B-WaterSmart

Drivers and barriers: proposal for a new governance model

Deliverable 5.5

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Drivers and barriers: proposal a new governance model

Deliverable 5.5

Summary

The present report corresponds to Deliverable 5.5 of B-WaterSmart – "Drivers and barriers: proposal for a new governance model". It offers an overview of key present challenges for water governance across the 6 Living Labs of B-WaterSmart: Alicante (Spain), Bodø (Norway), East Frisia (Germany), Flanders (Belgium), Lisbon (Portugal) and Venice (Italy), according to the 12 OECD Principles for Water Governance (2015).

It includes six dedicated chapters where we analyse what improvements in the current water governance models will drive a more effective implementation of water-smart solutions across the fields of water reuse, sludge reuse and stormwater management. The report includes a set of recommendations for the LLs of the project and beyond, with a view to a more adaptive, fair and resilient water governance, along the lines of the circular economy and a fuller integration into the nexus of water, energy and waste.

This deliverable follows up on D5.3 – "Drivers and Barriers for Water-Smart Solutions across 6 European Cases: Policy and Governance", submitted in M18 (February 2022) and concludes Task 5.2 on Drivers and Barriers for the Implementation of B-WaterSmart Solutions (M36). It will inform further work of WP5 – Society, Governance and Policy, namely Task 5.4 – Guidelines and recommendations for policy & regulation for water-smart systems.

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List of Acronyms and Abbreviations

CE	Circular Economy
CoP	Community of Practice
D	Deliverable of B-WaterSmart
DWD	Drinking Water Directive
EC	European Commission
EU	European Union
LL	Living Lab
M	Month
MS	Milestone Report of B-WaterSmart
NBS	Nature-based solutions
RO	Reverse Osmosis
SO	Strategic Objective
T	Task
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive
WP	Work Package
WWTP	Wastewater Treatment Plant

Executive summary

The present report corresponds to Deliverable 5.5 of B-WaterSmart – "Drivers and barriers: proposal for a new governance model". Its main objective, considering the stage of the project (2020-2024) is to propose improvements to current governance models, in order to overcome the gaps identified over the course of developing the project solutions and discussing them with key stakeholders through Communities of Practice (CoPs, WP1). The 12 OECD Principles for Water Governance (2015) were adopted as framework for the analysis and the recommendations.

This deliverable follows up on D5.3 – "Drivers and Barriers for Water-Smart Solutions across 6 European Cases: Policy and Governance", submitted in M18 (February 2022), which included a first characterisation of policy and governance issues across the B-WaterSmart LLs, and is also informed by the results of Task 5.3 – Assessment of stakeholders' attitudes towards water-smart solutions. The information included on the LLs should be considered in complement with that first report. The submission of D5.5 marks the conclusion Task 5.2 on Drivers and Barriers for the Implementation of B-WaterSmart Solutions (M36) and will inform further work of WP5, namely Task 5.4 – Guidelines and recommendations for policy & regulation for water-smart systems.

Chapter 1 introduces the objectives and context of the report, including an overview of the main developments and remaining challenges for water governance in Europe since the creation of the OECD framework. The climate and socio-economic crises bring up the need to improve water management from an integrated and circular perspective, along the nexus with energy, waste and food.

Chapter 2 offers an analysis of governance gaps with implications for the products and solutions under development in the 6 Living Labs of B-WaterSmart: Alicante (Spain), Bodø (Norway), East Frisia (Germany), Flanders (Belgium), Lisbon (Portugal) and Venice (Italy), according to the 12 principles of water governance of the OECD framework (OECD, 2015). The methodology for the assessment is mostly based on the results of the CoPs and the own diagnosis from LL representatives (owner and mentors), but in relevant cases it also includes interviews to key informants (stakeholders and governance experts). The sections on chapter 2 include a set of recommendations for improving water governance in each LL, tailored for a selection of the water-smart solutions under development.

Chapter 3 offers a synthesis of the key governance recommendations to facilitate implementation of solutions related to water reuse, sludge reuse and stormwater management. The section is organised in this way in order to work as a quick reference guide for policymakers and stakeholders of different sectors, including B-WaterSmart partners, CoP members, other water-smart projects and stakeholders involved in the circular economy of water in Europe and beyond.

Grounded on the OECD framework, D5.5. assessment highlights key concerns that need to be addressed in order to enhance the **efficiency**, **effectiveness**, as well as **trust and engagement** for a more adaptive, fair and resilient water governance over the coming years. Among them is policy coherence, as management has become increasingly integrated across the water cycle and the nexus with waste and energy. Financing and regulatory frameworks are other crucial dimensions that will require attention to ensure an effective adoption of the B-WaterSmart tools and technologies, in line with the European Green Deal, the Action Plan for Circular Economy and the EU Adaptation Strategy to Climate Change.

1 Introduction

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1.1 Background and objectives of this report

Within the work of Work Package 5 – Society, Governance and Policy – we have been analysing the drivers and barriers to the implementation of water-smart solutions (task 5.2) in these three domains. Deliverable 5.3 – "Drivers and Barriers for Water-Smart Solutions across 6 Cases - Policy and Governance" (Gomes et al., 2022) includes an overview of water governance models in the regions of B-WaterSmart Living Labs: Alicante, Bodø, East Frisia, Flanders, Lisbon and Venice. In addition, D5.1., "Manual of Stakeholder Mapping and Engagement" offers a literature review on the evolution of water governance over the last few decades, as well as a discussion of its present challenges, worldwide an in Europe and particular. The analysis of D5.5. also takes into consideration the work developed on governance for the Water-Smartness Assessment Framework (Governance Capacity Framework) (D5.2 and D6.3).

The present report (D5.5.) aims at providing a more detailed analysis of the governance gaps and issues with implications for the implementation of B-WaterSmart solutions, and therefore does not include such an extensive review, for which we refer to the deliverables mentioned above. D5.5. provides dedicated chapters in which the WP5 team, in articulation with the LL teams ('owners' and 'mentors') analyses the governance implications of selected technologies and tools under development in the Project. They then provide practical recommendations for the improvement of the issues identified, using the OECD framework of water governance as a reference (2015).

