an integrated multidisciplinary approach.

- Areas for improvement include: water saving where more effort should be put into reducing leakages, water treatment which should incorporate innovative solutions, water re-use where international standards should be put in place and desalination where further understanding of the costs and benefits and the environmental impacts associated is needed.

- Global governance going beyond borders is needed, with all actors at all levels being involved and where a better integration of available information and datasets, as well as research and structural funds should be achieved. Better cooperation between different policy streams such as agriculture and the new CAP, and energy policy, would result in resolving current and future water challenges.

- The 1st cycle of the WFD clearly shows success stories (intercalibration exercise, enhancement of international cooperation, public participation, increase of knowledge base, improvement of chemical water quality) but also a long road ahead to meet the ambitious objectives of European water policy (e.g. not all RBMPs have been submitted, low ambition of the RBMPs, lack of concreteness and comparability, dressing up "business as usual" as compliance with WFD).

Session II – Unlocking the most promising measures

- The measures to be considered in order to improve water resource efficiency and sustainability should aim at giving answers to different problems simultaneously in a coordinated way. These should include voluntary and mandatory measures for the agriculture sector, increase green infrastructure, land and wetland restoration, and should address ecosystem services.

- Reliable funding (public and private funding) is key for implementing measures Market instruments and private investments should be more strongly considered for a better implementation of the current legislation. However, before such measures are put in place there is a need for sound knowledge of water accounts and for certain preconditions to be met.

- More practical guidance is needed to improve implementation at a regional level.

- Water reuse may prove to be an effective measure to address water scarcity and efficiency; however, further work is needed on quality assurance, and setting standards in cooperation between different sectors.

- Regarding pharmaceutical substances in water, stakeholders pointed to the need for further action and European regulation. Besides discussions in the context of the EQS Directive, further steps may need to be taken,: firstly, by implementing stringent legislative criteria, and/or looking at ways to reduce pharmaceuticals at source (upstream) and working on hotspot management (e.g. hospital discharges).

Session III – Economic incentives for a more efficient water resources management

- There was general consensus on the need for water pricing. However, agreement was reached on the fact that this should be implemented alongside other policy tools and after several preconditions have been met, such as: sound knowledge on e-flows, abstraction licenses, water rights, stronger enforcement of water legislation and property rights, establishment of mandatory metering and increased awareness raising campaigns.

- Pricing should be considered involving all relevant stakeholders.

- There was a call for a complete application of the polluter-pays principle which would result in covering remediation costs as well as increasing competitiveness of more efficient water users.

- Regarding the application of social water tariffs, governments should ensure equality, transparency and access to water for low income groups.

- There is a need to impose conditions on the use of EU funds (Rural Development, Cohesion Policy). The objectives of the WFD should be included in cross-compliance requirements under the CAP objectives.

- The European Commission could consider the elaboration of practical guidance for the interpretation of environmental and resource costs needs.

Session IV – Governance system and knowledge base

- Since its adoption, the WFD has been the main driver for water management in Europe improving, among other positive aspects, governance and transboundary cooperation, increasing public participation and knowledge.

- The governance structure should focus on Member States and take into account the hydrological complexity of the different MS.

- The panel was of the opinion that no further legislation was needed, but rather further support to implement existing legislation by reducing the fragmentation between different governance levels and environmental sectors, eliminating rigid concessions systems and by ensuring stronger enforcement.

- Cooperation between the water and agricultural sector is where governance is most deficient, mainly due to the difficulty in setting up a dialogue and because of the system of subsidies in the agricultural sector. Political will is needed to push further cooperation between the CAP and the WFD.

- Within the WFD process, the knowledge base should be improved. There is agreement on the need for better communication on sound scientific results to decision makers via an improved Science Policy Interface, as well as an increase in the sharing of success stories and results of the assessments.

Session V – Innovation and Global aspects

- The Innovation Partnership is an opportunity to find new solutions for the water challenges we face. It is also a chance for EU water industry to become more competitive and to translate ideas of the European water sector into marketable solutions.

- The scope and aims of the Innovation Partnership will be further clarified together with industry and the public sector until the end of 2012, when the strategic implementation plan of the partnership is due.

