WORK PACKAGE 7 (PHASE 4)

IMPLICATIONS OF THE DIFFERENT SCENARIOS

Analysis of the Environmental Implications of the Scenarios

Deliverable 7

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Preface

Euromarket is a research project on "Water liberalisation scenarios: an empirical analysis of the evolution of the European water supply and sanitation sectors". The project is funded by the European Union under the "Energy, Environment and Sustainable Development" programme of the 5th RTD Framework Programme.

This project analyses the likelihood of water liberalisation in Europe and the nature and form it may take in the foreseeable future. The analysis is conducted at the interface of sectoral dynamics, enterprise strategies and regulatory practices. Within this framework, the project first examines explicit and implicit policies of the EU in the water supply and sanitation sector. At the heart of the study is the identification and evaluation of possible scenarios for the evolution of the water sector and their driving forces. These so called water "liberalisation" scenarios are assessed on the basis of their social, economic, environmental, legal and institutional implications. Finally, the project aims at outlining the potential choices national and in particular EU policy-makers will have to make in order to establish a more comprehensive and integrated water management policy. The project includes a total of ten work packages spread over five phases:

- ***Phase 1***: Formulation of the objectives of the EU in the water sector (WP1),
- ***Phase 2***: Analysis of the European water supply and sanitation sector today (WP2-4),
- ***Phase 3***: Identification of plausible EU scenarios for the evolution of the water sector (WP5),
- ***Phase 4***: Analysis of the economic, environmental, social and institutional implications of these liberalisation scenarios (WP6-9), and
- ***Phase 5***: Elaboration of practical recommendations for policymakers at EU and national level (WP10).

For each work package, a report consisting of the final results of the work package is produced. The following list gives an overview of the deliverables:

- ***Deliverable 1*** Analysis of the EU explicit and implicit policies and approaches in the larger water sector,
- ***Deliverable 2*** Analysis of the European water supply and sanitation markets and its possible evolution,
- ***Deliverable 3*** Analysis of the strategies of the water supply and sanitation operators in Europe,
- ***Deliverable 4*** Analysis of the legislation and Emerging Regulation at the EU country level,
- ***Deliverable 5*** Identification and description of plausible water liberalisation scenarios,
- ***Deliverable 6*** Analysis of the economic implications of the water liberalisation scenarios,
- ***Deliverable 7*** Analysis of the environmental implications of the water liberalisation scenarios,

- ***Deliverable 8*** Analysis of the social implications of the water liberalisation scenarios,
- ***Deliverable 9*** Analysis of the institutional, organisational, and legal implications of the water liberalisation scenarios, and
- ***Deliverable 10*** Recommendations for EU policy makers.

More information on the project and the deliverables can be found on the Euromarket Website (http://www.epfl.ch/mir/euromarket).

Contents

1 OBJECTIVE AND APPROACH OF WP7 WITHIN THE EUROMARKET PROJECT 1

2 BACKGROUND 2

3 METHODOLOGY FOR THE ANALYSIS OF THE ENVIRONMENTAL IMPLICATIONS 4

4 ANALYSIS OF SCENARIO 1A: DELEGATION CONTRACTS AND STRONG REGULATION 11

4.1 Summary of End State 1a 11

4.2 Implications on the protection of water resources and quality 11

4.3 Implications for drinking water related issues 14

4.4 Repercussions on other water uses and sectors 15

4.5 Interdependencies between the environmental implications of End State 1a 16

5 ANALYSIS OF SCENARIO 1B: DELEGATION CONTRACTS AND EXTREME COMPETITION. 18

5.1 Summary of End State 1b 18

5.2 Implications on the protection of water resources and quality 18

5.3 Implications for drinking water related issues 19

5.4 Repercussions on other water uses and sectors 20

5.5 Interdependencies between the environmental implications of End State 1b 20

6 ANALYSIS OF SCENARIO 2: OUTSOURCING 22

6.1 Summary of End State 2 22

6.2 Implications on the protection of water resources and quality 22

6.3 Implications for drinking water related issues 26

6.4 Repercussions on other water uses and sectors 28

6.5 Interdependencies between the environmental implications of End State 2 29

7 ANALYSIS OF SCENARIO 3: REGULATED MONOPOLY 31

7.1. Summary of End State 3 31

7.2. Implications on the protection of water resources and water 31

7.3. Implications for drinking water related issues 32

7.4. Repercussions on other water uses and sectors 34

7.5. Interdependencies between the environmental implications of End State 3 35

8 ANALYSIS OF SCENARIO 4: DIRECT PUBLIC MANAGEMENT 36

8.1 Summary of End State 4 36

8.2 Implications on the protection of water resources and quality 36

8.3 Implications for drinking water related issues 38

8.4 Repercussions on other water uses and sectors 39

8.5 Interdependencies between the environmental implications of End State 4 39

9 ANALYSIS OF SCENARIO 5: COMMUNITY MANAGEMENT 41

9.1 Summary of End State 5 41

9.2 Implications on the protection of water resources and quality 41

9.3 Implications for drinking water related issues 44

9.4 Repercussions on other water uses and sectors 45

9.5 Interdependencies between the environmental implications of End State 5 45

12 SYNTHESIS 47

13 CONCLUSION 52

14 BIBLIOGRAPHY 54

Boxes

Box 1: Key principles of sustainable water management 6

Box 2: *Lyonnaise des Eaux*, Brittany: Nitrate polluted drinking water – Who is responsible? 13

Box 3: DBFO Delfland – Increased performance monitoring and measurement 25

Box 4: Yuvacik Company, Turkey – Incomplete information 26

Box 5: Yorkshire Water Services (YWS) – Leakage problems due to lack of maintenance 28

Box 6: Anglian Water Service (AWS) – Nitrate pollution 32

Box 7: Thames Water – Leakage problems 33

Box 8: Munich *Stadtwerke* – Voluntary environmental measures 36

Box 9: Vienna Waterworks – Source protection 37

Box 10: German Water Associations – Benefits of involving the community 42

Box 11: Dutch Water Boards – Decentralised autonomy as basis for an effective water resource protection 43

Tables

Table 1: List of illustrative examples 5

Table 2: Relation between principles and indicators 10

Table 3: Classification matrix of the environmental implications within the different End States 49

1 Objective and Approach of WP7 within the Euromarket Project

Work package 7 (hereafter: WP 7) analyses the environmental implications of the different European scenarios for the evolution of the water sector (so called water "liberalisation" scenarios). It is part of the fourth phase of the Euromarket project.

These scenarios were developed in **Phase 3** (WP 5). Each scenario is composed of two different elements: the *End State*, which describes the situation at a particular future point in time, and the *Storyline*, which connects the present situation to the End State in a logical manner.

The following six End States were identified and are subsequently analysed:

- ***End State 1a***: Delegation contracts and strong regulation,
- ***End State 1b***: Delegation contracts and extreme competition,
- ***End State 2***: Outsourcing,
- ***End State 3***: Regulated monopoly,
- ***End State 4***: Direct public management,
- ***End State 5***: Community management.

Phase 4 consists of four parallel Work Packages with WP 6 analysing the economic, WP 7 the environmental, WP 8 the social and WP 9 the institutional, organisational and legal implications of the six EU scenarios. On the basis of the analysis of these implications, WP 10, which forms part of **Phase 5**, gives recommendations on how the negative implications of each End State could be circumvented or rectified in order to achieve sustainable water management.

Within **WP 7**, the analysis of the environmental implication of the different EU scenarios includes an assessment of the ***implications on water quantity and quality***. Furthermore, potential repercussions of the outlined environmental implications on ***other water uses and sectors*** not directly connected to drinking water supply and sanitation are examined and possible changes in the behaviour of different water users are analysed. In a final step, each scenario analysis summarises possible ***interdependencies*** of the described environmental implications.

WP 7 is directed and managed by **Ecologic –** Institute of International and European Environmental Policy, Berlin. The work package partner is **UNESCO-IHE** – Institute for Water Education, Delft. The responsibility for authoring parts of this report is shared amongst the two partners.

2 Background

Within WP 5, the Euromarket project identified six scenarios for the evolution of the European water sector – the so-called "water liberalisation scenarios" (cf. Chapter 1). These scenarios are based to a certain extent on the existing institutional models of the water and wastewater sector in different EU Member States. Due to a long tradition and history of water management in Europe, the institutional and legal framework of the water supply and sanitation sector varies highly from Member State to Member State. Nevertheless, WP 7 analyses the environmental implications of the different water liberalisation *scenarios* at *EU level* in order to disengage from the national perspective.

The environmental implications of the different scenarios are of special importance, since "*Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such*.", as the Water Framework Directive (WFD)[1] already states in its preamble (1). Water resources provide the basis for the existence of human beings and cannot be replaced. Thus, the protection of water resources and quality is one of the key tasks in order to guarantee a sustainable supply of drinking water. The following paragraphs highlight the main characteristics of each scenario and the reasons for and motivation behind the analysis of the environmental implications.

End State 1a is characterised by the delegation of the water supply and sanitation services to companies, stipulated by a Directive on competition for the market, and a strong regulation authority. This scenario is derived from the French concession model with the addition of a regulative approach. Due to the compulsory bidding procedure every 10 to 15 years, the services provision is subject to short-term planning horizons that can lead to considerable implications on the environment. With regard to ***End State 1b***, even stronger implications on the environment could be expected, since the planning horizon for the service provider is shorter due to open tenders every five years, with contracts awarded solely on the basis of least cost. This selection procedure provides strong incentive to leave aside environmental protection measures. In addition, the local authorities have lost most of their responsibilities and influence, because of European market rules, and because of the progressive loss of their technological and economic expertise. This has potentially impacts on the monitoring of the compliance of the water and wastewater companies with environmental standards.

In the ***second End State***, European operators generally decide to outsource non-core activities to external sub-contractors, supported by the lowering of EU threshold values beyond which contracts are subject to public tendering procedures. This End State continues the already ongoing development towards outsourcing within the EU. Nevertheless, unlike under delegation contracts (End State 1a and 1b), the operators bear the risk of exploitation. Outsourcing activities might lead to environmental

implications, though this depends predominantly on the duration of the outsourcing contract and the indicators which form the basis of the tendering procedure.

The water sector in ***End State 3*** is regulated by different systems. Depending on the institutional framework, the regulatory approach varies between high-powered benchmarking with centralised regulation and medium-powered benchmarking and decentralised regulation. The strong regulative approach is based on the actual price regulation system in England and Wales. The decentralised one would occur mainly in those countries with remaining strong municipal influence in the water sector. Implications of End State 3 on the environment can be expected if the regulative approach does not consider precautionary environmental measures in an appropriate way.

End State 4 is characterised by local public water and sanitation services bodies under the direct control of the municipality. Instead of a regulative body, each operator acts as regulator in its region. This End State derives from some existing water sector models with strong municipal influence in the EU. The close co-operation between the water services body and the municipality lead to some implications on the protection of water resources and quality which however depend on the overall institutional and legal framework and the time horizon of the municipality in charge of the water and sanitation services.

The ***fifth End State*** consists of a rather rare institutional arrangement within the EU: community management. Water supply and sanitation services are organised in different forms, such as voluntary organisations (i.e. user co-operatives), water management associations formed by landowners, private enterprises or public corporations, and water company boards including consumer representatives (consumers own the water assets). Such organisational structures can be found *inter alia* in the German water and soils associations, the Dutch water boards and the mutualised water undertaking of Wales. Implications on the environment can be expected depending largely on the internal contractual and institutional agreements between the community management members.

All in all, the analysis of the environmental implications of the different End States is of special importance, since the project finally aims at formulating recommendations for the achievement of a sustainable water management. Besides the economic, social and institutional implications, the possible impact on the water resources protection will form the basis for the development of the recommendations for EU and national decision-makers.

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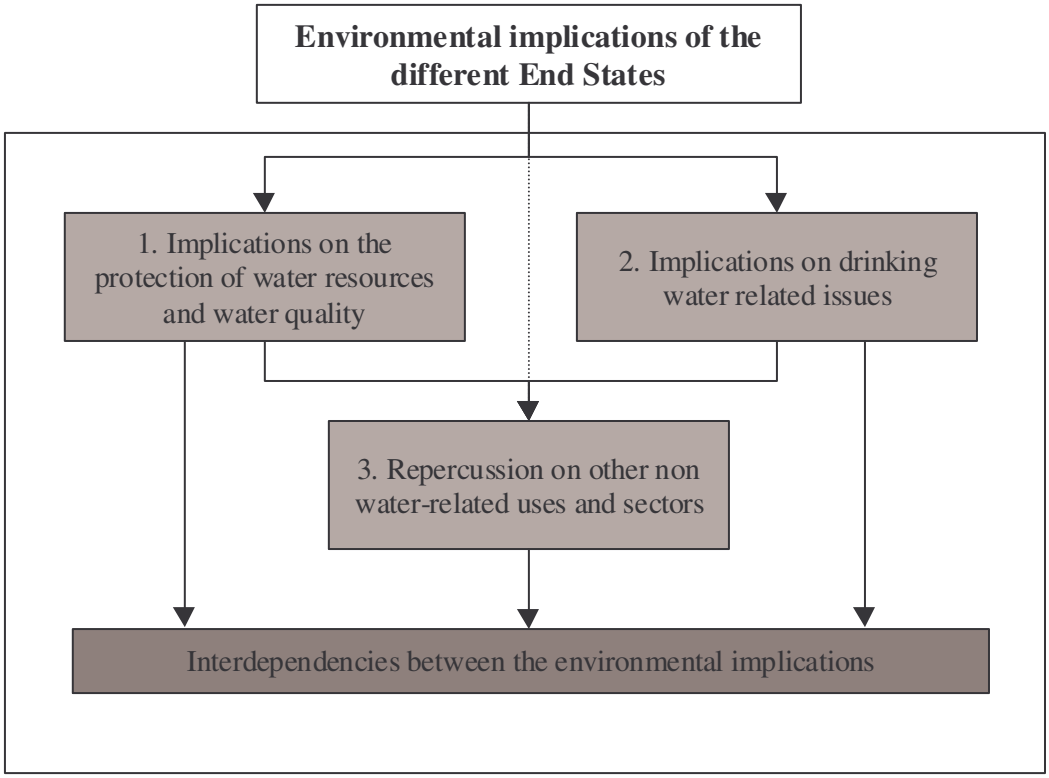
[1] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ EC L 327, 22.12.2000, p. 1.