The final chapter of this report offers a summary of the cross-cutting 'bottlenecks' and recommendations in the areas of wastewater reuse, sludge management and stormwater management. These should be relevant not only for the Living Labs, but also in the view of a wider replication of the water-smart solutions in other European regions and beyond Europe. The deliverables of Task 5.4. – D5.7. "Guidelines for Policy and Regulations" – and D5.8, a set of thematic policy briefs will then build upon on the conclusions of D5.5. and provide updated and final recommendations for policymakers and stakeholders, at the final stage of the project (Months 42 and 48, respectively).

1.2 Current challenges to water governance in Europe

The OECD Water Governance Initiative established the key voluntary principles for water governance in 2015 (Figure 1) – around the key dimensions of Effectiveness, Efficiency, Trust and Engagement - along with the Sustainable Development Goals, of which SDG 6 aims to 'Ensure access to water and sanitation for all'. They have been endorsed by more than 170 stakeholder groups or governments worldwide.

Figure 1 - OECD Principles of Water Governance

(OECD, 2015)

Since the adoption of the OECD Principles on Water Governance in 2015, the OECD Water Governance Initiative has developed an implementation strategy based on an indicator framework to facilitate the assessment of the governance system, as well as a collection of plus than 50 best practices to foster learning among policymakers, practitioners and other stakeholders (OECD, 2022).

Water governance models "have been too incremental and local, water has to be managed as a collective global resource, not just across borders through treaties", concluded the report 'Turning the Tide', launched in March 2023 just before the special Water Conference organised by the United Nations, which resulted in a new Water Action Agenda (General Assembly resolution 75/212)[1] aimed at fulfilling the Sustainable Development Goals. B-

[1] https://sdgs.un.org/conferences/water2023/action-agenda

WaterSmart aims at contributing to overcome such challenges, while contributing to align water governance with recent policy strategies of the EU, such as the Green Deal, the Action Plan for Circular Economy, the EU Adaptation Strategy to Climate Change and the new Drinking Water Directive.

Over the last few years Europe was affected by worsening droughts and heatwaves, and it has become increasingly evident that the climate crisis will require a fully integrated water management and governance. “Smart, sustainable water use requires transformational changes in all sectors”, as stated in the new EU Adaptation Strategy to Climate Change (2021), which wows to turn Europe into a climate-resilient region by 2050.

Governance systems have to adapt in order to maximise the resources available across the water value chain, minimising pollution and creating value for water in all its forms. The European Green Deal (2019) is among the most recent policy advances in fostering an integrated strategy to support the implementation of the Sustainable Development Goals (SDG), including the promotion of environmentally-friendly food production systems (strategy Farm to Fork). The Green Deal is designed to offer a framework through which existing EU policies such as the Water Framework Directive and Bathing Water Directive can be integrated towards these ambitious goals (European Commission, 2019).

Member-States in the EU have followed different approaches in complying with the WFD, from a complete restructure of the governance systems to minimal adjustments. A completely decentralised, multi-level governance model may be ideal, but implies costs that may not be sustainable for smaller scales (Rowbottom *et al.*, 2022)

To avoid potential problems with pollution trade-offs at catchment and basin scales, farm-scale and catchment-scale analysis of pollution risks to freshwater quality need to be integrated and used to inform stakeholders' decisions on the choice of appropriate eco-schemes and agri-environment-climate measures (Bieroza *et al.*, 2021). Ideally, governance should address key water challenges through a combination of bottom-up and top-down approaches, while responding to place-based needs, but high transaction costs are to be avoided (Gurría, 2019).

Policy coherence is therefore at the core of the water governance challenges nowadays, as we will see in the detailed assessment of B-WaterSmart LLs. For better harmonisation between management responses, planning and implementation of measures under the WFD and the Floods Directive, we need to make use of multi-benefit measures, such as nature-based solutions (NBS), which can address the goals of different sectoral policies, such as nature conservation, provision of high-quality drinking water, reduction of flood risks and recreation (EEA, 2021).

On the eve of the UN Conference on Water, in March 2023, a report from the Global Commission on the Economics of Water stressed that, globally, multilateral governance of

water is still fragmented and “failed in too many cities and countries to create durable partnerships between all stakeholders, designed and structured to deliver the public interest”.

In Europe, transboundary management of water resources between shared river basins (**appropriate scales**) remains a challenge. The existing treaties are based on ecological concerns mostly, but not yet up to the challenge of the climate crisis and a growing demand, which will require new governance mechanisms with a wide representation of interested stakeholders, including farmers and industries (Baranyai, 2019). This is all the more important as new strategies for stormwater management arise, calling for a fully integrated management of the water cycle and the implementation of nature-based solutions, a key pillar of the EU Climate Adaptation Strategy that should play an increasing role in land-use management and infrastructure planning, as well as improving compliance with the Water Framework Directive requirements for good ecological status (European Commission, 2021).

As we have discussed in WP5 deliverables previously, water governance in Europe is currently moving into a more adaptive model, which responds to the challenges brought about by climate change, with more intense and frequent climate extremes, requiring flexibility and innovation in e.g., stormwater management, drought response and prevention of water scarcity, by resorting to alternative sources (such as reused treated wastewater). These systems should support a process of transformative change, helping to enhance innovation, learning, adaptation, trust, cooperation and the achievement of more effective, equitable, and sustainable outcomes at multiple scales (Pahl-Wostl, 2017).

Furthermore, there is a pressing concern in ensuring social justice and inclusiveness of most vulnerable and underrepresented groups in society. The pandemics of COVID-19, and then the economic recession, have exposed how minorities and low-income households, for instance, require a dedicated attention to ensure they have access to basic services, as well as a voice in decision-making processes on water management. We are addressing those issues in another deliverable that has been submitted in parallel in August 2023 (Month 36), D5.4. – Preliminary report on social acceptance and behaviours towards water-smart solutions.

In the next section we will discuss the particular challenges of adapting governance models to implement a circular economy of water, across the nexus of energy, food and waste.