- The EUWI has been a successful instrument to put water on the development agenda and stakeholders favour its continuation. Strategic discussions are ongoing on how and whether to continue the EUWI with emphasis on the means to have a significant impact on the water sector and to gain support at the political level.

3.4. Calendar of main events

A number of meetings, workshops and public consultations took place to enable a thorough discussion on the problem description, objectives and policy options to be included in the Blueprint. The most relevant milestones were:

- 8-9/11/2011 Strategic Co-ordination Group CCAB, Brussels (incl session on SPI)
- 16-18/11/2011 Bonn2011 Conference: The water, energy and food security nexus. The Solution for the Green Economy http://www.water-energy-food.org
- 8-9/1/2 Informal meeting of Water and Marine Directors, Warsaw;
- 7 December 2011- 28 February 2012: Public consultation on Fitness Check
- January 2012: Stakeholder meetings for the Fitness Check
- 9-10 February 2012: 2nd Stakeholder meeting for the Fitness Check
- 29 March 2012: meeting with Water Directors on options
- 12-16 March 2012: 6th World Water Forum (Marseille)
- March-June 2012 - Public consultation on draft objectives and policy options for the Blueprint.
- 21-25 May 2012: Green Week focusing on water and 3rd EU Water Conference (24-25 may)
- 4-5/6/2012 Informal meeting of Water and Marine Directors of the European Union, Candidate and EFTA Countries (Copenhagen);
- 7/7/2012: CY presidency: Informal council

4. ANNEX 4: INTER-SERVICE CONSULTATION

4.1. Impact Assessment Steering Group

The DGs consulted were: ENV, CLIMA, JRC, SANCO, ECHO, ECFIN, AGRI, COMP, MARKT, TRADE, SJ, REGIO, INFSO, MARE, RTD, ESTAT, EMPL, SG, MOVE, ENER, ELARG, TAXUD.

Prior to sending the IA to the IA Board, 6 Inter-service meetings took place:

- 1st ISG meeting: 4/4/2011: presentation of the overall framework for the assessment and ongoing or planned studies.
- 2nd ISG meeting: 19/01/2012: Discussion paper, state of play studies, presentation general outline of the IA.

- 3rd ISG meeting: 15/02/2012: Presentation of the draft findings of the Fitness Check,
- 4th ISG meeting: 8/03/2012: Support document for public consultation on policy options.
- 5th ISG meeting: 20/04/2012: discussion of the outline of the IA
- 6th ISG meeting: 6/6/2012: 1st version IA with draft results from support studies.
- 7th ISG meeting on 18/06/2012: 2nd version of the IA for final comments prior to sending it to the IAB.
- 8th and last meeting on 26/09/2012 during inter-service consultation.

4.2. Impact Assessment Board

The present section details how IAB recommendations for improvements in its opinion (Ares(2012)889801 - 20/07/2012) have been taken on board in the version 4.0 submitted to inter service consultation.

(1) Strengthen the problem definition and their drivers and reinforce the baseline scenario.

The report should be more focussed in presenting the problems, by clearly showing the relevant deficiencies of the current water policy and by explaining its implementation gaps and unsolved legal problems.

The report now focuses on the 12 concrete water management problems, for which there is a need to act at EU level, based on the assessment of implementation of current EU water policy.

On the basis of a comprehensive overall problem presentation the report should clearly identify the concrete problems to be addressed by the blueprint. This can be achieved by better presenting and integrating the current 'level 1' and 'level 2' problems with the 12 specific problems currently presented in annex 3.

Information from annex 3 has been brought back to the main report, which provides a better articulation between the problems linked with the state of EU water and the problems linked with the management of water at EU level.

The refocused set of problems should then be corroborated by concrete Member State data and examples, such as the actual status of the water bodies.

For each issue, information from the Fitness Check, assessment of River basin Management Plans, review of Water Scarcity and Drough policy and supporting studies is provided showing when relevant differences between Member States

Finally, the report should considerably reinforce the presentation of the baseline scenario by integrating the scattered analysis presented in annex 1 synthetically into the main text. In doing so it should become clear how the different implementation gaps in the Member States would evolve, in how far the discharge of pollutants is expected to remain a problem in the *long run and, for instance, how on-going activities to improve the knowledge base will close information gaps.*

For each problem, an assessment of the baseline is provided. However, as explained in the report, the quality of the information provided by the member states in their reporting does not allow so far a proper assessment of how the status of EU waters is likely to evolve in the medium and long term. One of the objectives of the Blueprint is to ensure this kind of assessment is possible on the basis of the forthcoming management plans (2015) for the review of WFD by 2018.