3 Methodology for the Analysis of the Environmental Implications

This work package analyses the environmental implications of each of the six End States on the basis of a set of sustainable water management criteria. It starts by analysing the implications of each End State on the protection of water resources and water quality as well as on drinking water related issues. In a second step, it presents (if relevant) the repercussions on other uses and sectors not directly related to the drinking water and sanitation sector[2]. The analysis considers both repercussions as a consequence of the scenarios as such, and repercussions related to the identified environmental implications on the protection of water resources and drinking water related issues. The implication assessment will provide mainly trend, directions and indications. The study then discusses the interdependencies between the environmental implications.

Finally, it provides an overview of the six End States from an environmental perspective, and if possible and appropriate, facilitated through a classification matrix which illustrates the importance of each criterion within the different End States.

Figure 1: Methodology for the analysis of the environmental implications



[2] The analysis focuses on the *industrial* sector (chemical, metal and power industry and the food and beverage industry with cooling water and process water uses) and on the *agricultural* sector (irrigation, farming practices).

Scope of the study

The reference date for the analysis of the liberalisation scenarios is the year 2020 as referred to in the End States described. However, it takes events from the storyline of the scenario into account if necessary, i.e. in those cases where developments prior to 2020 have significant environmental implications that need to be taken into consideration in order to have a full account of the environmental implications of each End State.

In addition to the analysis of the environmental implications, examples will illustrate the environmental implications of the scenarios (see Table 1). These local examples serve an illustrative purpose only, since the main focus of WP7 is to analyse the environmental implications of the scenarios at EU level.

Table 1: List of illustrative examples

Scenario	Illustrative examples
Scenario 1a – Delegation contracts and strong regulation	▪ Lyonnaise des Eaux, Brittany, France: Nitrate polluted drinking water
Scenario 1b – Delegation contracts and extreme competition	No appropriate examples possible
Scenario 2 – Outsourcing	▪ DBFO Delfland, The Netherlands: Increased performance monitoring and measurement ▪ Yuvacik, Turkey: Incomplete information ▪ Yorkshire Water Services (YWS), UK: Leakage problems due to lack of maintenance
Scenario 3 – Regulated monopoly	▪ Thames Water, UK: Leakage problems ▪ Anglian Water Services (AWS), UK: Agricultural problems, especially nitrate pollution
Scenario 4 – Direct public management	▪ Munich Stadtwerke, Germany: Voluntary environmental measures ▪ Vienna Waterworks, Austria: Source protection
Scenario 5 – Community management	▪ German Water Associations, Germany: Benefits of involving the community ▪ Dutch Water Boards, The Netherlands: Decentralised autonomy

The analysis builds on the End States and Storylines as developed in WP 5 and draws on results of the deliverables D1-D5 completed so far within the Euromarket project. Furthermore, available literature on the analysis of environmental implications is integrated in the analyses and experts were interviewed to complement and validate the analysis where appropriate. For WP 7, the research team contacted relevant stakeholders of the environmental field, both at European and national level.

From principles to indicators

The indicators for the environmental implications analysis of the six scenarios are developed on the basis of the principles of sustainable water management. These principles are elaborated on in various documents at international and European level[3]. Chapter 18 of the Agenda 21 – the outcome of the 1992 Rio Summit on Sustainable Development – is of particular importance as it lays down objectives for the protection of fresh water resources in terms of quantity and quality, including water pollution and prevention control, as well as for drinking water supplies and sanitation.[4] The following box gives an overview of the key principles of sustainable water management.

Box 1: Key principles of sustainable water management

Sustainable water management is manifested through the application of the following key principles[5]:

1. The ***precautionary principle*** implies that in order to protect the environment, a precautionary approach should be widely applied, meaning that threats of serious or irreversible damage to the environment or human health, and unknown risk must be avoided. Lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
2. The ***prevention principle*** requires action to be taken to protect the aquatic environment at an early stage. It is now not a question of repairing damages after they have occurred, but rather of preventing those damages from occurring at all. This principle is however not as far-reaching as the precautionary principle.
3. The ***source (reduction) principle*** states that environmental damage / emissions of pollutants should preferably be prevented or reduced at the point of source, rather than by using 'end-of-pipe' technologies.
4. The ***integration principle*** stipulates, according to Article 6 of the EC Treaty, that environmental protection requirements must be integrated into the definition and implementation of EU policies and activities referred to in Article 3 (including, among others, agricultural and fishery policies), in particular with a view to promoting sustainable development.
5. The ***resource minimisation principle*** states that the direct and indirect consumption of resources and energy is to be continually reduced or should be minimal. Water uses should shift away from non-renewable to renewable resources.

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3 Among others the Agenda 21, the EC Treaty, the Water Framework Directive, the Drinking Water Directive, the 6th Environmental Action programme.

4 The chapter describes seven different programme areas: (1) Integrated planning and management of water resources, (2) Assessing water supply, (3) Protecting water resources, water quality and aquatic ecosystems, (4) Drinking water supplies and sanitation, (5) Water and sustainable urban development, (6) Water for sustainable food production and rural development, and (7) Impacts of climate change on water resource.

5 Adapted from Kraemer and Kahlenborn, 1998, and Kraemer, 1998; precautionary principle and prevention principle from EEA Glossary.

6. The ***regionality principle*** and the ***principle of local provision*** imply that regional resources and habitats are to be protected and spatial environmental externalities avoided. Each region[6] should as far as possible resolve its water related problems while making use of its own resources.
7. The ***reversibility principle*** states that water management measures must be modifiable, and their results must be reversible.
8. The ***polluter-pays / user-pays principle*** states that expenses resulting from pollution and the use of resources are to be charged to the polluter / user.
9. The ***co-operation and participation principle*** captures the issues of democratic control and local co-determination and states that all actors concerned or affected by a decision have to be consulted and involved into the decision-making process.
10. The ***intergeneration principle*** stipulates that the timeframe of observation with regard to water management plans and decisions must correspond to the timeframe of effects. Therefore, the interests of future generations have to be taken into consideration in the decision-making process.

These principles are of varying importance for the analysis of the environmental implications within WP 7. Some sustainable water management principles (e.g. the precautionary, the prevention and the regionality principle) are more important for the environmental analysis, while the polluter pays / user pays principle and the co-operation and participation principle form cross-cutting issues. They are linked to economic implications (WP 6) and social implications (WP 8) respectively.

The principles of sustainable water management serve as a basis for the development of the set of indicators used for the analysis. These indicators implement three criteria and are grouped accordingly:

- ***Criteria 1***: Protection of water resources and quality,
- ***Criteria 2***: Sustainable drinking water supply, and
- ***Criteria 3***: Repercussions on other uses and sectors.

The following section describes these indicators in more details.

Criteria 1: Protection of water resources and quality

- ***Local water supply***: This indicator is based on the regionality principle as well as the principle of local provision. Each region should solve its water management issues using its own resources and avoid all spatial environmental externalities. This is especially important for the situation where "foreign" water supplies are tapped into extra-regional resources as a result of the exhaustion or pollution of a region's own water resources. Instead, a region's efforts should concentrate on actively rehabilitating its own water resources and restoring original water conditions.

[6] The term "region" does not refer to administrative boundaries but rather to a hydrological region, which can encompass, for instance, a sub-basin.

- ***Water source protection***: This indicator implements the precautionary, prevention, source reduction, integration, reversibility and the inter-generation principles. The definition of water protection zones leads to a restricted use of the area surrounding the water source. In addition, co-operation as well as contractual agreements on good practices are created between water supply utilities on the one side and land-users and farmers on the other. This forms an element of the integration principle.

  Another important factor to protect water sources is to minimise the load of wastewater pollutants discharged into waters. Thus, in the field of wastewater management, a holistic approach including upstream reductions and further development of technologies is necessary to reduce resource inputs. This also requires measures for water pollution control, as stipulated in Article 16 of the Water Framework Directive (WFD).

- ***Realisation of voluntary environmental protection measures***: Based on the prevention, integration and source reduction principles as well as the co-operation and participation principle, voluntary environmental protection measures are realised in order to avoid pollution of water resources. The realisation of such protection measures gives the opportunity to prevent environmental damages instead of using end-of-pipe technologies to remove pollution ex-post. Financial incentives are often used to encourage the use of preventive, as opposed to 'reactive' measures.

- ***Quantity of water resources used***: The implementation of the resource minimisation, inter-generation and the co-operation and participatory principles leads to an important feature of water resources protection, namely the minimisation of the quantity of water resources used. With regard to the natural water cycle, it is important to ensure a balance between the use and the regeneration of water resources in order to avoid their over-use. Consequently, a system of water resource management is necessary for adequate planning (e.g. through water abstraction licences).

Criteria 2: Sustainable drinking water supply

- ***Quantity of water consumed***: The resource minimisation and inter-generation principles imply the responsible use of water sources. This includes the aim of minimising the quantity of water consumed in order to additionally reduce the amount of energy and chemicals required for the purification and transportation process. In this context, water saving techniques can play an important role.

- ***Application of minimisation principle***: The minimising of chemicals used within treatment processes implements the precautionary and prevention principles as well as the resource minimisation principle. The EC Drinking Water Directive does not directly stipulate the application of the minimisation principle. However, this is an important principle to ensure that

the use of chemicals is kept at a minimum to the benefit of the overall protection of groundwater sources. That is to say, concentrations of chemical substances that can contaminate drinking water or impair its quality are to be kept as low as reasonably possible according to the generally acknowledged technical standards.[7]

- ***Quality and security of drinking water supplied***: The sustainable use of water resources (i.e. the prevention and precautionary principle) entails the provision of drinking water that is of a very high standard as regards reliability of supplies[8] and drinking water quality. Measures for securing health protection (such as so called "multi-barrier systems"[9]) help to minimise the risk of supplying polluted water. To do so, one should rely increasingly on resource conservation activities in addition to advanced treatment technologies (see bullet point on water source protection above).
- ***Investment in pipe system and quality of infrastructure***: Sufficient investment in pipe systems is necessary to ensure high quality infrastructure in the water sector. The long life and thus amortisation time of pipe systems necessitate a long-sighted approach in order to guarantee the its adequate and continuous maintenance. This approach implements the precautionary and resource minimisation principles as well as the integration and inter-generation principles.
- ***Reduction of leakage and water losses***: This indicator implements the resource minimisation, precautionary and inter-generation principles. The reduction of leakage and water losses is of great importance in terms of both waste water and drinking water. Indeed, uncontrolled waste water discharges out of defective pipes into the surrounding environment cause a pollution problem. Inversely, the leakage of water into sewer pipes leads to waste water dilution and thus to failures of the biological treatment process.
- ***Recovery of the costs for water services***: According to both the polluter-pays / user-pays principle and the co-operation and participation principle, the costs for water services, including environmental and resource costs, have to be recovered. This is also a key requirement of Art. 9 WFD.[10]

Criteria 3: Repercussions on other water uses and sectors

- ***Availability (quality and quantity) of surface water***: This indicator is based on the prevention principle, the resource minimisation principle and the intergeneration principle. The indicator

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7 This is defined *inter alia* in the German Drinking Water Regulation (*Trinkwasserverordnung*)

8 Note: This is a cross-cutting issue with the work package on social implications (WP 8).

9 Multi-barrier systems embrace several safety stages for the protection of the drinking water. The precautionary actions of the system include *inter alia* the protection of the water abstraction area against any contamination such as municipal and industrial waste water, agricultural pollution and hazardous substances; the sedimentation and filtration through the soil layers, water treatment with disinfection as well as the maintenance of the pipe system (cf. Umweltbundesamt, 2000).

10 This is a cross-cutting issue with the work package on economic implications (WP 6).

refers to regulatory limitations imposed on the industry and agricultural sectors in terms of flexibility and quantity of surface water intake.

- ***Availability (quality and quantity) of groundwater***: This indicator is based on the prevention principle, the resource minimisation principle and the intergeneration principle. The indicator refers to regulatory limitations imposed on the industry and agricultural sectors in terms of groundwater abstraction flexibility and quantity.
- ***Industrial wastewater management***: This indicator is based on the precautionary principle and the prevention principle. The indicator refers to the operational flexibility of industry with respect to changing wastewater discharge standards and their enforcement.

The following matrix gives an overview of the relation between principles, criteria, and indicators.[11]

Table 2: Relation between principles and indicators

Criteria	(i) Protection of water resources and quality				(ii) Sustainable drinking water supply					(iii) Repercussions on other water uses / sectors		
Indicators / Principles	Local water supply	Water source protection	Voluntary environmental protection	Quantity of water resources used	Quantity of water consumed	Application of minimisation principle	Quality and security of drinking water	Quality of infrastructure	Reduction of leakage and water losses	Availability of surface water	Availability of groundwater	Industrial wastewater management
Precautionary		x				x	x	x	x			x
Prevention		x	x			x	x			x	x	x
Source reduction		x	x									
Integration		x	x					x				
Resource minimisation				x	x	x		x	x	x	x	
Local provision	x											
Reversibility		x										
Co-operation & participation			x	x								
Inter-generation		x		x	x			x	x	x	x	

[11] Due to its rather economic nature, the polluter-pays principle is not part of the analysis.