1.2.1 CE and Nexus approach for water governance in Europe

Since the last decade, it has become increasingly apparent that an integrated approach to solving security challenges connected to water, energy, and food can provide co-benefits. By considering the potential impacts on specific decision-making systems, people can develop practical solutions for all sectors under consideration. Therefore, adopting a nexus approach and the Circular Economy policy will be crucial to ensure sustainability (Uddin *et al.*, 2023).

In general, the nexus approach serves as (i) a tool for systems integration, where synergies and trade-offs are considered when assessing development pathways; (ii) a platform for stakeholder engagement, providing an important opportunity for scientists and other stakeholders to co-design, coproduce and co-implement nexus assessments, including prospective policy interventions and development pathways; and (iii) a method for exploring development pathways that can capture cross-cutting issues confronting the integrity and sustainable development of a human-environment system (Estoque, 2023).

Nexuses in the human-environment realm are becoming more complex, evolving from a simple two-node nexus (e.g., food-energy nexus or water-energy nexus) to up to six-node (e.g., water-energy-food-economy-society-environment) nexus. The WEF (water-energy-food) nexus has been a prominent important focus of research in the field of natural resource management and sustainability (Estoque, 2023), followed by the WEFE nexus (water-energy-food-environment) that has gained predominance in the literature in recent years.

The literature suggests a relationship between circular economy and the nexus approach, where Nexus thinking has been illustrated as 'the most appropriate way for transitioning to CE. The Circular Economy provides a closed framework concerning resource exploitation. The supreme goal of CE is to balance economic advancement, preserve resources and conserve the environment (Uddin *et al.*, 2023). A Nexus approach, in which by-products of one resource are used as resources for other products, can be made operational by applying the principles of CE. The use of a CE framework not only operationalises, but also accelerates the adoption of a Nexus, helping overcome its limitations on policy and practice levels (Parsa *et al.*, 2021).

Public and stakeholders engagement is another area where these two concepts meet: the nexus approach allows decision makers to develop appropriate policies, strategies, and investments, to explore and exploit synergies and to identify and mitigate trade-offs among the development goals related to water, energy and food security. It enhances the comprehension of interconnections among the water, energy, food, and environment sectors, thereby opening up opportunities to redesign these interdependencies within the context of the Circular Economy (CE) (Makropoulos, C. et al., 2022). Water-smart solutions are enclosed within three interdependent cycles Water-Energy-Nutrients/Materials (Frijns, J. And Smith, S., 2023, Figure 2).

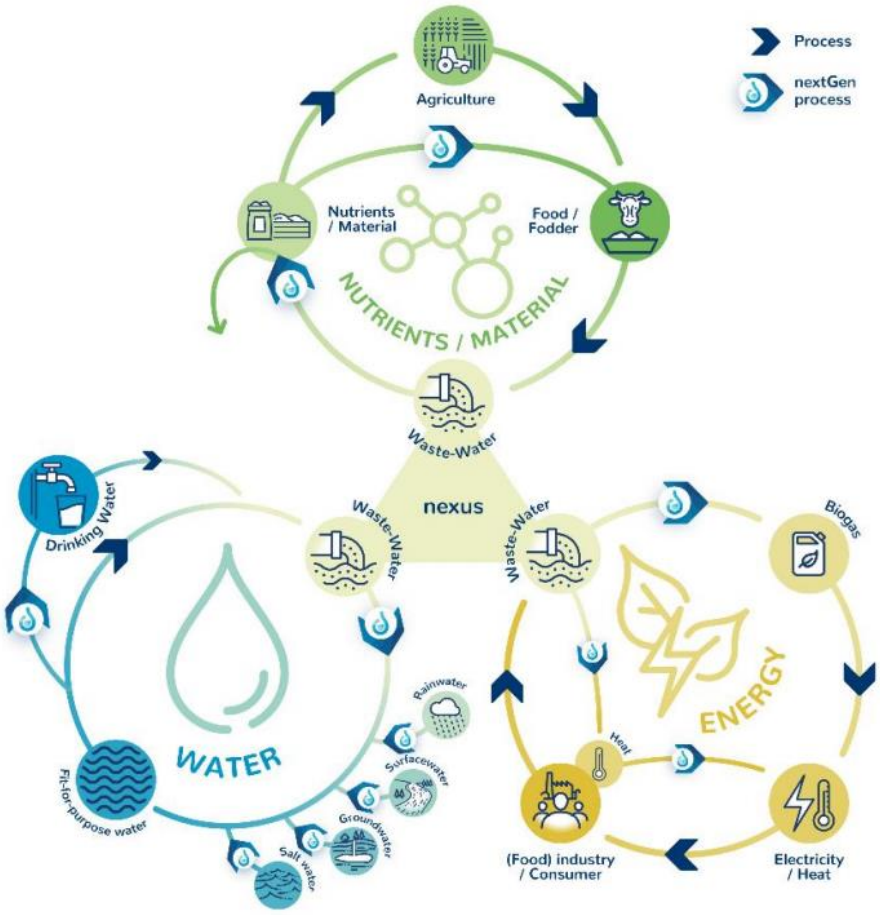

Figure 2 - Wastewater CE Nexus

(source: Nextgen´s Water Solutions D)

Challenges of the Nexus approach

Today, the formulation, design and evaluation of development pathways as well as the development and testing of methodologies for integration and the identification and assessment of synergies and trade-offs, are among the current challenges, not only in nexus research, but also in sustainability research in general. The development of modelling/simulation frameworks for implementing the nexus approach and the identification of the relevant indicators and target values to be used for assessing trade-offs and synergies (Estoque, 2023).

In various Mediterranean countries (e.g., Spain and Italy), despite the commitment of governments, the practical implementation of the WEF (water-energy-food) nexus approach

remains very challenging, both because there is not yet a full and complete understanding of the interdependencies between the resources involved and because there is still a lack of real coordination between the political actors and stakeholders (Bazzana, D., et al., 2023).