Finally, the report should discuss the legal basis for the elements of the toolkit that would require legislative action.

The need to act at EU level is specifically addressed in section 2.7. As we are not making any legislative proposal, we understand the need for a legal base as an explanation of why the Commission is empowered to put forward such proposals and how they fulfil the subsidiarity and proportionality principles.

(2) Establish clearer objectives and better defíne the policy options.

On the basis of the revised problem definition, the report should define "smarter" policy objectives, clearly indicating what the 'Blueprint' is trying to achieve in practice. To this end it should differentiate them in general, specific, and operational objectives avoiding general expressions like e. g. "more efficient water governance" which are difficult to translate into subsequent progress indicators for monitoring and evaluation purposes.

In section 3.3 specific objectives have been reworked, making them "SMART". To the extent this is relevant, the report includes a time line.

Finally, the report should better explain the logic behind the identification of the different policy measures and their possible combination into option packages/alternative sets of measures. It should be clarified that they constitute a kind of toolkit where the Member States can choose from based on necessity.

Chapter 5 provides an assessment, for each of the 12 problems, of the different options (see below). This is the basis for the building of the selected package for action at EU level which is assessed in chapter 6. The toolkit notion is reflected in sections 4 and 6.

(3) Better assess and compare impacts.

The report should present a more complete assessment of the impacts across the three pillars, providing a more comprehensive qualitative assessment. This should include the quantification of expected costs and benefits for Members States, where feasible. In doing so, the report should better explain the assumptions underlying the analysis, for instance by moving relevant analytical information from annex 4 to the main text. The report should be clearer on expected Member State/regional impacts, given their different specific problems and implementation gaps of water related legislation.

Chapter 6 provides an assessment, for the preferred package, of how the options are effective in solving the problems and achieving the objectives, how they can contribute to coherence and acceptability, and their expected environmental, social and economic impacts. A more detailed analysis is provided in Annex 3. However, this assessment has significant limitations as the proposed package is a toolkit and costs and benefits depend very much on Member States choices for the measures and support instruments to be implemented in the forthcoming river basin management plans.

Moreover, the report should more explicitly assess impacts on business/SMEs, for instance by detailing how they would be affected due to stricter water pricing policies. This should include a deeper analysis of the development of administrative burden, by indicating how the Member States and enterprises (including farmers) would be affected by the proposed measures and by analysing explicitly and quantifying any reduction potential.

This assessment is provided when relevant in Annex 3.

Finally, the report should explicitly compare, on the basis of a revised set of specific objectives, the different policy option packages against a fully developed baseline scenario.

The way the selected package is constructed is clarified in chapter 6: for each specific objective the best solutions are identified, and the combination forms the selected package. Synergies and possible trade-offs between elements of the preferred package are analysed. The report then provides an assessment of the selected package with reference to the baseline, using the same criteria used in chapter 5 for the assessment of options under the 12 specific issues.

5. ANNEX 5: KEY STUDIES/WORK CARRIED OUT BY EXTERNAL CONSULTANTS

DG Environment has launched a set of contracts which cover large parts of the scope of the Blueprint Impact Assessment and are summarised in this annex. Some studies are still not finalised. Their outcome will be integrated into the final version of this Impact Assessment.