4 Analysis of Scenario 1a: Delegation contracts and strong regulation

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4.1 Summary of End State 1a

End State 1a is characterised by an EU directive on competition for the market (from 2009) which introduces the obligation to undertake a bidding procedure every 10 to 15 years for the provision of water and sewerage services. The most frequent form of delegation contracts is concessions or lease (*affermage*) contracts that represent around 65% of the European market.

The public authority is responsible for the whole service and can be local (municipal or supra-municipal) or regional. In general, it remains the legal owner of the assets, even though, in cases of concession contracts, the infrastructure is financed and owned by the operator before it returns to the authority at the end of the contract. The responsibility for investment depends on contractual arrangements between authority and contractor: while the concessionaire finances all investment costs including replacement costs, agreed expansion costs and working capital, the *affermage* contractor is not responsible for financing any infrastructure expansion, reinforcements and rehabilitation. However, at the end of the *affermage* contract, the operator is required to hand over all assets to the responsible public authority in good repair.

With the 2009 EU directive, the Member States are also obliged to introduce an independent regulatory authority for the water sector. This regulatory authority exercises an *ex-post regulation*, which includes the control of water prices and the quality of service through performance indicators, including drinking water and wastewater treatment quality standards, leakages in networks, and water shortages. Environmental regulation is set at national level by an entity under the responsibility of the Ministry of the Environment. Pollution remains an important issue, leading to increasingly complex quality standards.

4.2 Implications on the protection of water resources and quality

In markets dominated with delegated contracts, implications on the ***protection of water resources*** are most likely. Indeed, the water and sanitation operators have a tendency to be short-term profit oriented and seek efficiency improvements at the expense of water resources protection as they favour a profit-oriented market strategy. The water sector on the other hand is characterised by a long-term investment strategy and planning horizon. For example, in some areas, the protection of the local water resources would be successful with an appropriate investment. Keeping the source may however imply implementing (post) treatment technologies, or efforts for the protection of the water quality if

pollution has reached or is threatening to reach a certain level. However, if the costs of expanding and maintaining the infrastructure necessary to retrieve and transport water from other resources are lower, actors in markets dominated with delegated contracts would favour this option. This would probably lead to the closing of the original source; the area surrounding the source (water protection zone) would lose its protection status, and this in turn could lead to an increase in the pollution of the source. This process could however not be repeated indefinitely, as the number of available sources is limited in most regions.

Connected to this, ***local water supply*** may be at risk or neglected if a company chooses to use extra-regional water resources. This solution can be an overall cheaper option, especially in cases where the water can be transported over a long-distance rather than over great heights. However, the long-distance transport of water will lead to a higher use of energy, as well as of chemicals to disinfect the water. This would go against the principle of sustainable water management (resource minimisation and regionality principle).

Additionally, the winning company of the competitive tender process acting under a short-term perspective may not have the incentive to make co-operative or contractual agreement on good environmental practices with farmers and land-users located close to streams or water sources (so-called ***voluntary environmental measures***). The consequence might be a low, or lower, level of water pollution control. All in all, the improvement of the regional environment and resource protection through precautionary measures can be in opposition to the aim of short-term efficiency gains and thus of secondary importance to the water and sanitation operator (precautionary approach versus end-of pipe technology). However, it should be noted that the water and sanitation operators are constrained by a legislative framework and their actions are limited within this framework.

Strong environmental regulation opens up a window for the development of new technologies, the use of which water providers can emphasise to convince of their ability to meet environmental targets. Delegating authorities may focus increasingly on the means made available to reach standards, and less on the actual results (Cour des Comptes France, 2003).

The following example from Brittany, France illustrates the case that a water provider in markets dominated by delegation contracts seems to have more incentives to use end-of-pipe technologies to remove pollution ex-post rather than to take precautionary actions in order to protect the regional water resources against pollution (see Box 2). Indeed, this end-of-pipe solution would have represented an additional profit to the *Lyonnaise des Eaux* but not a lasting solution to the problem of water pollution.

Box 2: *Lyonnaise des Eaux*, Brittany: Nitrate polluted drinking water – Who is responsible?

Brittany is a region characterised with intensive agriculture. With some eight million pigs and over two million cows, it ranks among the first French bovine and porcine producing regions. (Cour des Comptes, 2002)

When *Lyonnaise des Eaux* started providing the town of Guinguamp (in the northern part of Brittany) with water in 1987, the nitrate values were well below the present legal threshold (AMF, 2001). Starting in 1990 however, these values gradually increased until eventually, in 1995, *Collectif Eau Pure*, an association gathering 176 water consumers, launched a boycott and refused to pay the water bills. Over the previous years, their drinking water had presented unacceptably high nitrate values nearly two days out of three (Bauby and Lupton, 2004).

These water consumers resorted to legal means and successfully prosecuted *Lyonnaise des Eaux*. The water provider then lodged a complaint against the French State for not having implemented the 1991 European Nitrates Directive. The State was convicted in 2001 and made to pay an important fine to the company for its image prejudice (Drobenko, 2001).

An interesting aspect of the situation is the incentive it created for the contracted water company. Indeed, to solve the drinking water quality problems, *Lyonnaise des Eaux* offered, unsuccessfully, to sell a new technology to the municipality of Guingamp (Bourblanc, 2005).

The (mostly local) authorities in charge of the drinking water and sanitation sector are likely to reduce their scientific and technical staff after having delegated the provision of services to the bid-winning company. Accordingly, company employees, and not municipal staff, will be responsible for monitoring and operating the treatment facilities and infrastructure. If this company has strong market power (as do big multi-utility companies), regulatory authorities might experience problems to enforce environmental regulation. Only in cases where the private water supplier acts as provider of suited treatment plants at the same time, could they favour technically more elaborated solutions.

The implication on the ***quantity of water resources used*** is difficult to estimate. There might be a risk that the water resources will be used more quickly than is naturally reproduced (over-use of water resources), since operators under delegated management could favour achieving an "economic level of leakage" (see Section 4.3). An additional risk presents itself if the quality of the water is particularly low: the treatment process may require higher abstraction from the source to provide sufficient amounts of water meeting drinking water quality standards. However, these implications depend in general on the legislative framework and the implementation of a system of water resource planning (e.g. through water abstraction licences or economic instruments, such as water abstraction charges).

4.3 Implications for drinking water related issues

The implications on the ***quantity of water consumed*** are difficult to determine. In markets dominated by delegated contracts, there is a risk that the water operators do not see the need for taking actions in order to reduce the quantity of water consumed such as the establishment of water saving techniques or the installation of water meters. This may be due to economic constraints regarding the related constructive measures. In general, only the water consumers would benefit from these measures. However, the water company can increase the fix charges of the water price if the quantity of water consumed is extensively reduced and the consumption can be proven through meters.

In markets dominated with delegated contracts, there can be implications on the ***quality and security of drinking water supplied***. Due to the profit motive of privately owned companies, there is the risk that they will replace cost-intensive (precautionary) measures for securing health protection (such as so-called "multi-barrier systems"[12]) and favour the less expensive alternative of adding chlorine. Only if the contract between the municipality and the delegated company includes strict regulations concerning the security and quality of drinking water supplied, can the risk that precautionary measures are replaced by end-of-pipe solutions be lowered. Although the company has to meet the legal quality standards, including health and environmental threshold values, the related strategies to reach this aim can differ.

Negative implications can be expected from delegation contracts as regards the ***investment in the pipe system*** in view of its relatively heavy weight in the overall costs of water provision and the given costs structure for water supply (80% fixed costs). If the delegated company searches for an extensive reduction of costs, it will not only try to reduce the costs of operation management but also try to reduce the necessary maintenance investment duties. Such practices have heavy implications on the ***quality of infrastructure***, especially after a long period without appropriate maintenance and modernisation of the infrastructure. Infrastructure maintenance can be neglected for a long period of time before its real long-term value becomes apparent. The lack of investment and the following reduction in the infrastructure quality can also cause economic problems in the long run. If the concession contract expires or the water operator ends his work, the facilities fall back to the municipal owner or a new services operator needs to be found. Indeed, it will be difficult to get together the funds to earn the costs of the reconstruction of the infrastructure system.

The water sector is characterised by long-life equipment, which requires optimisation of investment over a long planning horizon. In view of the large initial investments required and the large period over which the benefits are spread, delegated companies providing the water supply services only for the concession duration of 10 to 15 years do not have an economic incentive to ***reduce leakage and***

[12] For more information on "multi-barrier systems", see the indicators' description in the methodology chapter (Chapter 3).

water losses in the long term. However, high rates of water losses lead to an increasing need for energy and chemicals for the treatment. Additionally, it causes pollution problems in the surrounding environment. Further, the related dilution of waste water in the sewer pipes results in failures of the biological treatment process.

In short, it became apparent that not only ownership but also the time horizon of the company providing the water supply services have implications on its behaviour. However, one should not forget that the regulation authority will exert considerable influence over the incentives sent to water providers.

4.4 Repercussions on other water uses and sectors

Martin Bijlsma (UNESCO-IHE)

The repercussions as a consequence of the scenario as such relate to the regulations set at national level and to the anticipated increasingly complex quality standards. Regulation at national level might reduce flexible application and/or enforcement of standards locally. Such flexibility would be desired to deal with specific local conditions, for example in case of extreme weather conditions or where certain standards might seem to require an excessive investment considering local conditions. Such lack of flexibility might create industrial water management problems with respect to, for example, limitations on discharges of cooling water or wastewater effluent. The consequence of increasingly complex quality standards is that industries are likely to face higher treatment, monitoring and administrative costs.

The analysis of the scenario resulted in three major environmental implications: reduced protection of water resource areas, increased energy and chemical use in water treatment and transportation and, finally, reduced willingness on behalf of the water supply company to invest in the implementation of voluntary environmental protection. Reduced protection levels of water resource areas can lead to increased levels of water pollution and, as was argued, can cause these resource areas to lose their protected status altogether.

Agriculture is likely to face both positive and negative repercussions from these implications. Loss of protection status of resource areas will at first be experienced as a positive development. Farmers can return to an intensive agricultural practices with respect to pesticide and fertiliser use, which will increase crop yields. On the other hand, the longer-term consequences of this behaviour will be an increased risk of environmental pollution. Increased groundwater pollution might inhibit its use by the farmers for *inter alia* cattle drenching.

The ***industry*** can also be affected both positively and negatively by a removal of the protected status of resource areas. Operational flexibility would be increased as certain restrictions on the use of chemicals no longer apply. On the other hand, increased water pollution can lead to restrictions in

groundwater use, forcing for example the food and beverage industries to identify new, and possibly more costly sources of clean water.

4.5 Interdependencies between the environmental implications of End State 1a

The central aspect of this end state is the relatively short planning horizon (10 to 15 years) given to concessionaires to recover their investments in the infrastructure expansion and maintenance, and to *affermage* contractors to receive a revenue on the funds provided for routine repair and replacements of short-lived components. This short contract duration reduces the water providers' incentive to include in their budgets aspects whose benefits unfold within a much larger timeframe. The potential neglect of these long-term aspects can have many intertwined implications with reinforcing effects.

A first aspect that presents advantages only in the long term is the implementation of precautionary measures to protect the resource. These often take the form of contractual agreements with farmers or land-users regarding the implementation of best practices on soils either surrounding a source or covering a source-relevant area. Best practices do not automatically lead to an improvement of the water quality but can do in a significant number of cases, if the type of soil permits it. If they are not put into practice, the chance is high that the quality of the water resource will deteriorate. In a self-reinforcing effect, poor water quality means that more time is needed for land-use change to have an effect and reverse the trend, thus reducing even further the incentive for water providers to consider such measures.

In this context, end of pipe solutions and technological or chemical treatments take on a growing importance. The short term planning horizon incites water providers to diversify the ways in which to increase their profits, and selling certain technologies to the municipality or including their use in contracts offer such an opportunity. This allows for a much more direct return on investment than precautionary measures do. However, and this is particularly true when chemicals are used, such treatments can have a negative impact on the water quality. The incentive to move away from precautionary measures and implement post-abstraction treatment thus can have a double impact on the quality of the resource.

Not only the quality, but also the quantity of the resource may be affected by the treatment. Indeed, treating poor quality water can lead to rising water abstraction to ensure that sufficient amounts of drinkable water are produced. Hence, both the quality and the quantity of the water resource are put at risk by the incentives given by a short-term planning horizon. In extreme cases, the source can even be closed and abandoned for another, possibly extra-regional one.

The investment in the infrastructure maintenance and extension (the latter only in case of concession contracts), a second aspect requiring long-term interests and planning, may also suffer under the arrangements described in this end state. As previously mentioned, the lack of investment in

infrastructure becomes visibly problematic only after several years, perhaps even decades, of neglect. Even before that point however, water losses through leakage will increase. To continue providing sufficient amounts of water to the consumers, water abstraction rates will thus have to increase, thus adding pressures on the source. At the other end of the service, wastewater pipes may also leak, leading first off to pollution problems, but also to rain water coming into wastewater pipes. This dilutes the wastewater, which as a result cannot be treated as effectively, creating as it is released further environmental problems.

In short, the strains on the water resource both in terms of quantity and quality can be numerous and in part self-reinforcing. This naturally has an impact on other sectors, such as the farming and the beverage industry.

However, the ex-post regulation provided by an independent authority can alleviate the expected implications of the delegation management on the environment. The monitoring of the service quality through performance indicators can potentially influence the companies' objectives towards more environmental efficiency of the drinking water and wastewater processes. This depends largely on the selection and definition of the indicator used (cf. also implications of the different regulative frameworks, Chapter 7) and the competence of the related authorities.

5 Analysis of Scenario 1b: Delegation contracts and extreme competition

Nadine Herbke, Britta Pielen, Jessica Ward and
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5.1 Summary of End State 1b

End State 1b is characterised by a EU directive requiring responsible authorities to introduce open tenders every **five** years, with contracts awarded solely on the basis of **least cost**. The market is dominated by an oligopoly of the largest private European water companies, and direct public sector management is gradually disappearing. The market being organised by European market rules, the authorities in charge of the drinking and sanitation sectors have lost most of their responsibilities and influence, because of the progressive loss of their technological and economic expertise. In addition, the local authorities have lost their freedom to choose whichever operator they please.