Data sharing is and will be essential in the coming years; the EU should facilitate the exchange of information among stakeholders to better understand the interlinkages of the Water–Energy–Food nexus and identify areas for improvement. Also, to propose sustainable and equitable solutions, the EU needs to regularly monitor and evaluate Member States' policies to assess their effectiveness and make any necessary adjustments (Bazzana, et al., 2023).

In the current scenario of climate change and climate variability in Europe, the main challenge of water governance will be to ensure water for people, economic activities, and ecosystems. For this purpose, an integrated water resources management model that guarantees economically, socially, and environmentally sustainable development is needed. In this context, the circular economy (CE) is proposed as an effective framework for sustainable water management (Morseletto et al., 2022).

First, the process of developing a CE for water involves the development of new technologies and business models, to generate a more intelligent chain across the water-energy-nutrients/resources nexus. Technology development in this area has reached quite far. However, several sociotechnical barriers remain, including mismatch between market needs and solutions, conservative sectors and value chains, skills shortages, and regulatory and institutional barriers, including limited end-user acceptance (Damman *et al*., 2023). Another social barrier related to the challenge for new collaboration and business models, is that it requires new **capacities**, partnerships with other sectors and interaction (communication) with authorities (Kakwani & Kalbar, 2020).

Besides, circular water management requires a stronger **policy coherence**, with a fuller integration of policies and regulations across different sectors, such as water, agriculture, energy, and waste management, as well as adequate **financing** e.g., through governmental incentives (Ddiba et al. 2020). Effective regulations must be complemented by a supportive institutional framework. Circular water schemes often transcend the boundaries and responsibilities of various regulatory and administrative entities. This division of responsibilities hinders the widespread adoption of beneficial practices such as water reuse (Frijns et al., 2016). Therefore, it is imperative to establish an efficient and tailored governance structure to address these challenges.

In addition to improving harmonisation, there is a clear requirement for targeted incentive regulations to promote circular schemes. These incentives can take various forms, such as streamlined reporting obligations or financial measures like implementing a carbon tax and establishing regional development funds to encourage circular energy initiatives like biogas recovery from wastewater. Furthermore, supporting the uptake of recovered energy and materials from water by other public sectors can be achieved through public green procurement. To enhance market acceptance of value-added recovered products from the water sector, a CE label akin to the European Eco Label system could be beneficial (Makropoulos et al., 2022).

Also, for **financing**, there is clear opportunity for circular solutions to become part of the ESG (Environmental, Social and Governance) investment landscape, and to become the focal point for more public-private partnerships. By leveraging the strengths and resources of both the public and private sectors, these partnerships can foster collaboration, innovation, and sustainable solutions.

Effective **stakeholder engagement** across different sectors and governance levels is essential. To achieve this, it is crucial to have sufficient governance capacity to facilitate and support such coordination and collaboration (Ddiba et al., 2020). Addressing these circularity and governance challenges requires a multi-dimensional approach. The Living Labs of B-WaterSmart are anchored in the co-creation of innovative solutions with a wider involvement of stakeholders, through Communities of Practice (CoPs), which allow for the discussion of end user's needs from an early stage, as well as their direct participation in the development and adjustment of technical solutions and policies.

To create trust among the stakeholders, the implementation of circular models also requires the regular and transparent provision of **data & information**. Consequently, an effective use of knowledge and information and communication technologies is needed for **monitoring and evaluation** of policy results, the implementation of solutions and the engagement process itself, following transparent criteria of effectiveness, efficiency, equity and sustainability (Villa-Landa Sokolova & Perero Van Hove, 2022).

2 Recommendations for improving water governance in the 6 LLs

2.1. ALICANTE

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2.1.1. Context of the Living Lab

Water scarcity in Alicante is a growing problem due to the lack of rainfall and the increase in demand. In particular, in Alicante there is a high demand for water for agriculture and urban use, so technologies and methodologies are being investigated to promote water reuse, resource recovery and the circular economy around the urban water cycle. These proposed solutions are:

- Energy recovery from sewage treatment plant effluents and organic waste through co-digestion.
- Recovery of nutrients from the sludge line to produce fertilisers.
- Production of disinfectants from brine from the regeneration of reused water.

The BWS solutions with the greatest governance implications are the ones related to the **sludge and reclaimed water**. These two areas have been selected because they have a cross-cutting application and impact on territorial governance. Likewise, it also has a great impact on a social and relational level with other social/sectoral groups. Innovation on sludge and reclaimed water have great potential for scalability and replicability, so it is interesting to analyse them in depth under the OECD principles.

2.1.2. Key governance gaps

In the Alicante LL, correlation with the 3 OECD principles of water governance have been detected: “Enhancing effectiveness”, “Enhancing efficiency” and “Enhancing trust and engagement“. It is important to highlight that, although some principles have been well addressed in the Alicante Living Lab, during the course of the project some room for improvement has been detected, for instance, in the case of “Stakeholder engagement” and “Integrity and transparency”.

Of the 12 principles defined, only 3 have been excluded, namely "Appropriate scales within basin systems", "Capacity" and "Data and information". These indicators have no relevant application in the case of the LL of Alicante and have therefore have not been explicitly included in this analysis.

In the case of "Appropriate scales within basin systems",there are two levels in the basin system with an optimal degree of coordination for the territory. On the one hand there is the local management of the municipalities aimed at efficiency in the use of water resources. On the other hand, there is the basin vision, managed by the Confederación Hidrográfica del Segura, which allocates the available resources from large volumes of demand.

Regarding “Capacity”, given the long history of resource scarcity in the territory, the responsible authorities are already well aware of the problem and the complexity of water challenges to be met. The set of competencies required to carry out their duties is well managed. Furthermore, the Alicante Living Lab counts on a network of highly qualified professionals with extensive experience in innovation, operations, infrastructures, sustainability, socio-economic evaluation, etc. in the water sector. Therefore, no specific training is required to carry out the project.