Contract title	**Timing**	**Lead contractor**	**partners**	**Description**
Contract to support WFD implementation (3 years)	July 2009-June 2012	WRc (40%)	Aminsa, ARCADIS, BRGM, DHI, Ecologic, Ecosphere, Environmental Institute – SK, Eurokeys, Institut Molekularbiologie und Angewandte Ökologie, Intersus, International Office for Water, milieu, NERI, NIVA, P&F Consulting, The regional and Environmenatl Center for Central and eastern Europe, Sogreah, Soresma, Umweltbundesamt, VITUKI.	Terms of reference: http://ec.europa.eu/environment/funding/pdf/calls2008/specifications_en08113.pdf The analysis of the RBMP should provide information on how MS have changed their water management since the adoption of the WFD, and how the WFD principles have been incorporated into the legal, administrative and implementation practice in MS. The screening assessment should be able to provide information on how MS are implementing the key technical elements of the WFD. In addition, the analysis of the RBMP should be able to provide a comparable picture of what MS are doing to tackle the main threats and challenges for water. Finally, the assessment will assess the level of commitment of the measures (e.g. legal obligation vs. voluntary, financial resources earmarked), allowing the comparison of the overall level of ambition of MS action.
PP Comparative study of pressures and measures in the major RBMP in the EU	Oct 11 – Oct 12	WRc	ABP mer, Acteon, Anteagroup, Arcadis, Cenia, DHI, Ecologic, Ecosphere, Environmental institute, Fresh Thoughts Consulting, Intersus, Institut za vooe Republike Slovenie, Milieu, NERI, NIVA….., P/F consulting, The regional and Environmenatl Center for Central and eastern Europe, SIECOConsult, TYPSA, Umweltbundesamt, VITUKI.	Terms of Reference: http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11028.pdf This specific study on pressures and measures complement the ongoing RBMPs assessment by taking a top-down approach on certain identified subjects that merit a deeper analysis. Information will be used from the RBMPs but also from other sources in order to broaden the scope of the analysis, on the following subjects: Governance and legal aspects, development and analysis of appropriate methodologies, integration of water policy into related sectors and the WFD programme of measures, economic aspects, innovation and technology. Ongoing.

Contract title	**Timing**	**Lead contractor**	**partners**	**Description**
Service contract for the development of tools and services for the water information system for Europe (WISE)	Dec 11 – Dec 12	ATKINS Danmark		Terms of reference: http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11025.pdf Support for diffusion of Blueprint background information: maps, indicators, knowledge mapping, etc.
Support in preparation of the Impact assessment of the 2012 review of the Water Scarcity and Droughts. Water Scarcity & Droughts Policy in the EU - Gap Analysis	Dec10 - Feb 12	ACTeon (22%)	Artesia (13%), FEEM (16%), Fresh-Thoughts (17%), IACO (16%), TYPSA (16%)	Terms of reference: http://ec.europa.eu/environment/funding/pdf/calls2010/specifications_en_10049.pdf Concrete elements for the baseline scenario (degree of implementation of water efficiency measures) Information on the cost-effectiveness of the measures to assess the overall impact on water availability and demand. Contribution to Blueprint policy options, in particular EU support to measures, indicators & target setting, use of economic instruments, governance, knowledge base and innovation. Ongoing.
Resource and economic efficiency of water distribution networks in the EU - Pilot project on the economic loss due to high non-revenue-water amounts in cities (Leakages)	Dec10 - July 12	ERM (100%)	none	5-8 pilot studies in water-scarce parts of Europe have analysed and quantified the factors of relevance for leakages at a river basin level and determined the links between the leakages and the cost structures. Identification of best practices for reducing water-losses in the EU or other countries. Recommendations on policy options for water efficiency in distribution systems. Ongoing.
Assessment of options for EU action on water efficiency of buildings	Dec10 - March 12	Bio IS (59%)	BRE (31%), ICLEI (10%)	Recommendation on policy options for water efficiency of buildings. Draft final report April 2012

Contract title	Timing	Lead contractor	partners	Description
				http://circa.europa.eu/Members/irc/env/climwatadapt/library?l=/scarcity_droughts&vm=detailed&sb=Title
Assessment of the efficiency of the water foot printing approach and of the agricultural products and foodstuff labelling and certification schemes	Completed	RPA Ltd (63.5%)	Cranfield University (36.5%)	Review of applications of the water footprint and foodstuff labelling and recommendation on how these can be applied in policy, labelling and certification schemes. Finalised report available at: http://ec.europa.eu/environment/water/quantity/pdf/Executive%20Summary%2027%20Sept_2011%20-%20revised2.pdf
Assessment of the options for water saving in agriculture and the costs and benefits of the different options.	Dec10 - Dec 11	Bio IS (73.5%)	Cranfield University (20.5%), RPA Ltd (6%)	Establishment of solid information on possibilities for water saving in agriculture. Clarification on existing data. Application of the findings to selected European pilot river basins. Finalised report available at: http://ec.europa.eu/environment/water/quantity/pdf/BIO_Water%20savings%20in%20agiculture_Final%20report.pdf
The role of water pricing and water allocation in agriculture in delivering sustainable water use in Europe.	Dec10 - Dec 12	Arcadis (43%)	Ecologic (13%), Intersus (19%), Fresh Thoughts (15%), Typsa (10%)	Case studies on water pricing policies for the agricultural sector in selected river basins. Recommendation on best practices. Finalised report available at: http://ec.europa.eu/environment/water/quantity/pdf/agriculture_report.pdf
Costs, Benefits and climate proofing of natural water retention measures	Dec10 – Mar 12	STELLA consulting (100%)		Based on a typology of natural water retention measures, the study will provide estimates of their costs and benefits, and of their potential for increasing resilience to climate change; analyse the potential of EU policy and funding instruments to promote non-regret measures. Finalised report available at: http://circa.europa.eu/Members/irc/env/climwatadapt/library?l=/nwrm/reports/final