Stringent environmental standards must be applied in all countries and be integrated in the terms of the contract and invitations to tender, especially as the pollution of resources is still important and new potentially toxic substances enter the water cycle.

5.2 Implications on the protection of water resources and quality

With regard to the protection of water resources and quality, the implications of delegated management contracts under extreme competition are generally even stronger than the ones of delegated contracts with tendering processes every 10 to 15 (see Section 4.2). Extreme competition includes compulsory tendering processes every five years and results in the selection of the cheapest bid. Accordingly the bid-winning company will search for a reduction of costs within an extremely short period and has no real incentive to invest in long-term oriented ***water source protection*** measures, such as co-operational agreements (CA) with farmers and land-users for the realisation of ***voluntary environmental protection measures***. This is especially the case if the available raw water (still) meets the quality standards, and the competitive situation presses the operator to obtain an increase in short-term efficiency.

The area surrounding the sources (water protection zones) plays an important role for the protection and conservation of the regional natural resources. In a market dominated by delegation management contracts under extreme competition, there is a risk that the short-term oriented private water suppliers push for a sale of municipal water protection zones in order to receive supplementary financial revenues. The water supplier would then tap into extra-regional resources. This can also happen if the region's own water resources are polluted or exhausted. The consequences would be the closing of the water source; the surrounding water abstraction zones would lose their protection status and this in

turn could lead to an increase in the pollution of the source. Furthermore, the long-distance transport of water will lead to a higher use of energy, as well as of chemicals to disinfect the water.

The authorities in charge of the drinking and sanitation sectors have lost most of their responsibilities and thus their influence (loss of their technological and economic expertise). In addition, the market is dominated by an oligopoly of large private European water companies. Consequently, the authorities can get into difficulties to monitor the compliance of the companies with environmental standards. This would reduce the level of ***water pollution control*** and in the worse case, endanger the water sources used for drinking water supply.

5.3 Implications for drinking water related issues

With regard to sustainable drinking water supply, the implications of delegated management contracts under extreme competition are generally even stronger than the ones of delegated contracts with tendering processes every 10 to 15 years (see Section 4.3). Extreme competition means that the call for tender takes place every five years and the cheapest bid wins. But the dominating private short-term oriented companies have no funds for and interest in heavy ***infrastructure investment***, since they have no assurance for recovering the investment. Consequently, such practices lead to a considerable reduction in the ***quality of infrastructure***, especially after a long period without appropriate maintenance and modernisation of the infrastructure. This poses a particular problem, since infrastructure maintenance can be neglected for a long period of time before its real long-term value becomes apparent. Thus, the occurring problems cannot be immediately solved and the consequence is a reduction in the quality standard over a longer period with far-reaching consequences for the drinking water quality (see below).

In markets dominated by short-term oriented private companies, it can be expected that the companies aim at meeting an economic ***level of leakage*** instead of reducing the rate of water losses as much as possible through long-term maintenance and provision activities relating to the infrastructure system. The lack of maintenance and renovation of the pipe system can lead to a deterioration of the hygienic quality of the drinking water supplied. For example, the water can be microbiologically polluted due to the leakage of waste water discharges in the surrounding environment and subsequently in the drinking water pipe. Furthermore, high rates of water losses lead to an increasing need for energy and chemicals for the treatment, including a possibly avoidable (through other measures) chlorination of the water. Due to the reduction in the infrastructure quality, long-term economic problems can be expected (cf. Section 5.2). Indeed, if the concession contract expires or the water operator ends its work, the facilities fall back into municipal ownership or a new services operator needs to be found. At this point however, it will be difficult to raise the funds for the reconstruction of the infrastructure system. Accordingly, the process of improving the infrastructure quality will last for some time.

5.4 Repercussions on other water uses and sectors

Martin Bijlsma (UNESCO-IHE)

The scenario contains three environmentally relevant assumptions: stringent environmental standards will be applied in all European countries, pollution remains an important issue and new potentially toxic substances enter the water cycle.

The repercussions as a consequence of the scenario as such relate to the stringent environmental regulations and the introduction of new potentially toxic substances into the water cycle. The likely consequence of stringent environment standards is that industries probably face higher treatment, monitoring and administrative costs. The introduction of new potentially toxic substances affects agricultural practices and food safety.

The analysis of the scenario resulted in three major environmental implications: reduced protection of water resource areas, increased energy and chemical use in water treatment and transportation and, finally, reduced willingness on behalf of the water supply company to invest in the implementation of voluntary environmental protection. Reduced protection levels of water resource areas can lead to increased levels of water pollution and, as was argued, can cause these resource areas to lose their protected status altogether.

Agriculture is likely to face both positive and negative repercussions from these implications. Loss of protection status of resource areas will at first be experienced as a positive development. Farmers can return to their normal - and from a crop yield point of view - optimal agricultural practices with respect to pesticide and fertiliser use, which will increase crop yields. On the other hand, increased groundwater pollution might eventually inhibit its use by the farmers for the purpose of, for example, cattle drenching.

The ***industry***, particularly the food and beverage industry, will be potentially negatively affected by a removal of the water protection zones. An increase in water pollution would eventually restrict the usage of groundwater resources in an area, and force the industry to look for other, possibly more expensive sources of water. It should be noted that other industries could experience an increase in flexibility, as their discharges would not be subjected to strict limitations in these zones anymore. Still, national and European environmental standards would continue to be valid, narrowing this flexibility increase.

5.5 Interdependencies between the environmental implications of End State 1b

End State 1b presents an extreme competitive situation which on the one hand includes stringent environmental regulation and on the other a decision process for the award of water provision contracts based solely on the basis of least cost. In this scenario, the aspect apparently most heavily

affected is the protection of water resources. The extremely short length of contracts implies a minimal willingness to invest in long-term measures, such as infrastructure and pre-treatment resource protection measures. Low investment in infrastructure will evidently affect water quantity (leakage), but also quality, as pollutants can enter drinking water pipes, or waste water can escape from leaking pipes and pollute their surroundings, including water resources. The municipality's potentially reduced ability to monitor water providers could reinforce such problems.

The attractiveness of water protection zones for water providers is for its part largely reduced in this scenario. Indeed, this long-term measure represents an investment in time with no direct financial returns. Water providers can try to encourage the municipality to sell these areas for development in order to potentially receive a share of the benefits, if contracts offer such a share agreement. They can also choose to largely abandon the implementation of specific land-use rules on these zones and favour the use of post-treatment technologies to secure drinking water standards. Such technologies, whether they involve chemicals or a specific process, present the advantage for the water provider that they can be sold or their implementation charged to the municipality. They thus open the possibility, unlike long-term protection measures, of a direct financial reward. In addition, they offer a fast solution to the problem of drinking water standards. However, they provide no long-term solution and can pose environmental problems themselves, as they imply a greater use of energy and/or chemicals. Additionally, land-users will not be incorporated in soil and water protection schemes, inferring further pressures (for instance through construction works or application of pesticides and fertilisers) on water resources. The costs to the food and beverage industry, farmers and water providers, among others, may thus rise as they are forced to look for further water sources to fulfil their needs.

6 Analysis of Scenario 2: Outsourcing

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with contributions from Martha Garcia (UNESCO-IHE)

6.1 Summary of End State 2

For End State 2, it is common in 2020 among all European operators to decide to outsource part of their tasks to external sub-contractors, although there is a large variation developed in respect of the width of these outsourcing contracts. Under the pressure to achieve enhanced efficiencies and innovation, outsourcing has come to be seen as a promising means to internalise scale and scope advantages. The general success of the use of outsourcing contracts in other governmental and former utility sectors was an important driver for the implementation of these practices in the water sector.

Another factor that stimulated outsourcing was the lowering of the threshold value by the European Commission beyond which contracts have to be awarded through public tendering. Consultancies and specialised subcontractors offer their services, in competition with each other. Nevertheless, unlike under delegation contracts, revenue risks are not transferred to the winning bidder; it is the criterion of the right of exploitation and its corollary, the transfer of the risks inherent in the exploitation, which distinguish public contracts ('or outsourcing') from concessions.

Environmental implications on water use, diffuse pollution, water hygiene and safety, flood control and the avoidance of over-extraction of water have remained important issues, in the context of excessive rain and water precipitation or draught. Member states approaches depend on their being affected by these effects.

6.2 Implications on the protection of water resources and quality

If and to what extent there are any implications of outsourcing on the protection of water resources and quality depends largely on the length of the outsourcing contract. Indeed the length of the contract determines the degree of freedom the contracted party has to undertake actions that could go at the account of sustainable water management. The relationship between the water services provider and the outsourcing company is made explicit in the contract signed between them. The content features of this outsourcing contract determine for a large part the emergence of environmental implications. The scope of the contract is important as the likeliness of environmental implication is considerably higher if the contract includes business processes that are directly related to the water resources, as for example the abstraction, treatment and discharge processes. If the contract features a business process that can only be very indirectly linked to the water resources, as for example the billing and collection processes, the implications on the protection of water resources will be very limited. Another

important contract feature is the length of the outsourcing contract. The length of the contract contributes in different and sometimes opposing ways to the likeliness of environmental implications:

1. The longer the contract duration, the higher the information asymmetries between the two contract partners. If the contract duration is relatively long, there is an increasing possibility that the contracted party might have undertaken actions with irreversible implications (and as such environmentally unsustainable), since the supervising partner did not acquire the information needed at the time when mitigating measures were still possible. This is conflicting with the indicator of ***water source protection*** as derived from specifically the reversibility principle of sustainable water management that states that water management measures must be modifiable, and their results must be reversible. Longer contract periods give the contracted party the opportunity to hide information and/or avoid analysing relevant data (Bakker, 2000). An illustrative example in that respect is when water abstraction and treatment is outsourced to an external party. If a contract is signed for these services to an external party for a relatively short period, there is an evaluation moment once the contract ends. At that moment there will be a demand for information on the current status of water resources. If for example it becomes apparent that the contracted party relied too much on scarce ground water resources, the supervising party will have the opportunity to undertake mitigating measures in the form of instructing the next contractor to rely more on surface water abstraction. The longer the contract period, the higher the risk that the groundwater resources are irreversibly depleted, excluding the possibility for the supervising party to take any mitigating measures to protect the groundwater resources.
2. The longer the contract period, the less it is possible to arrange for all possible future environmentally relevant developments to be considered at the moment of contracting. Long-term contracts bear inherent shortcomings in that they may overlook future developments (Samuels and Darity, 1996). This may result in an increased risk of unpredictability regarding how the contractor will address these new developments, possibly implicating negatively the protection of water resources and quality. For example if there is a long term decrease of available water resources due to unexpected longer dry seasons, which were not anticipated in the initial contract design, there is a risk that the contracted party will not adjust its operations to this new situation, but will continue according to the originally agreed upon contract (Bakker, 2000; EEA, 2003). The contracted party might not be willing to be flexible and ***realise voluntary environmental protection measures,*** jeopardising consequently in the long run the ***protection of water sources***. Next, the unpredictability of the future actions of the contractor might negatively implicate an indicator as ***local water supply***, if for instance the contractor will be tempted due to unforeseen local water scarcity to tap into extra-regional resources instead of concentrating on actively

rehabilitating its own resources and restoring the original water conditions. Furthermore, the unwillingness to realise ***voluntary environmental protection measures*** might have negative implications on the ***quantity of water resources*** used due to the unpredictability of the future actions of the contractor. The contractor might be motivated to discard from any water conservation campaigns as such campaigns might result in a decrease of water sales and consequently a decrease in cash inflows.

3. The previous argument addressed the environmental implications of incomplete information about the future in the outsourcing contract with higher likeliness of negative implications if the contract period becomes extended. The argument as presented here under Point 3, counter balances this previous argument, as it argues that if the contract period becomes longer, the higher the level of trust between the contract partners will be and the better both partners will be attuned to act upon unwritten demands of both partners. The shorter the contract period, the smaller the possibility and time for both contract partners to establish such sound relationship. In a short-term contract the contract partners will be tempted to convert the outsourcing arrangement in a mere sale/buy transaction. Under these conditions there is a profound risk that the contracted party will focus narrowly on the clear contractual performance targets for which it is directly accountable, leaving aside other less formally defined interests (McClure, 2000; O'Looney, 1998; Bakker, 2000). A strict interpretation of the contract might specifically discourage ***the realisation of voluntary environmental protection measures***. This narrow focus might provoke implications on the ***protection of water resources and quality*** since these implications have generally a longer time dimension.
4. The characteristic of partnership in outsourcing has also for another reason negative implications on the indicator of ***water source protection***. The risk that the tasks of the supervising and the contracted parties become overly intertwined increases with time, as the boundaries of the tasks become blurred. This risk incorporates the danger that the supervising party starts delegating supervising tasks to the contracted party, providing the ability to the contracted party to abuse his freedom of operations. Moreover, there is a risk that the supervising party becomes too distanced from day-to-day operations. The supervising party consequently starts becoming out of touch with the latest developments. By losing its capability to operate, the supervising party starts losing its capability to supervise (O'Looney, 1998). An operator without proper control and supervision might be tempted to engage in short term solutions, instead of guaranteeing proper sustainable long-term operations. The blurring of the tasks and responsibilities of the controlling entity and the managing entity might undermine especially the co-operation and participation principle of sustainable water management.