Finally, the “Data and Information” principle has been discarded because there is already a very ambitious plan underway to share water-related data and information, which is called The Observatory of Water Management in Spain. This proposal has been made in the framework of the so-called PERTE, the 'Strategic Projects for Economic Recovery and Transformation', a new resource created in the framework of the Recovery, Transformation and Resilience Plan of the European 'Next Generation' mechanism. Thanks to this initiative, the entities involved in the water sector will track water cycle indicators and share them openly at national level.

Enhancing effectiveness

Clear roles and responsibilities (reclaimed water): There are many actors involved in this field. The main one is the hydrographic confederation (which grants the use of reclaimed water), there is also EPSAR - Entidad Pública de Saneamiento de Aguas Residuales de la Comunidad Valenciana - (which acts at regional level) and the local administrations (which have the ownership of the wastewater treatment plants). There is a large overlap in some roles and there are also some issues that are not addressed because the roles are not assigned correctly.

In short, the leadership role to promote and encourage the use of reclaimed water is not defined. The result of this is very long administrative processes for the concession of the management and distribution of reclaimed water.

It should be noted that at least in Spain irrigators facilitate cooperation between water managers and farmers for the use of reclaimed water.

Policy coherence (reclaimed water): There is a lack of policy coherence with regard to the water allocated by a concession or a legitimate title for the private use of water, as it is sometimes not used by its holder. In other words, the administrative concession of

the volume of water is very difficult to modify. This means that there is no fair distribution of water resources.

Enhancing efficiency

Financing (sludge): A financing scheme is needed to promote the implementation of innovative sludge management solutions, such as energy recovery or the production of fertilizer products from sludge. Without solid financing support to back it up, there is no incentive for the situation to improve.

Regulatory frameworks (sludge): There is a very heterogeneous regulatory framework in the application of sludge that generates a lack of confidence in the agents involved in the sector (farmers, operators, etc.). For example, in the Valencian Community the Royal Decree is very lax, unlike in other autonomous communities in Spain, which is more restrictive. This variability can make it difficult to compare practices and results between different geographical areas.

Innovative governance (cross-cutting): Although some efforts are being made to involve key stakeholders and communities in governance, there is still much room for improvement in order to work towards a bottom-up approach.

Enhancing trust and engagement

Integrity and transparency (cross-cutting): There is a need to improve the implementation of ethical practices in providing data & information related to the water cycle. Water-related information needs to be readily available and accessible to individuals who have a legitimate need for it. This includes making information public, providing access to relevant documents, and disseminating information in a clear and understandable manner with gender perspective.

Stakeholder engagement (cross-cutting): There is a need to assess the principles of proportionality and representativeness of diverse groups of people in decision-making processes and participatory activities, considering race, ethnicity, gender, age, socio-economic status, education, physical abilities, among others.

Trade-offs across water users, rural and urban areas, and generations (reclaimed water): Rigidity in administrative concessions can create challenges for certain users, especially in situations where adjustments or adaptations are required due to changes in hydrological conditions or specific user needs.

Monitoring and evaluation (sludge): There is a need to clearly define the minimum types of treatment that sludge must receive prior to its application in agriculture and the physical-chemical and microbiological parameters that must be met depending on the type of crop, establishing a plan for its implementation so that public and private initiatives have legal certainty and a roadmap for where to go.

2.1.3. Recommendations for governance improvements

The description of potential recommendations follows the same structure presented in the previous section following the OECD principles and relates to the identified gaps in the same order. It includes a brief explanation of the gap at the beginning and the improvement proposed hereafter.

Enhancing effectiveness

Clear roles and responsibilities (reclaimed water): *There are many actors involved in the value chain of reclaimed water and* ***roles and responsibilities are not well defined,*** *so there are overlaps and sometimes lack of involvement of the parties. The improvement proposed to overcome these gaps is :*

- Regarding the definition of roles and responsibilities, it is proposed to **define common protocols** so that it is not left to the will of the entities to promote reclaimed water.

Policy coherence (reclaimed water): *There is* ***no efficient management of the water allocated by a concession****, as occasionally it is not used to meet specific water needs. The improvements proposed to overcome this gap are:*

- Effectively apply the **"use of leftovers" so that it is more flexible** to modify and adapt to the specific needs of the moment. In other words, if there is more water than has been granted, it should be possible to distribute it to meet specific needs without the requirement of an administrative concession.
- **Withdraw or suspend concessions** if they are not being used responsibly so that these resources can be used for other purposes.

Enhancing efficiency

Financing (sludge): *There is a lack of funding for* ***new investments*** *for sludge management and valorisation. The improvement proposed to overcome this gap is:*

- Public-private partnerships can be an effective strategy for financing sludge management projects. **Collaborative models can be established to share costs and benefits between public entities and private companies,** using mixed funding sources.

Regulatory frameworks (sludge): *There is* ***great regulatory uncertainty and heterogeneity of criteria*** *at territorial level. The improvements proposed to overcome this gap are :*

- **This regulation must be updated so that it is homogeneous** in all territories. To this end, there needs to be a **consensus at European level** to promote a common roadmap for sludge management. The search for **harmonisation and standardisation** in the regulation of sludge must be **promoted collectively and cohesively** among all agents.
- It is important that the competent authorities and water managers work on the continuous review and updating of the regulations related to sludge management in a cohesive way, taking into account technological developments, international best practices and environmental sustainability objectives.

Innovative governance (cross-cutting): *The current governance approach needs a new structure that will leverage innovative solutions, public-private partnerships and community engagement. . The improvements proposed to overcome this gap are:*

- The **scientific community and other expert actors in the sector must be involved** in order to be able to make innovative and rigorous governance and incorporate cutting-edge technologies and innovative solutions (smart and open data) .
- Promote public-private collaboration and information exchange between water management entities through discussion forums and benchmarking initiatives.
- Create a National Water Governance Board comprising representatives from government agencies, private sector, civil society, academia, and local communities. This board would oversee water management policies, ensure transparency, and facilitate inclusive decision-making.