Contract title	Timing	Lead contractor	partners	Description
				_report&vm=detailed&sb=Title
Support for the Fitness Check – phase 1	Completed	Deloitte	IEEP	Finalised. Report available on http://ec.europa.eu/environment/water/blueprint/pdf/safeguard_fitness_freshwater.pdf
Support for the Fitness Check – phase 2 - public consultation and 2nd stakeholder workshop Fitness Check	Oct 11 – Mar 12	IEEP	Ecologic, Bio IS	Finalised report available at: http://ec.europa.eu/environment/water/blueprint/fitness_en.htm
Climate Adaptation - modelling water scenarios and sectoral impacts (ClimWatAdapt)	Dec 09 – August 11	CESR (27%)		Finalised. Report available on http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/climate_adaptation/climwatadapt_report&vm=detailed&sb=Title
Contract to support the Impact Assessment of the Blueprint to safeguard Europe;s Water Resources - Lot A: Scenarios and targets for the protection of water resources	Nov 11 – Sept 12	JRC		Terms of reference: http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11015.pdf Development of a baseline scenario bringing together climate, land-use and socio-economic scenarios and looking at the implication for water resources availability and use under different policy scenarios. Development of an optimisation model linked with dynamic, spatially explicit water quality and quantity models allowing the selection of measures affecting water availability and water demand based on environmental and economic considerations Application to the whole European River Basins for a baseline scenario and a number of alternative policy and socio-economic scenarios. The aim of the assessment is to seek the maximization of net social benefits from the use of water by economic sectors including a range of components, such as welfare impacts for water users, valuation of key ecosystem services provision, valuation of external costs from degradation of ecological and chemical status and

Contract title	**Timing**	**Lead contractor**	**partners**	**Description**
				energy consumption triggered by water abstraction and return. Ongoing.
Contract to support the Impact Assessment of the Blueprint to safeguard Europe;s Water Resources - Lot B: Assessment Policy Options	Sept 11 – Oct 12	IEEP	Acteon, Arcadis, EWP, Fresh Thoughts, Milieu	Terms of Reference: http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11015.pdf Identification of policy problems and gaps, development a baseline scenario and definition of specific and operational objectives for policy making. Analysis of how policy measures and support actions at EU level interact with technical measures addressing water management issues over time as part of the baseline. Development of a range of policy options to take forward the measures.Identification of information gaps, together with work to gather data to fill these gaps. Stakeholder and public consultation. Assessment of impacts and comparison of a selection of policy options.
Contract to support the Impact Assessment of the Blueprint to safeguard Europe;s Water Resources - Lot C: Communication and Consultation	Sept 11 – Mar 13	Ecologic		Terms of reference: http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11015.pdf Organisation of the 3rd European Water Conference on 24-25 May 2011 and the final Blueprint conference in Cyprus.
Service Contract Water Accounts	12/11 -	Pöyry	SCM, VITO	http://ec.europa.eu/environment/funding/pdf/calls2011/specifications_en_11036.pdf Production of European water resource balances (quantity, quality) within the SEEAW framework at the monthly resolution under the ECRINS reference system. These water balances will contribute to the comparative analyses of key aspects of river basin management in river basins across the EU affected by water scarcity, droughts or desertification.

6. ANNEX 6: REFERENCES

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