As can be deducted from the above analysis, the local conditions largely define the implications of the length of the contract on the protection of water resources and quality for all indicators as defined in the methodology chapter (see Chapter 3). In addition to the length of the contract, as just analysed, another aspect of outsourcing can be assumed to have implications on the protection on water resources and quality. In establishing outsourcing contracts, there is a need to clearly state the specific targets that have to be reached by the contracted party and the way they are assessed. Many outsourcing contracts incorporate arrangements for performance monitoring and measuring, also in the field of environmental sustainability. Consequently during contract execution the contracting party will periodically monitor to what extent the contracted party fulfils its contractual duties in protecting the water resources. The performance monitoring and measuring characteristic related to outsourcing contracts can have positive implications on the ***water source protection.*** The establishment of a proper monitoring of environmental performance indicators, such as for example in the case of DBFO Delfland (see Box 3), can strengthen the application of good water management practices.

Box 3: DBFO Delfland – Increased performance monitoring and measurement

In the vicinity of The Hague, the local water board Delfland is responsible for handling the wastewater and securing clean surface water. In view of projected population growth and tighter environmental legislation, there was a need to increase the wastewater treatment capacity. The management of the water board decided to contract a private consortium to undertake this task through a Design Build Finance Operate contract. The major reason for the water board to engage in this innovative manner of contracting was to realise cost savings. An agreement was signed on the 5th of December 2003 between the water board and an international consortium called Delfluent to build and operate a new wastewater treatment plant, to renovate the current wastewater treatment plant and to maintain the distribution network for a period of 30 years. Within five years, the construction phase should be finalised. In 2008, both wastewater plants treat the wastewater of 1.5 million citizens and 40,000 companies. In setting up the contract, the latest monitoring technologies were incorporated to enable the water board to continuously monitor the performance of the private consortium. The contract includes standards to which the treated wastewater must comply and the way in which Delfluent BV must adapt to stricter specifications, new standards and future investments. The water board of Delfland established a dedicated team of contract managers, financial experts and wastewater technologists to ensure that these agreements are enforced. According to the water board, such type of monitoring efforts are normally not incorporated in treatment plants that are directly operated by the water board but this monitoring adds largely to the transparency in the operations (Hoogheemraadschap van Delfland, and Delfluent, 2005).

6.3 Implications for drinking water related issues

The implications on drinking water supply service are presented in two parts. The first part relates to drinking water services provided to the final consumers, in terms of quality and quantity. The second part relates to the attention paid to the maintenance of distribution network.

One of the aspects of outsourcing is that it often includes a competitive tendering process in the pre-contracting stage. The competitive element of the tendering process would ideally facilitate the selection of the bidder that proposes the best value for money. To what extent environmental sustainability plays an issue in this selection procedure depends largely to what degree environmental sustainability indicators (e.g. indicators on the ***quality and security of drinking water supplied***) are incorporated in the Terms of Reference that are given to the prospective bidders. If the Terms of Reference indicate that bidders should be concerned about the environmental sustainability, the assumption can be made that the competitive tendering process enables the selection of a bidder with the best intentions, reputation and proposals towards pursuing environmental sustainability.

A negative consequence of outsourcing contracts is the risk of a higher level of imperfect information for the contracting authority. This risk of imperfect information surfaces at various stages in the process of outsourcing. Firstly, when the outsourcing contract is made both parties will be attempting to incorporate all foreseen risks and mitigating measures in the contract. In view of the impossibility to oversee all types of risks that will occur, the contract is very likely to be made upon incomplete information. The desire of both parties to still pursue the project based upon incomplete information, might create problems in the future when circumstances arise that were not anticipated for. For example, unexpected disappointing profits or scarce cash reserves of the contracted party, might initiate him to delay expensive ***investments in the infrastructure*** or postpone cash absorbing efforts to ***reduce the leakage and water losses***, going in the long term at the expense of ***the quality and security of the drinking water supplied***. A case illustrating the implications of incomplete information on sustainable drinking water supply can be found in Yuvacik, Turkey (see Box 4), a country outside the European Union.

Box 4: Yuvacik Company, Turkey – Incomplete information

In this case the drinking water supply of Istanbul and the city of Izmit was endangered after the government made an outsourcing arrangement in the form of a BOT contract. The municipality of Izmit awarded a private company a BOT contract of US$ 900 million for a period of 15 years. The purpose of the contract was to build a water plant and a dam to increase the supply of water for domestic and industrial use for the city of Izmit and part of Istanbul. The production costs of the project came out higher than budgeted and once the first cubic metres of drinking water were produced, the water was too expensive for the local domestic and industrial sector. The original

contract did not cater for this unforeseen event and the outsourcing party decided to look for alternatives to generate revenues without the involvement of the responsible entity, the Turkish government. In March 2004, the Yuvacik Company signed an agreement to export 100,000 tonnes of water monthly, by sea, to an Egyptian company for industrial purposes. Although it was the intention of the government, the outsourcing arrangement did not cater to contribute to solve the sustainable drinking water problem in the region.[13]

This Turkish case illustrates that there is a situation of imperfect information at the time of contracting. During the execution of the outsourcing contract, the risk of imperfect information might also be higher for the contracting authority in cases where the contracting authority needs to control a large number of outsourcing contracts. In such situations the contracting party might loose the oversight of all of these different contractual arrangements since each of these arrangements will generate streams of scattered information. There is a risk that the contracting authority will not be able to integrate all of the information available and will not be able to optimise an integrated approach for operating the internally dependent business processes. For example, to optimally dose chemicals in the treatment process, one requires an integrated overview of all of the business process of drinking water provision. The involvement of numerous contracted parties in the business process might complicate the information integration and will as such have a negative implication on the ***application of the minimisation principle***. Such integrated overview of all of the business process of drinking water provision is also required to identify the optimum ***investment levels in infrastructure***, since there is a dependant relation between production, distribution and consumption. Lastly, also for addressing adequately ***leakages and water losses***, an in-depth understanding is required of the whole of the drinking water provision business process. For all of these indicators a possible inability of the contracting party to oversee the interdependencies between the various stages of the business process will invariably negatively implicate the sustainable delivery of drinking water.

Similar to delegation contracts, although in a lesser form, another element of incomplete information in outsourcing might implicate negatively the environment. Since in outsourcing the contracting party will not be directly involved anymore in day-to-day operations, there is a risk it might loose the capability, knowledge and information about the operations. This incapability of the contracting authority not only complicates the possibility of the operations to return to the contracting party after contract termination, but also during contract execution the contracting party might become too dependent of the private party in operations. The reliance of the contracting authority on the outsourcing company might specifically implicate the indicator of ***quality of infrastructure***, as

[13] Cf. Water Technology Website, [http://www.water-technology.net/projects/izmit/izmit1.html].

outsourcing might have implications on the attention paid to the ***investments in the pipe system*** and ***quality of infrastructure*** and the ***reduction of leakage and water losses***, since a private company continuously has to make a trade-off between short-term benefits and costs of long-term maintenance. Private companies are characterised by a profit objective, leaving a lower order of priorities for social and environmental issues in decision making. An illustrative example in this context comes from the Yorkshire drought of 1995 (see Box 5).

Box 5: Yorkshire Water Services (YWS) – Leakage problems due to lack of maintenance

The Yorkshire case illustrates what could happen during the operation phase of a BOT. The English summer in 1995 was especially dry and long. The problems in Yorkshire were particularly large because the local private water company that operated under a BOT contract had previously neglected maintenance. According to the regulator Ofwat, these problems in 1995 were largely caused by previous negligence of leakage control and headroom management (the margin between supply and demand) (Bakker, 2000).

It needs to be noted that the causal relationship between the outsourcing contract and the lack of maintenance cannot be established on the basis of this one illustrative case. The maintenance of the distribution network is a task that demands relatively high costs for small short-term benefit (Burbaker, 2003; Vermersch, 2005).

In short, in cases when the scope of the outsourcing contract includes a weighing of the outsourcing company between short-term actions that generate immediate benefits and activities that are more aimed at generating long-term benefits, there is an apparent risk that the outsourcing company will neglect the long-term activities. Specifically maintenance activities that only show their importance in the longer-run might be neglected. Outsourcing arrangements that incorporate such risk are for example BOT types of arrangement.

6.4 Repercussions on other water uses and sectors

Martin Bijlsma (UNESCO-IHE)

The scenario contains a number of environmentally relevant assumptions that make diffuse pollution, flood control and over-extraction of water important issues in the context of excessive rain or drought. The repercussions as a consequence of the scenario relate to future restrictions on water abstractions and on wastewater effluent and cooling water discharges. Increased concern with over-extraction might cause regulators to set legal limitations on groundwater abstraction, which could affect industries dependent on groundwater for process water. On the other hand, excessive draughts might lead to imposed limitations on cooling water discharges and wastewater discharges (with respect to

quantity and/or quality) into surface water. This would also affect normal operations. The scenario furthermore contains two elements with positive environmentally consequences: inclusion of environmental targets (or sustainability indicators) and increased monitoring.

The analysis of the scenario resulted in two major environmental implications: long outsourcing contract duration carries a risk of irreversible environmental consequences due to decreased resource protection, while, on the other hand, the contractually confirmed monitoring levels (and water quality indicators or targets) offer the opportunity to secure a certain quality level in case the operator is able to provide an efficient contract controlling.

The irreversible environmental consequences, such as pollution build up over longer periods, will adversely affect groundwater quality, which might eventually force industries to change their source of process water to another, more expensive one source. The positive environmental consequences of enhanced monitoring will allow industry and agriculture to continue their safely use of surface and ground water.

6.5 Interdependencies between the environmental implications of End State 2

The outsourcing scenario envisages that in the year 2020 the European water and sanitation sector will be featuring a large amount of involvement of external parties to perform specialised tasks on contract basis. As the contract defines the terms on which the designated tasks are executed, it plays a central role in the analysis on the implications on sustainable water management of this scenario. Therefore we structure our analysis of the interdependencies between the previously presented environmental implications according to three sequential contracting stages, being the implications that are related to the pre-contracting stage, to the contract design stage and to the contract implementation stage.

Pre-contracting stage: The first stage of contracting relates to the pre-contracting stage when a competitive tendering phase is carried out to select, ideally, the party that proposes the highest value for money. In case the importance of sustainable water management is recognised by the contracting party, and it has been properly addressed in the Terms of Reference for the bidder, this competitive process might indirectly lead to positive implications to the quality and security of drinking water supplied as the selected bidder will be the one that has (next to other issues) addressed the environmental requirements best.

Contract design phase: Once the bidder is selected, the contract will be drafted. Designing the contract requires that future risks are identified and addressed in the contract. It will not be possible in the case of long-term contracts to oversee all future risks. This inability might create the risk that if something unforeseen happens, the contracted party might choose to solve the matter in an unsustainable manner. Due to this emergence of incomplete information at the moment of contract design a large number of indicators of sustainable water management might be negatively implicated, as the realisation of

voluntarily environmental protection measures, local water supply, quantity of water used, quality of infrastructure, and the quality and security of drinking water supplied. In case the contracting party tries to mitigate these problems of incomplete information by insisting on the establishment of a proper monitoring system, the above mentioned negative implications might be largely counterbalanced. The contract will in such cases force the contracting parties to clearly state the contract objectives and how these are monitored via environmental indicators. The creation of such a monitoring system of environmental indicators will positively implicate the protection of sources, as on that monitoring information precautionary and preventive measures can be taken.

Contract implementation phase: After signing the contract, the contract is implemented which could have a variety of environmental implications in either way, depending on the local situation. The first element that determines if contract implementation is environmentally sustainable is the success of the previous phases. The selection of the right bidder and a proper contract design will facilitate the emergence of positive environmental implications. But aside from the implications from these previous phases, also the degree of environmental sustainability of the outsourcing contract will depend to what extent the partners are able to build a sound relationship. A relationship with a level of trust will enable both contract partners to attune their actions to unwritten demands. Such level of understanding and trust will likely implicate positively towards the realisation of voluntary environmental protection measures. In this respect longer-term contracts compared to shorter-term contract would facilitate a higher likeliness that such level of trust between the partners have the time to grow. It needs to be noted that if the levels of trust between the two partners is too extreme, it might turn to implicate negatively the environment. In such situation the dependence during the contract period of the contracting party upon the contracted party might become too large, since the contracting party is distancing itself from the day-to-day operations. This dependence of the contracting party might implicate the integration principle, as policies might become out of touch with the day-to-day demands and possibilities. Also the contracted party might be tempted to abuse his freedom of operations, possibly resulting in paying less attention to longer-term, sustainable and (possibly) more expensive solutions. Moreover, if the contract is longer, the contracting party might also find out too late that the contracted party has managed the contract in an environmentally unsustainable manner. This would provide an increasing possibility that irreversible negative implications arise on the protection of water sources and quality.

7 Analysis of Scenario 3: Regulated monopoly

Nadine Herbke, Britta Pielen, Jessica Ward and
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7.1. Summary of End State 3

End State 3 provides for a wide spectrum of benchmarking and regulation options of the water and sanitation sector. At one extreme of this spectrum, private monopolies are subjected to high-powered benchmarking with centralised regulation, while the other pole of the spectrum presents medium-powered benchmarking and decentralised regulation, mainly in those countries where municipal influence remained strong in the water sector. This analysis focuses on the **first pole**, i.e. **high-powered benchmarking with centralised regulation**. Although the market is characterised by private monopolies, publicly owned operating entities still prevail in a few member States. Operators tend to provide all water supply and sanitation services and manage and own all assets. A strong external and independent regulating authority at central level determines the tariffs, budgets, prices and investments that companies may charge or carry out. It is also in charge of conducting the benchmarking and of enforcing its results.

In accordance with the Water Framework Directive (WFD) full cost recovery is applied, including environmental and resource costs in some countries. Further, the WFD encouraged the formation of integrated operators based on water basins but in spite of progress accomplished, diffuse pollution remains important. Environmentally-friendly behaviour was stimulated through the obligation on operators to provide technical advice to customers on how to reduce water demands and wastewater pollution.