Enhancing trust and engagement

Integrity and transparency (cross-cutting): There is room for improvement in addressing ethical practices to provide data & information related to the water cycle. The improvements proposed to overcome this gap are:

- Promote openness and transparency in sharing information. This involves providing accurate and comprehensive information about actions, policies, and decisions that impact individuals, communities, or stakeholders. Transparency helps build trust and fosters accountability.
- Strive to provide equal and inclusive access to information for all individuals, irrespective of their backgrounds or characteristics. Take into account diverse needs, including language accessibility, accommodating

disabilities, and ensuring that information reaches marginalized or disadvantaged groups.

- Continuously review and improve ethical practices related to information and data and make necessary adjustments.

Stakeholder engagement (cross-cutting): *Underrepresentation of diverse groups* *in stakeholder engagement activities (dissemination events, visits to the plant, CoPs, etc.) and in decision- making processes. The improvements proposed to overcome this gap are:*

- Achieve **equitable gender representation in team members** in all activities (40/60%).
- Achieve **equitable gender representation in the involvement of different stakeholders** in the project: partners, local community, industries, etc.
- Strive to have **samples with diversity**, including different age groups, socioeconomic levels, educational backgrounds, and representation of the main ethnicities within the researched context.
- Always **justify the selection processes**, with special attention to those processes that cannot achieve representativeness in the different variables presented.

Trade-offs across water users, rural and urban areas, and generations (reclaimed water): *Farmers' **perception** of reclaimed water is that if they accept it, they give up other water resources (groundwater, drinking water, etc.). The improvement proposed to overcome this gap is:*

- Change perceptions by offering greater **flexibility and agility in administrative water concessions** by applying certain limits and supervision. This can ensure direct and agile exchange of water resources, always with administrative oversight to ensure that water is not misused.

Monitoring and evaluation (sludge): *There is **no proper assessment and monitoring** because there is no consensus and no plan to carry it out. The improvement proposed to overcome this gap is:*

- **Create a "Sludge Round Table"** like the "Water Round Table" at regional or national level. It should be an initiative represented by administration, companies, scientific and expert community, users, etc. It could update regulations and cover legal issues with the whole sector in order to respond to real and current problems.

In conclusion, addressing the water scarcity issue in Alicante requires a multi-faceted approach that focuses on enhancing effectiveness, efficiency, trust, and engagement. Clear roles and responsibilities need to be defined for the management of reclaimed water, along with protocols to promote its use and allocate the additional cost. Policy coherence can be improved by implementing flexible mechanisms such as the "use of leftovers" to ensure efficient allocation of water resources.

Enhancing efficiency involves addressing data and information gaps by promoting transparency and equal access to information for all stakeholders. It also requires the establishment of clear regulations and policies for sludge management, encouraging public-private partnerships for financing, and promoting innovation and circularity in sludge management practices.

Building trust and engagement requires the active participation of diverse stakeholders. Equitable gender representation and inclusion of various socioeconomic backgrounds and ethnicities in stakeholder engagement activities and decision-making processes are crucial. Additionally, addressing trade-offs across water users, rural and urban areas, and generations is essential. Farmers' concerns about reclaimed water can be addressed through administrative oversight, ensuring proper usage while providing flexibility in water concessions.

Effective monitoring and evaluation are vital for assessing the progress and impact of water management strategies. Establishing a "Sludge Round Table" at the regional or national level can facilitate collaboration among different stakeholders, including administration, companies, scientific experts, and users. This platform can drive consensus-building, update regulations, and address legal issues related to sludge management.

In conclusion, a comprehensive and collaborative approach, encompassing clear responsibilities, efficient resource allocation, transparent information sharing, equitable stakeholder engagement, and robust monitoring and evaluation, is essential to address the water scarcity challenges in Alicante and ensure sustainable water management for the future.

2.2. BODØ

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2.2.1 Context of the Living Lab

The solutions demonstrated in the LL of Bodø are, with reference to the section 1.3.5 of the description of work, identified with the following numbering, which is used as reference in the text below:

- Solution 12: Efficient small-scale biogas production at small wastewater
- treatment plants
- Solution 14: IoT sensors for infiltration detection:
- Solution 15: Smart water meters for leak detection
- Solution 29: iWidget+ Platform (or Fiware enabled multi-dashboard)

While these solutions are being tested, nature-based solutions (NBS) for stormwater management have also been a topic of interest, and in fact the main focus of the local Community of Practice (CoP). As this solution is associated with considerable governance challenges, this section will focus on NBS for stormwater management (added as solution number 35), in addition to solution 12. Solution 14 and 29 have so far been less discussed with local stakeholders.

Solution 15 has potential to involve users more actively in water management, and as it involves several partners and is tested in individual households the technology has also been prominent in the discussions in the LL. As the focus is on leakage detection rather user involvement, mainly one governance issue has been discussed: Challenges with fulfilling the EU General Data Protection Regulation (GDPR), due to complex documentation requirements as regards data flow, Data Processor Agreement (DPA), risk analysis, and homeowner contracts. Failure to comply may lead to loss of trust by customers and fines. For small municipalities with limited capacity, this may be challenging. Municipalities also have different built environments and rules regarding smart water meters, hence it is important to not underestimate the time needed to provide the required documentation.[2] According to the sector organisation Norwegian Water, this is an area where many employees feel they lack competence. In 2023 they have therefore started a competence project which will result in a national report/guideline on how to manage person data in the water sector.[3]

[2] Summary presentation on GDPR challenges by Rachelle Collette, Bodø Municipality, LL meeting 14.06.2023.

[3] Project is described at the website of Norwegian Water (Norsk Vann): https://va-kompetanse.no/wp-content/uploads/05-2023.pdf

In the following sections we therefore focus the analysis and reasoning on solutions 12 and 35, which are associated with wider governance challenges.

2.2.2. Key governance gaps

The key governance gaps identified, in terms of the OECD principles of water governance, apply to the dimensions of "Enhancing effectiveness" and "Enhancing efficiency". The third dimension, "Enhancing trust and engagement", is not of major concern, since the key stakeholders including end-users are and will be involved in the demonstration and/or the CoP, and since the integrity and trust in water utilities and public service providers generally are considered to be high in Norway.[4]

2.2.2.1. Enhancing effectiveness

Clear roles and responsibilities: In Norway, stormwater management is defined as the responsibility of municipalities, however with guidance from the national Directorate for Water Resources and Energy and county governors. Adaptation to climate change impacts is under the authority of the Ministry of Climate and environment, with the Norwegian Environment Agency as its directorate, but is also ultimately a responsibility of municipalities. According to the national White paper on climate adaptation (2023), adaptation shall be integrated into all planning and land use activities.[5] When it comes to NBS (solution 35), it is up to the municipal council and chief municipal executive to decide how to organise this integrated management, and it is done in different ways and to different degrees in different municipalities.[6] Internal communication and coordination can therefore be a challenge, e.g. planning department and technical department may have different views on NBS and what is the best stormwater management solution in specific cases.

As for solution 12, this is not a challenge to the same extent. However, water, wastewater and waste management are in some cases carried out by the same organisation and in other cases, like Bodø, it is split, with the technical department of the municipality being in charge of water and wastewater management, and municipal waste being handled by an intermunicipal company (Iris Salten), which is owned by nine municipalities (including Bodø). While limited volume is a challenge when biogas from one wastewater treatment plant is considered in isolation, higher volumes may be reached by combining resource

[4] OECD (2022): Trust and public governance in Norway. https://www.oecd-ilibrary.org/sites/648a5c4a-en/index.html?itemId=/content/component/648a5c4a-en

[5] National White Paper on climate adaptation (part 2): Meld. St. 26 (2022–2023) - regjeringen.no

[6] Guideline for stormwater management (Norwegian Environment Agency): Håndtering av overvann - veileder - Miljødirektoratet (miljodirektoratet.no)

streams from several treatment plants as well as other organic waste fractions. In the case of Bodø LL, both parties are keen to explore different options and Iris is willing to take charge of the eventual biogas production, but at a general level who should take the initiative is not given, and the role distribution varies across regions.

Policy coherence: Gaps related to this principle are common, due to the sectoral nature of governance and policy itself. In the case of Bodø LL, we see the need for more effective coordination across policy areas, both for solution 12 (efficient small-scale biogas production) and solution 35 (NBS for stormwater management). When it comes to NBS, there are statal guidelines for climate and energy planning and climate adaptation in municipalities, which encourage integrated management and require that NBS shall be assessed and non-selection of NBS must be justified.[7] On the other hand, water cycle services are to be based on "Best Available Technologies", and urban densification is an important measure to limit climate gas emissions. There may also be tensions between desire to implement blue-green infrastructure and other infrastructure needs/priorities, such as parking space.

As regards solution 12, biogas production has been strongly encouraged in Norway. However, biogas for transport applications has not been incentivised to the same extent as battery-electric solutions. Also, up to recently, renewable power from the national grid has been very cheap, with the implication that parts of the produced biogas have been flared.[8] More recently, electricity prices have increased and the Norwegian Maritime Directorate has promoted use of liquid biogas to fuel cruise ships and eliminate climate gas emissions from Norway's World Heritage fjords by 2026.[9] Still, what is the most sustainable use of biogas remains debated. At the same time, there are tensions over national fertiliser regulations. The national regulation of organic fertilisers has been under revision since 2009, due to tensions between agriculture, wastewater and environmental policies, which create uncertainty regarding the future framework conditions for alternative sludge management strategies.[10]

Capacity: Norway has 356 municipalities, which vary greatly in terms of population, geography and industry. Thus, the capacity and knowledge level is variable. As to solution 35 (NBS for stormwater management), some of the consulted stakeholders stated that there is enough capacity and knowledge. Others suggested that public decision makers in some cases lack practical experience and build extensively on theory,

[7] Statal planning guideline for climate and energy planning and climate adaptation: Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning - Lovdata

[8] There is no gas grid for industry and domestic use in Norway, except a smaller one in Rogaland county (where upgraded biogas from the regional water and waste utility IVAR is being injected).

[9] Information from the Norwegian Maritime Directorate: https://www.sdir.no/sjofart/fartoy/miljo/utslipp-fra-skip/nullutslipp-i-verdensarvfjordene-fra-2026/

[10] Recent article explaining how the uncertainty concerning the organic fertiliser regulation is a barrier to biogas production: https://www.tu.no/artikler/ingen-biogass-uten-ny-gjodselforskrift/529234

and therefore are risk averse instead of facilitating innovation. Some users/property developers would like to get more knowledge/training on NBS and the Blue-Green Factor.[11] As regards solution 12, Norway has around 40 biogas plants and there is a solid knowledge base. Iris Salten is a relatively large intermunicipal company with its own development department, and Bodø Municipality has also got highly competent technical staff.

2.2.2.2. Enhancing efficiency

Data & information: As regards solution 35 (NBS for stormwater management), availability of data is a challenge. In particular, there is the need for more experimental data, e.g., in terms of climate conditions and operations/maintenance. There is not a lack of willingness to share information, which in most cases is openly available, but different municipalities tend to want to invent their own solutions. There are several documents and guidelines with examples of NBS, but lack of a national, overarching guideline.[12][13] Concerning solution 12 (biogas production), limited data & information is not an issue.

Financing: Water cycle services in Norway are mainly financed via self-cost and user/polluter pays principles. However, due to backlogs huge infrastructure investments are expected in the coming years, and there is a focus on "leaving no one behind" and e.g., keep water and wastewater fees at an affordable level. As regards solution 12, establishment of biogas production facilities is eligible for grant support from Enova, a Norwegian state enterprise promoting the development and upscaling of sustainable energy and climate technology.[14]

When it comes to solution 35 (NBS for stormwater management), the introduction of a stormwater fee has been discussed, but so far not implemented. Municipalities as well as counties may apply for grant funding from the Norwegian Environment Agency for knowledge development and feasibility studies for climate adaptation, but not for implementation. The total amount of grant funding available is, however, limited (NOK 6.4 million in 2023).[15] On the side of developers, there are few sources of additional

[11] Policy instrument to ensure and maintain desired levels of green and blue in new development projects.