7.2. Implications on the protection of water resources and water

The implications of regulated monopolies on the ***water resources protection*** depend to a great extent on the regulative system and the indicators used for setting the prices and regulating investments. If the regulative framework does not extensively consider precautionary measures for the protection of water resources, the companies will not include these measures in their annual investment programme. Instead, they will favour the implementation of (post) treatment technologies in order to gradually meet the quality standards. The case of Anglian Water Services (AWS) illustrates that in such a regulative framework companies seem to receive an incentive to implement end-of-pipe solutions, such as blending or technological treatment, rather than act preventively and eliminate pollution at source (see Box 6).

Box 6: Anglian Water Service (AWS) – Nitrate pollution

Anglian Water Services (AWS) supplies some four million customers in the Anglian region with water. Land use in the region is mainly agricultural, which has lasting consequences on the water resources. 50% of the water supplied by AWS comes from groundwater sources, of which half are vulnerable to diffuse and point sources of pollution. Thirty three sources present nitrate concentration values above the legal threshold of 50mg/l (Beeson and Cook, 2004).

A model developed by the British Geological Survey (BGS) revealed that, irrespective of land use changes, these pollution trends are likely to continue for the next fifteen years, mainly due to the composition of the soil (Beeson and Cook, 2004).

AWS currently treats high-nitrate groundwater by blending several sources, and, to a lower extent, ion exchange and reverse osmosis. Blending is done by abstracting low-nitrate water from deep boreholes in the same or a different aquifers, and from surface water. This low-nitrate water is then mixed with water presenting a higher nitrate concentration. However, the blend potential of the deeper boreholes is gradually reducing, casting uncertainty on the possibility to continue using this method after 2015 (Beeson and Cook, 2004).

Voluntary environmental protection measures play an important role for the protection of water resources and the aquatic environment. These actions are implemented as part of long-term economic considerations, and entail the payment by the water provider of a certain sum to land users to support the implementation of best practices. Although an allocation of the costs for water protection on water suppliers would lead to a reversed polluter pays principle, this procedure has been developed as an effective instrument of water pollution control over the past decades.[14] Water supply companies, which are competing with other companies, act normally on more short-term planning horizons, since they do not have a strong enough position in the market. Thus, there might be a risk that voluntary environmental protection measures are of lower importance to them.

7.3. Implications for drinking water related issues

With regard to the ***quantity of water used***, the implications depend highly on the installation of meters to record the data on the effective water consumption of the supplied household. If the investment for the installation of water meters is not reflected in the indicators which form the base for the enquiries and actions of the regulation authority, the water companies have no incentive to provide the consumers with water meters. Consequently, the water bills will not be based on the effective water consumption and there is a risk that the quantity of water consumed will increase.

The implications of regulated monopolies on the ***investment in the infrastructure*** depends on how the regulative approach account for such long-term investments. This is of special importance, since the municipal influence on the water and sanitation sector is highly reduced, so that the regulation authority has to ensure that the water and wastewater companies sufficiently invest in the infrastructure facilities in the long run. The case of Thames Water's leakage problems (see Box 7) shows the consequences which may arise if the regulation authority does not make sure that the water and sanitation invest sufficiently in the maintenance of their infrastructure.

With regard to the implications of regulated monopolies on the ***leakage rate***, most regulative systems in the water sector define an economic level of leakage (ELL) in order to set leakage targets. This ELL can be set in a number of ways and cover a range of aspects related either exclusively to the water provider and its budget, or based on a more holistic approach and including costs carried by society as a whole, such as environmental damages. In the first case, companies have a minimal incentive to realise extensive maintenance and related investment actions in the pipe system in order to reduce the water losses beyond the defined economic level of leakage. In the second, the calculation of environmental costs has to struck a fine balance between the needs of society as a whole and the ones of the company to remain functional and competitive. This approach presents the advantage of taking into account extensive leakage compromising the availability of potentially rare drinking water resources.

Box 7: Thames Water – Leakage problems

Thames Water provides drinking water and sewage services to London and across the Thames Valley. With water losses representing a quarter of all leakage in England and Wales, the private company has the highest leakage rate of all the English and Welsh water companies and has been a cause of increasing concern for the water company regulator Ofwat. Indeed, the company loses 28% of the water it puts into supplies (Minting, 2000; Webb, 2003).

The specific context of London presents many challenges to address the problem of leakage. The dense urban structure renders repairing mains difficult and costly. Replacing pipes in London, for instance, leads to disruptions. To avoid closing streets to traffic too often, co-ordination with road repair works would be necessary but is not always possible. In addition, urban expansion, a growing number of tall buildings (requiring high water pressure) and increasing water consumption exert further pressure on the infrastructure (Levett, 2002).

In parallel to the slow renewal of its infrastructure, Thames Water proposed the building of a reservoir in Abingdon which would cover an area of about 10 km^2. Such a reservoir would increase Thames'

[14] For more information on governance of water-related conflicts in agriculture and the application of co-operative agreements (CAs), please refer to Brouwer et al., 2003.

supplies by 5 to 10% and would not be running before ten or fifteen years after construction starts (Minting, 2000). The construction of the reservoir would have great environmental impacts. Among them: traffic increase during the construction phase, changes of groundwater levels and flow during the two-year period needed to fill the reservoir, loss of agricultural land and habitats, and the creation of new habitats to name but a few (Levett, 2002).

Interestingly, faced with increasing water demands, Thames finds the reservoir solution more economical than the replacement and maintenance of its infrastructure, or the use of demand management measures such as metering (Levett, 2002; Minting, 2000).

The leakage problems of Thames Water in England and the selected solution is a good example to illustrate possible repercussions on other sectors and uses (see Section 7.4).

In short, the implications of the regulation monopoly End State on the drinking water related issues depend largely on the design of the regulation system and the performance indicators the system is based on. From an environmental perspective, it is necessary to define and select the indicators in a holistic manner, taking into account (long-term) environment and resource costs as well as social costs.

7.4. Repercussions on other water uses and sectors

Martin Bijlsma (UNESCO-IHE)

The scenario contains four environmentally relevant assumptions: strong regulating authorities will be established, more problems with diffuse pollution will occur, water companies will stimulate environmentally friendly behaviour through technical advice to their clients and finally, the WFD cost recovery will be applied that accounts for environmental costs.

The repercussions as a consequence of the scenario as such relate to the problem of diffuse pollution and cost recovery. Allowing diffuse (groundwater) pollution to build up over a longer period of time will lead to deteriorating water quality. This will eventually force industries to change their source of process water to another, possibly more expensive source. Industry and agriculture will then face higher operational costs. However the WFD generally requires that the Member States take account of the principle of recovery of the costs of water services, including environmental and resource costs, in accordance in particular with the polluter-pays principle. This will extend the incentive to reduce the discharge of pollution into waters.

One result of the scenario analysis is the fact that the willingness of private water companies to establish voluntary environmental protection measures is reduced, if the regulation system is not based on a holistic approach. This enables farmers to continue applying pesticide and fertiliser at rates based on optimal crop yields rather than based on environmental protection. The longer-term consequences

of this behaviour is an increased risk of environmental pollution. In addition, with regard to the quality of the infrastructure system, the water operators has an decreased incentive to carry out infrastructure modernisation measures. This is the case if the economic level of leakage (ELL) approach, basis of most regulation systems, does not include environmental and resource costs. In the Thames Water case (cf. Section 7.3) the construction of the reservoir (instead of leakage reduction) leads to traffic increase during the construction phase, loss of agricultural land and habitats, and the creation of new habitats to name but a few consequences.

7.5. Interdependencies between the environmental implications of End State 3

The analysis of the environmental implications focus on the End State's first pole, i.e. private water monopolies subjected to high-powered benchmarking with centralised regulation. The implications of the regulated monopolies end state depend to a great extent on the regulative system and the indicators used for setting prices and regulative investments. As a result, the analysis could not identify obvious environmental impacts but only point to potential risks depending on the options chosen for regulation. At the forefront of these determinant options lies the definition of the economic level of leakage (ELL). Indeed, the ELL can set various incentives, depending on whether it primarily considers the water provider's budgets or includes costs carried by society as a whole, such as environmental and resource costs.[15] This will have an influence on infrastructure investments, which in return can affect water quantity. Water quantity is actually the aspect which seems the most potentially put under strain in this scenario. Whether the regulation authority foresees a wider use of water meters, or whether blending is chosen for post-extraction treatment to respect drinking water quality standards will also induce varying degrees of water extraction.

Pollution, especially diffuse pollution, could also represent an important risk, depending on whether water providers are encouraged, by regulation or other means, to seek out (co-operative) agreements with land-users or other agri-environmental measures to reduce water pollution. If this is not the case, it is unlikely that land-users will apply standards that are stricter than foreseen by national and European law. Water pollution increase imply higher costs for the industries dependent on water quality, such as the beverage industry, and for farmers.

[15] According to the Article 9 of the WFD, all Member States shall take account of the principle of recovery of the water services costs, including environmental and resource costs.

8 Analysis of Scenario 4: Direct public management

Nadine Herbke, Britta Pielen, Jessica Ward and
R. Andreas Kraemer (Ecologic)

8.1 Summary of End State 4

This End State is characterised by the absence of competition in/for the customer market or for various service inputs. However, there is competition for upstream goods and services. The tendering processes of such goods and services are subject to public procurement rules. The operator is typically a non-autonomous local public water services body under the direct control of the municipality. There is no independent regulatory authority. Instead, each operator acts as a regulator in its region, and the protection of customers' interests is assured by democratic control, public ownership and management of the network.

Environmental regulation is the responsibility of river basin authorities who also recommend the building or adaptation of the sewage and treatment systems in close collaboration with the water operators in the interest of the resource.

8.2 Implications on the protection of water resources and quality

The close interaction between local water supplier and the stakeholders within the supply area can lead to a long-sighted and co-operative approach for water resources protection. There is an incentive for the water supplier to establish ***voluntary environmental measures*** in order to protect the areas surrounding water sources (water abstraction area). Theses measures help to avoid potential water pollution and thus protect the water resources in a long run. The case of Munich *Stadtwerke* illustrates that the protection of the water resources through the realisation of co-operation agreements with farmers helps to reduce nutrients from agricultural sources (see Box 8). These actions from the municipal water supplier also lead to high quality and security of drinking water supply in the long run (see also Section 8.3).

Box 8: Munich *Stadtwerke* – Voluntary environmental measures[16]

The Munich *Stadtwerke* (SWM) are entirely owned by the municipality of Munich and supply the city and its surrounding region with water as well as energy and public transportation.

The Munich drinking water is abstracted from three areas that are predominantly used for agricultural purposes. To secure the water quality, the SWM has been consistently buying plots of lands in the

[16] Note: All information from the Munich Stadtwerke website: www. swm.de

catchment areas. These plots are then either reforested or leased under very strict conditions. Despite these measures, water pollution continued to increase due to extensive agriculture. Although the pollutants stayed well below the legal limits, the SWM decided to act preventively and launch a co-operation programme with farmers.

Now, some hundred farmers take part in this programme and apply strict organic farming methods on 2.500 km^2 around the main water abstraction area of *Mangfalltal*, thus improving the quality of water, meat and produce. SWM supports the farmers with a little over 230 Euro per hectare, which for the consumer translates in a price increase of half a Euro cent per cubic meter of water.

For the ***protection of water sources***, the time horizon is of great importance. Since the local public authority (municipality) is responsible for the provision of water services over a indefinite period (in principle), it has a strong incentive to protect the water sources it uses and the surrounding area against any pollution. The Vienna Waterworks case shows long-term strategies as the declaration of the Vienna Water Charter help to protect their water sources (see Box 9).

Box 9: Vienna Waterworks – Source protection[17]

The Vienna Waterworks is part of the Vienna municipal government, and provides the population of Vienna (just over 1.7 million people) with water originating to 90% from the surrounding mountains. Some 600 km^2 around the sources are designated as source protection zones, 50% of which are owned by the city of Vienna.

In 2001, the city of Vienna gave water constitutional protection and further strengthened this focus on safe water with the *Vienna Water Charter*. This Charter emphasises the aspects of quality and sustainability of water protection, provision and use over financial profits.

In addition to the waterworks, another division of the city administration plays a central role in implementing key points of the charter: the office for forestry and agriculture. Indeed, this office is responsible for the sustainable care of the forests and arable land covering the source protection areas, and works in close co-operation with the waterworks. All soil uses, such as forestry, tourism, hunting and fishing can thus be co-ordinated with the needs of water protection. The water is filtered through ecologically balanced forests and reaches the consumer without any treatment other than a disinfection with a minimal dose of chlorine dioxide.

[17] Note: All information from the city of Vienna Website [www.wien.gv.at] and the Website of the Vienna Waterworks [www.wasserwerk.at].

However, certain factors can render the development of such water protection schemes less effective or more complex. The delimitation of water protection zones must be imposed over the interests of land-owners, who may oppose having to sell their property or lose certain usage rights. As a result, the municipality may want to design protection zones with the smallest possible perimeter. In addition, though source protection and the resulting increased water quality benefit a large group of people in and outside the municipality, the costs linked to the encumbrance and the delimitation of the zone remain with the municipality on whose territory the protection zone lies. The unequal repartition of costs may therefore represent a barrier to the setting of protection zones. Last, in the case of contractual agreements with farmers, the number and clout of these farmers represent an important factor promoting or impeding that effective contracts on best practices be set up. Negotiations regarding the financial compensations and the measures to implement will prove easier if the number of farmers involved is small. Even in these conditions – the agricultural sector being used to negotiations – the conclusion of a contract may prove long and difficult (Miquel et al., 2003).

8.3 Implications for drinking water related issues

In general, the implications on the sustainable drinking water supply depend to a great extent on the actions which the water operators take to protect the sources used for the water abstraction (cf. Section 8.2). Accordingly, the time horizon of the enterprise plays an important role in terms of measures and strategies which they develop and implement, in order to provide a ***high quality and security of drinking water supplied***. In this End State, the municipality, as the owner and operator of the water supply and sanitation services, has a strong incentive to manage the water services in view of the next decades. Thus, the municipal enterprise will implement "multi-barrier systems" (systems consisting of several stages to guarantee a safe drinking water supply of high quality, to minimise hygienic risks and to avoid the application of safety chlorination). As already mentioned in Section 8.2, the *Water Charter*, the constitutional document or water protection of the city of Vienna, shows also a possible approach to implement a long-term oriented strategy for guaranteeing the sustainable supply of the region with drinking water (see also Box 9).

Water and sanitation undertakings under direct public management underlie ***democratic control through citizens*** and water consumers. They have the opportunity to send their complaints concerning the water services quality directly to the municipality and, if necessary, to vote the municipal government out of office at the next local elections. The municipal undertakings thus have an incentive to provide a sustainable drinking water quality. However, this is only the fact if the municipality acts in a "good governance" manner and their planning strategies regarding the water supply and sanitation services are long-term oriented. Due to the strict local retention of the water

services, there is a risk that the municipal undertaking abuses its position leading in a most extreme case to corruption.

8.4 Repercussions on other water uses and sectors

Martin Bijlsma (UNESCO-IHE)

The scenario contains two environmentally relevant assumptions: River basin authorities will be responsible for environmental regulation and they will recommend sewage treatment facilities in the interest of the resource.

The repercussions as a consequence of the scenario as such are twofold: additional installation and operation of treatment facilities might form additional cost factor for industry, while increased wastewater treatment improves water quality benefiting industry and agriculture alike.

The analysis of the scenario resulted in one major environmental implication: voluntary environmental measures will prevent pollution and provide long-term protection. Such measures will improve water quality and thereby benefit industry and agriculture.

8.5 Interdependencies between the environmental implications of End State 4

The Direct Public Management End State presents various driving forces that pull, as regards the environment, in opposite directions. Some could lead to a sustained commitment to water and environmental protection while others could result in environmental degradations. In direct public management, the town-governing body, and therefore, theoretically, the town's citizens, plan and make their own decisions regarding, among other, water management. Large cities set aside, municipal representatives will tend to live in the area where they have political responsibility or were elected. They therefore have a vested interest in finding long-term solutions to secure the town's – and their own – water provision. The long planning horizon provided by municipal ownership of the water provision infrastructure offers a favourable framework for such a far-sighted approach. Precautionary measures, including co-operation with land-users, can be more easily envisaged than in a context where returns on investment must be realised rapidly, as is the case for private firms.

Accountability is a further aspect encouraging a long-sighted approach to water management. Water quality, together with its price, belong to the issues that come into play when citizens elect their representatives, and this can give an incentive to provide high quality water at an acceptable price. However, the impacts of water management decisions and water protection measures become evident many years later, so that the original decision-makers most probably cannot be held accountable once the damage is apparent. In short, vested interest and commitment of elected and/or responsible officials, ownership structure allowing for a long planning horizon and, to a certain extent, democratic accountability all seem to indicate a tendency towards a sustainable, long-sighted water management.

Further driving forces, however, clash with this disposition. Geographic factors can severely limit a municipality's willingness to implement long-term water source protection measures, if the land it can protect within its boundaries filters water used by another community, for instance. In this case, unequal repartition of costs and benefits between communities could mitigate the readiness for adopting a long-sighted approach. In addition, and as in any democratic society, a municipality consists of citizens and groups with conflicting interests. Any decision regarding choices of investments, land development and land use has to strike a balance between these interests. What is more, strong power groups such as agricultural lobbies can wield political clout to impede or exert influence on the implementation of measures they are unfavourable to, for instance the setting up of best-practices programmes.

9 Analysis of Scenario 5: Community management

Marco Schouten
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9.1 Summary of End State 5

The community management scenario describes that in 2020 users of water services across Europe are structurally involved in the provision of water services as owners or decision makers. One type of community management is that the water supply and sanitation services are organised in voluntary organisations (i.e. user co-operatives). Another type is that customers own the water assets or are contributing to water supply and sanitation management through representation in water company boards. Also a common form of community management in the End State are the – so called – water management associations formed by landowners, private enterprises or public corporations, that were responsible for the delivery of water supply and sanitation services. Obviously, just as in the other defined End States, the community has to comply with EU and national standards, for what concerns drinking water standards and sanitation. With respect to environmental standards related to the conservation of aquatic ecosystems the WFD establishes public control through basin authorities. Furthermore, public regulators can control the basic quality of the service, public health and environmental aspects.

9.2 Implications on the protection of water resources and quality

Apart from all the indicators and principles affected in the following analysis for water resources as well as drinking water it should be emphasised that in particular one principle of sustainable water management is very much related to the scenario of community management, being the co-operation and participation principle. In general, establishing a management mode as community management by involving users as owners or decision makers is capturing the central theme that this principle addresses, being that all actors concerned or affected by a decision have to be consulted and involved into the decision-making process. Community management as such positively implicates the related indicators to the co-operation and participation principle as the taking of ***voluntarily environmental protection measures*** and the ***quantity of water resources used***. These positive implications are based upon the assumption that due to involving users in decisions about their local situation, on one hand the decisions themselves will be better matching the local demands and limitations, while on the other hand once the decisions are made the carrying capacity for implementation will be increased. Box 10 below provides an illustration from the German Water Associations of the positive implications related to the involvement of community members in the provision of water services.

Box 10: German Water Associations – Benefits of involving the community

An estimated 1,200 Water Associations in Germany are active in water supply, including the supply for agricultural use. These Water Associations are self-governing consortia of property-owners, companies, public-law corporations and other interested parties for land and water management purposes, sometimes covering large land areas. Members control the association according to democratic principles. As relevant for our analysis of possible environmental implication, the functional self-government in Water Associations has proved to be effective in several aspects relevant directly or indirectly to the analysis of environmental implications. One is that the involvement of community members results in a high degree of political legitimacy. Secondly, the structure of water associations allows users to contribute their knowledge of local conditions and their potential co-operation in the spirit of the principle of shared responsibility. Finally, small-scale structures give meaning to the otherwise abstract term 'public benefit' in the eyes of those responsible: the 'public' is the population of a village, town or city (Kraemer and Jäger, 1995).

A more negative implication of community management for the indicators of ***quantity of water resources*** used and the implementation of ***voluntary environmental protection measures*** is the relative amateurism of non-professionals, such as users in the decisions related to the delivery of water services, is outlined below. With regard to the indicator of ***quantity of water resources used***, the stimulants to rational water use are generally pricing of the water to be consumed and awareness rising campaigns. Especially the water price is instrumental in motivating the control of water consumption rates in household. In community management the users that are affected by the prices are also the ones that are involved in the setting of the price levels. This direct involvement might lead to a tendency of users to keep the tariffs at a low level. Only in cases when users perceive that the water resources they depend upon are at risk and measures are needed to secure the water resources, the implementation of conservative water consumption policies might have sufficient carrying capacity among the users. Therefore, there is a risk that community management do not base their water management on the fact that the available water resources are limited (Moriarty, 2005). Particularly in areas with water shortages such as Spain and Italy (EEA, 2005), serious implications arise, such as depletion of surface and/or ground water resources as well the damage to and destruction of ecosystem. The more water is abstracted, the higher the risk that the amount of water left is not sufficient to keep the water body's normal carrying capacity. Moreover, non-experts, as users involved in decision making in the community management model could be unaware of the need to undertake ***voluntary environmental protection measures*** as they do not recognise these kind of cause-effect chains in nature. Due to their relative amateurism they might miss the expert judgement to timely

anticipate the development of their water resources in the longer term and withhold from measures to reduce the discharge of pollution units in the basin or reduce the abstraction rates.

An element that characterises community management that implicates sustainable water management in a more positive manner is the element of autonomy. Community management is characterised by a decentralised functional organisation that aims to take the responsibilities and tasks related to the provision of water supply and sanitation services into their own hands. As such, the local water services are to a certain extent shielded from external influences, like national politics or developments in other sectors. This higher level of independence or autonomy compared to other types of management modes might proof to provide positive environmental implications, The case from the Dutch water boards illustrates this argument (see Box 11).

Box 11: Dutch Water Boards – Decentralised autonomy as basis for an effective water resource protection

As a low-lying country, the Dutch are forced to deal with water issues intensively as it impacts their habitat directly and very visibly. It was early recognised that quantitative water problems could not be solved individually and as a result, draining and the building of dykes were a joint effort. The establishment of water boards since the 12th century as a functional autonomous decentralised organisation is based on this needed collaborative action. Nowadays the functional water board organisation still holds an independent position within the general democracy in the Netherlands, being not subjected to a general political weighing of interests. This autonomy is reflected in the so-called interest-pay-say principle that characterises the Dutch water board system. The idea behind this triplet is that those who are considered to have an interest in the execution of water boards, should also bear the costs for this proportionally and should have a say in the assemblies of water boards. Water boards, as such, are highly financially independent from the government, since each of the water boards has its own water board taxes raised and collected locally. Water boards finance their activities on an individual basis entirely with the revenues of their own taxes, providing them with a budget of around € 2 billion annually. Because of this system of regional water board taxes, water boards are hardly affected by national politics or economic fluctuations. Moreover, to reduce any dependency on loaning policies of the central government or commercial banks, the water boards in the middle of the last century established their own bank, the Netherlands Water Board Bank (NWB).

The implications for the environment of the water boards' autonomy can be illustrated by the development since the 1970s of discharges on surface water. The treatment of urban wastewater is a responsibility of the water boards and since the 1970s the discharges of wastewater into surface water have steadily decreased as a result of large-scale investments in wastewater treatment plants despite economic recessions and political changes. It should be emphasised that the guaranteed levies of the

water board have made it possible to finance the wastewater treatment plants, without any government grants whatsoever. In addition the water pollution tax levied by the water board has clearly had a regulating effect on the corporate discharges of wastewater: the pollution discharged by companies decreased between 19970 and 2000 from 33.3 to 7.3 pollution units (p.u.), while in the same period the pollution discharged by households increased from 12.5 p.u. to 15.9 (Havekes et al., 2005).

As the example from the Dutch water boards illustrates, the possibility of a community organisation to steer its own course independent of national politics, may have positive implications for sustainable water management in general. Especially an indicator as ***local water supply*** is positively implicated as it relates to the regionality principle or the principle of local provision. The community management mode allows a higher autonomy compared to other management modes to solve the water management issues using is own resources and avoiding all spatial environmental externalities.

9.3 Implications for drinking water related issues

In community management there is tendency of the users involved in the decision making to act in its own interest on the short term, as it is out-of-scope for individual users to oversee the sustainability in the long-term of service provision. When users are involved in the decision making, the decision might be focussed too much on the immediate provision of sufficient drinking water of good quality for an affordable tariff, neglecting the possible longer term environmental implications; especially if these long term implications are not very clear. In view of this focus on immediate satisfaction of consumer wishes, the idea of rational consumption might be ignored, implicating the indicator of ***quantity of water consumed***.

Additionally the tendency of community management to strive for affordability of the service (Moriarty, 2005) will trigger too much emphasis on pursuing cost savings to keep the tariff low. It could be that the search for cost savings may in the long run violate sustainable drinking water supply. This search for continuous cost savings could be in the form of a choice to use the cheapest available treatment chemicals (as relates to ***application of the minimisation principle***), without acknowledging possible long run negative environmental implications (Gasteyer, 2004). Another issue implicated by the search of cost savings are the costs for maintenance of the infrastructure. Community management modes might be tempted to delay costly preventive ***investments in the pipe system and quality of infrastructure*** in view of the aim to achieve in the immediate term affordable services (Moriarty, 2005; Vincent, 2005; Gasteyer, 2004). Nevertheless, some factors of community management also undermine this line of argumentation that community management motivates short term decisions, as for example the fact that the community has to live itself with its decisions.

9.4 Repercussions on other water uses and sectors

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The Community Management scenario contains two environmentally relevant assumptions: public regulators control public health and environmental aspects and the community must comply with EU water quality and sanitation standards. The environmental analysis does not identify any repercussions as a consequence of the scenario as such.

The analysis of the scenario resulted in two major environmental implications which can have repercussions on other water uses and sectors: (i) unsustainable management and over-exploitation of water resources cause increased pollution levels and water shortages, and (ii) due to lack of expertise the option of voluntary environmental measures may be overlooked.

Agriculture is likely to face two consequences from over-exploitation of water resources. The reduced availability of surface water for irrigation potentially affects crop yield. Furthermore, the possible lowering of groundwater tables increases the need for irrigation. Overlooking the option to invest in the implementation of voluntary environmental protection measures enables farmers to continue applying pesticide and fertiliser at rates based on optimal crop yields rather than based on environmental protection. The longer-term consequences of this behaviour will be an increased risk of environmental pollution.

9.5 Interdependencies between the environmental implications of End State 5

The scenario of community management envisages that in 2020 users will be frequently involved as owners or decision makers in the European water sector. The involvement of users therefore is central in our structure in presenting the interdependencies between the previously identified environmental implications. The first aspect which needs to be noted is that the act of involving users in the water sector in itself already contributes beneficially to indicators related to one specific principle of sustainable water management, being the co-operation and participation principle. The higher level of democratic control and local co-determination will positively contribute to realising sustainable water management within the locality in which the community is involved. Related indicators of voluntary environmental protection, and quantity of water resources used will be better addressed by involving the community. The involvement of the community also has another advantage. Due to the local involvement of users in decision-making on local water management, external interferences, as national politics, might be shielded off. Hence a sustainable water management indicator as local water supply as derived from the regionality principle or the principle of local provision might be positively implicated. A more negative aspect of the involvement of users in the management of water services is the possibility that within the group of users there is not sufficient qualified expertise to manage the service provision adequately on a sustainable environmental basis. In particular the longer-

term implications of current action might be overlooked in view of the higher level of complexity and in-depth understanding that it requires. Since the users are themselves involved in the decision-making, the community might for instance put too much emphasis on satisfying immediate term demands of users for sufficient quantity and good quality drinking water at an affordable price, possibly partly overlooking the longer-term consequences. These negative environmental implications affect also other sectors, such as the agriculture. If farmers do not have sufficient access to surface water to irrigate their lands due to water pollution or scarcity, their crop yields will be implicated. This problem might even be made worse if ground water tables are lowered as this increases the dependence of the farmers on surface water to irrigate their lands

Examples of this lack of knowledge or awareness can be found in cases when the community is ignorant that using and consuming large quantities of water resources might in the long run affect the availability of water resources. Also due to lack of expertise, users might not be aware of the need to take voluntary environmental protection measures in order to avoid pollution of water resources. Also related to managing the provision of drinking water, the relative amateurism of users might be implicating negatively an indicator as investment in pipe system and quality of infrastructure, since the users might lack the understanding the need of doing expensive preventive maintenance that primarily brings benefits in the long run. Another example is when the community chooses to use the cheapest available solution for water treatment to serve a short-term objective as affordability. Such solutions might less environmentally friendly, in the long run negatively implicating the protection of the water sources**,** which will lead other sectors that depend on good quality ground water to suffer.

12 Synthesis

This section provides a synthesis of the analysis of the six End States. It offers a descriptive overview from an environmental perspective. It further includes a classification matrix providing a horizontal overview of the implications for the different End States (see below).

The analysis identified a certain number of determinant factors with potentially great environmental impacts. These are inter alia the length of the contract, the regulative framework in which companies operate and the level of monitoring.

The ***length of the contract*** is a recurring factor. At least two scenarios give companies a limited time frame to plan and invest: In Scenario 1a, bidding procedures take place every 10 to 15 years, in Scenario 1b every five years, and though the outsourcing scenario does not specify any time frame, contract duration could vary greatly from short to long. This factor has a considerable influence on companies' decisions. Indeed, the water sector is characterised by the fact that it requires important investments in infrastructure and its maintenance and by a cost structure with 80% fixed. The investments do not translate into benefits before a long period of time (sometimes as long as 50 to 100 years) and the rates of return will tend to remain low. This means that companies with a short contract will have little interest for long-term investments in infrastructure maintenance and extension (the latter only in the case of concession contracts where the operator is responsible for this task), especially if they intensively search for cost reduction opportunities. This leads to a reduction in infrastructure quality, especially after a long time without appropriate maintenance and can cause also economic problems when the contract expires. Furthermore, the companies will most probably neglect precautionary measure, such as agreements with farmers to promote less polluting land-use and keep nitrate rates low in the long term, and favour end-of-pipe solutions, such as technological treatment of nitrate polluted water. The direct public management and the community management scenarios on the other hand offer a quasi unlimited time frame in which to plan. Implementing precautionary measures then becomes economically sensible, despite the fact that the benefits of such measures appear only after several years, provided that the municipality has appropriate funds for the investment. However, political issues take on an important role in this scenario. Indeed, the municipality will need to achieve a balance between various interests and priorities in a transparent manner in accordance with the principles of good governance. Urban, industrial or agricultural development should be implemented in parallel with an appropriate level of water protection.

Another important factor is the ***regulative framework*** in which companies operate. The indicators used for setting the prices and regulating investments in Scenario 1a and Scenario 3 will determine the environmental implications that are to be expected. Indeed, the regulative framework defines which investments can be recovered, for instance through an increase in consumer prices. If this framework

does not leave much freedom for infrastructure maintenance or does not consider precautionary measures, the water providers will have little incentive to include these measures in their annual investment programmes. This is especially the case if the regulative system is based on the so-called economic level of leakage (ELL). The ELL is usually defined as level at which further leakage reduction costs the water supplier more than to produce water from another source. In this context, water operators have no incentive to invest in infrastructure measures to reduce the leakage level below ELL. This increases the tendency to exploit alternative sources potentially leading to a higher level of chemicals and energy required for the production of drinking water. The ELL can however be defined in an holistic way and also include environmental and resource costs as well as costs born by society as a whole.

Finally, the ***level of monitoring*** water providers are subjected to has considerable consequences. The analysis of the delegated management and outsourcing scenario found that water providers could potentially keep certain information undisclosed until the end of their contract, possibly leading to irreversible environmental damages. A monitoring that includes criteria of security of supply, drinking water quality and water resource protection could ensure that contractors do not take advantage of their freedom of operation to the detriment of water resources.

As regards the repercussions on other sectors, one should particularly focus on the agricultural sector. Indeed, agriculture plays a double role in the water sector: On the one hand, it benefits from and needs clean water resources available at low costs. It benefits, be it in the short-term, from using such potentially polluting substances as fertilisers and pesticides. A balance needs to be found between the sector's long and short-term interests, keeping in mind the difficulty of depolluting water resources once the damage is done.

These aspects stood out as particular important in the analysis. For more details, the following table provides a clear comparison of the end states and their environmental implications. The implications are classified in three categories: potentially negative, uncertain, and potentially positive. However, these categories give only a tendency concerning the environmental implications.

Table 3: Classification matrix of the environmental implications within the different End States

Implications of: / On:	**End State 1a – Delegation contracts and strong regulation**	**End State 1b – Delegation contracts and extreme competition**	**End State 2 – Outsourcing**	**End State 3 – Regulated monopoly**	**End State 4 – Direct public management**	**End State 5 – Community management**
Criteria 1: Protection of water resources and quality						
Local water supply	**Potentially negative** – If exploiting extra-regional sources is cheaper	**Potentially negative** – If exploiting extra-regional sources is cheaper	**Potentially negative -** Due to incomplete information at contracting stage			
Water source protection	**Potentially negative** – If the costs of keeping a source are higher than exploiting another source	**Potentially negative** – No incentive to invest in long-term protection measures	**Potentially negative** – Information asymmetries and the risk of abuse of freedom, especially in cases of longer term contracts **Uncertain** – Dependent upon to what degree partners succeed in building a relationship of trust and mutual understanding **Potentially positive –** Due to higher level of performance monitoring and measurement.	**Uncertain** – Depending on the regulative framework, operators could have an incentive to implement (post) treatment technologies	**Uncertain** – Long planning horizon allowing for long-term protection measures, but political process and conflicting citizen interests can impede their optimal implementation	
Realisation of voluntary environmental protection measures	**Potentially negative** – Short-term perspective gives no incentive to make contractual agreements on good environmental practices with land users	**Potentially negative** – Extreme short-term perspective gives no incentive to make contractual agreements on good environmental practices with land users	**Potentially negative** – Due to incomplete information at contracting stage **Uncertain** – Dependent upon to what degree partners succeed in building a relationship of trust and mutual understanding	**Uncertain** – Depending on whether the regulative framework includes precautionary measures	**Uncertain** – Long planning horizon allowing for long-term protection measures, but political process and conflicting citizen interests can impede their optimal implementation	**Potentially positive –** Due to involving community members **Potentially negative –** Due to lack of expertise among users
Quantity of water resources used	**Uncertain** – Potentially high quantities used due to leakage, depending on the legislative framework		**Potentially negative –** Due to incomplete information at contracting stage			**Potentially positive –** Due to involvement of community members **Potentially negative –** Due to lack of expertise among users

Implications of: / On:	**End State 1a – Delegation contracts and strong regulation**	**End State 1b – Delegation contracts and extreme competition**	**End State 2 – Outsourcing**	**End State 3 – Regulated monopoly**	**End State 4 – Direct public management**	**End State 5 – Community management**
Criteria 2: Sustainable drinking water supply						
Quantity of water consumed	**Uncertain** – Potentially no incentive for operators to encourage water saving	**Potentially** – Potentially no incentive for operators to encourage water saving		**Uncertain** – Depending on whether water meters are part of the regulative indicators		**Uncertain** – Depending on whether the community acknowledges the importance of sustainability over short term horizons
Application of minimisation principle	**Potentially negative** – Higher use of chemicals e.g. if the water is transported over long distances	**Potentially negative** – Higher use of chemicals e.g. if the water is transported over long distances	**Potentially negative –** Due to fragmentation of the business process			**Uncertain** – Depending on whether the community acknowledges the importance of sustainability over short term horizons.
Quality and security of drinking water supplied	**Potentially negative** – No incentive to implement "multi-barrier systems", increasing use of chlorine	**Potentially negative** – Result of information asymmetry	**Potentially positive** – Due to selection and tendering process. **Potentially negative** – Due to incomplete information at contracting stage and possible conflict between short term profit objective of the private party with long term sustainable water management.		**Potentially positive** – Long term planning horizon gives incentives to implement "multi-barrier systems"	
Investment in pipe system and quality of infrastructure	**Potentially negative** – Potential cost reduction at the expense of infrastructure	**Potentially negative** – No incentive to invest as no assurance of recovering investments	**Potentially negative –** Due to incomplete information and fragmentation of the business process . Also the distancing of policy makers from day-to-day operations might attribute negatively.	**Potentially negative** – No incentive to reduce leakage	**Potentially positive** – Long-term planning possible	**Uncertain** – Depending on whether the community acknowledges the importance of sustainability over short term horizons.

Implications of: / On:	**End State 1a – Delegation contracts and strong regulation**	**End State 1b – Delegation contracts and extreme competition**	**End State 2 – Outsourcing**	**End State 3 – Regulated monopoly**	**End State 4 – Direct public management**	**End State 5 – Community management**
Reduction of leakage and water losses	**Potentially negative** – No incentive to reduce leakage	**Potentially negative** – No incentive to reduce leakage beyond economic level of leakage	**Potentially negative –** Due to incomplete information at contracting stage	**Potentially negative** – Most regulative systems set the target leakage rate at the economic level of leakage leaving aside environmental costs		
Criteria 3: Repercussions on other sectors and uses						
Availability (quality and quantity) of surface water			**Potentially positive** – As improved monitoring allows continued undisturbed use of surface water		**Potentially positive –** Water protection offers better quality	**Potentially negative** – Due to overexploitation of water resources
Availability (quality and quantity) of groundwater			**Potentially negative –** Due to future restrictions and limitations on ground water abstraction **Potentially positive** – As improved monitoring allows continued undisturbed use of ground water	**Potentially negative** – Increase in diffuse pollution if water protection zones are lifted	**Potentially positive –** Water protection offers better quality	**Potentially negative –** Due to overexploitation of water resources
Industrial wastewater management			**Potentially negative –** Due to future restrictions and limitations on waste water discharges			

13 Conclusion

As the Water Framework Directive states it, „Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such“. Most importantly, water resources provide the basis for our existence and cannot be replaced. Guaranteeing a sustainable use of water resources is therefore a key priority, and this concern lies at the centre of this report. The following chapter present the main conclusions derived from the analysis of the environmental implications of the different End States.

With regard to environmental implications, one of the key aspects concerns the incentives that the End States' institutional and management framework sets in terms of sustainable water management. Although the regulative and political framework varies within the EU, the assessment of the implications provides specific directions and trends for each scenario. Neither delegated monopolies scenarios provide adequate incentives for the implementation of long-term oriented water protection and infrastructure maintenance measures. Consequently, the procurement process and especially the key points of the contract defined between both parties play an important role in order to secure an adequate investment in water protection measures and water infrastructure modernisation over the whole contract period. This could be achieved through the periodic adaptation of the service contract.

A long contract duration in itself does not suffice to provide incentives to implement sustainable water management measures, as shown by the analysis of the outsourcing scenario. Monitoring, or some form of supervision, is an essential element for both the delegated monopolies and the outsourcing scenarios to ensure that information asymmetries between the water or services provider and the contracting municipality remain minimal. Thus potential water-related environmental problems can theoretically be acted upon before they become irreversible. Specific targets laid out in the contract may help to influence the contractor's behaviour. Therefore, it is necessary that the authority responsible for the supervision of the water company is still able to hark back to professional and well informed staff in order to act on the same level.

The direct public management scenario offers a higher incentive for the realisation of precautionary environmental measures in the long term provided that the municipality plans to carry out the water supply and sanitation services over a long planning horizon. Therefore, the continuous information of the municipalities is a key action to prepare them for the challenges of water management issues such as new environmental and quality standards and setting political priority under tight public funds. The latter is a problem that municipalities are increasingly confronted with.

One should also address the fact that the implementation of best practices regarding land-use involving payments to or financial compensations for the land-users may seem to go contrary to the polluter-pays principle laid out in the WFD. However, these financial compensations would generally not be

provided by the State but by the water users. In addition, voluntary co-operation agreements have so far proved to be the most effective solution to diffuse sources of pollution, especially coming from the agricultural sector. These agreements can take a wide range of forms and are easier to implement in small basins, where the relation between land-use and pollution is easier to demonstrate.[18] Their effectiveness may however vary according to, among other, hydro-geological factors.

As the illustrative examples showed, the provision of water services in the EU takes place in very different contexts. Vienna benefits from its extraordinary geographic situation and receives its water mainly from mountains, thus ensuring a high quality at a comparatively low cost. Thames Water on the other hand provides water in Europe's most populous city, a factor that weighs heavily on the infrastructure. No single system will possibly take account of such varied situations. Similarly, the legal and institutional systems for water supply and sanitation services vary widely between the EU Member States. For the future, it is important to give the responsible authority at local level the opportunity to choose between different management systems including mixed management forms such as publicly owned undertakings under private law and public-law corporations to fit the local needs.

In short, it is not possible to derive overall environmental implications from the scenario analysis and thus favour one single scenario from an environmental perspective, especially since some scenarios can exist in parallel (e.g. outsourcing can take place regardless of the management form). Despite the overall institutional and legislative framework, the length of the planning horizon defined by the responsible authority is one key factor. The authority has to identify first a clear view of how to guarantee a safe and sustainable water supply and sanitation before deciding on the management framework of the services.

[18] For more information, please refer to Brouwer et al., 2003.

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