[12] Report by Asplan Viak and SINTEF on NBS for Norwegian Environment Agency (2020): Løsningen er naturbasert - Asplan Viak

[13] Report by Menon, on NBS, for Norwegian Environment Authority (2017): m830.pdf (miljodirektoratet.no)

[14] https://www.enova.no/bedrift/biogass/

[15] Grant scheme for climate adaptation in municipalities and counties (Norwegian Environment Agency): Tilskudd til klimatilpasning - Miljødirektoratet (miljodirektoratet.no)

funding available, except e.g., participation in EU or national research and innovation actions.

Innovative governance: Innovative practices may be encouraged on a general note, but there is no specified need in relation to the solutions being demonstrated in Bodø. Innovation partnership contracts are increasingly deployed in the Norwegian water sector, also in relation to stormwater management, but so far mainly where the NBS includes advanced technology components.[16] This could also be an alternative for small-scale biogas production integrating bioresources from multiple sources.

2.2.2.3. Enhancing trust and engagement

Promote stakeholder engagement: As regards solution 35 (NBS for stormwater management) there is a diversity of actors, including newcomers (e.g., property developers) that should be more involved in decisions for a future effective implementation of this solution. The municipality has good procedures for stakeholder involvement and participation. However, the degree of awareness and interest from the public has been limited up to now, implying the need for new and more creative approaches.

2.2.3. Recommendations for governance improvements

The description of potential recommendations follows the same structure presented in the previous section and relate to the identified gaps in the same order.

Enhancing effectiveness

Clear roles and responsibilities: When it comes to solution 35 (NBS for stormwater management) it is difficult to recommend a specific distribution of roles and responsibilities, since every municipality is different. One may, however, recommend that each municipality should take specific steps to identify the form of coordination that fits the local context best. Different solutions are currently in operation, e.g., some have a dedicated coordinator, while others have an interdepartmental working group for NBS.

[16] Link to program promoting innovative procurement in Norway, with example NBS project: Fremtidsrettet overvannshåndtering med digital skybruddsplan - Innovative anskaffelser

For solution 12, no particular improvement is proposed. Except need to consider synergies and benefits across municipalities when planning/selecting solutions.

Policy coherence: As regards solution 35 (NBS for stormwater management) the observations from Bodø LL support the findings in previous reports as well as the recent White Paper on climate adaptation: There is the need for central guidelines on how municipalities and counties should integrate climate change adaptation into their land use and planning processes.

In line some of the reviewed reports (e.g. Asplan Viak and SINTEF, 2020; Menon, 2017) we also suggest a stronger emphasis on NBS as the preferred solution: the Statal planning guideline for climate and energy planning and climate adaptation should state this even more strongly than today.

When it comes to solution 12 (small-scale biogas production), there is the need to finalise the prolonged revision of the national regulation on organic fertilisers.[17] Norwegian Water has commissioned work on a national sludge management strategy, which is due in summer 2023 (not yet publicly available). Moreover, the EU Urban Wastewater Treatment Directive (UWWTD 91/271) should be implemented in such a way that integrated water management and resource recovery is accelerated.

Enhancing efficiency

Data & information: For solution 35 (NBS for stormwater management) building up a national knowledge base on NBS would be an important step. We have no specific improvement proposals with respect to solution 12.

Financing: The current Grant scheme for climate adaptation in municipalities and counties (administered by the Norwegian Environment Agency)[18] is quite limited (NOK 6.4 million in 2023) and could well be increased to accelerate knowledge development and implementation of NBS.

Capacity: Optional training on NBS targeting a mix of stakeholders, with the aim to also build knowledge and share experience across sectors, is recommended. We also support the steps emphasized in the national White Paper on climate adaptation: Information resources, networks for sharing experience, and cooperation with regional authorities.

[18] Tilskudd til klimatilpasning - Miljødirektoratet (miljodirektoratet.no)

Enhancing trust and engagement:

Stakeholder involvement: Continued efforts to engage stakeholders in relevant ways, e.g., Community of Practice, training, innovative forms of citizen engagement.

2.3. EAST FRISIA

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2.3.1. Context of the Living Lab

As defined in Annex 1 part B section 1.3.5 of the Grant Agreement, the following (technology and software) solutions are developed for and demonstrated within the LL East Frisia with the same numbering used consistently throughout all project documents, even if the titles are sometimes abbreviated for the sake of readability):

- Solution #6: Treatment of vapor condensate / whey permeate for reuse in dairy industry.
- Solution #22: Extended UWOT model for simulation of urban water cycle
- Solution #23: Regional demand-supply matching GIS tool
- Solution #28: Short-term demand forecasting tool

These solutions aim to contribute directly to tackling the challenges and supporting the objectives of the LL as described in D1.7 (description and planning for each LL), milestone document MS06 (first long-term vision) and in MS22 (strategic agenda agreed by CoP). In short, the solutions aim to i) identify and use untapped water resources, ii) increase efficiency of water allocation and use, and iii) to increase reuse of process water (as substitute for drinking water) in water-demanding key industries of the area, such as the dairy industry.

2.3.1.1. Solutions with governance implications

Of these solutions, only solution #6 has major governance implications, in particular current gaps, or shortcomings in governance. This is the result of an internal assessment of the project team involved in the work for LL East Frisia (in particular OOWV and IWW). The other three solutions developed and demonstrated within LL East Frisia are mainly tools for internal use by the LL owner OOWV (water supplier and water board) where no governance implications or obstacles could be identified. Hence, the analysis of governance implications and development of recommendations to improve governance was focused on solution #6, to ensure maximum efficiency in use of project resources.

2.3.1.2. Main innovation and governance challenge of this solution

For the production of dairy such as cheese, about equal amounts of milk and additional water are necessary, and usually this additional water needs to be drinking water. Thus, for a typical dairy production site the volume of water needed can easily be counted in million m^3 per year. Usually, drinking water is required for this purpose, with the (at first glance) paradoxical effect that huge amounts of water are being extracted from the milk (to enable cheese production) and discharged after treatment, whereas a similar amount of fresh drinking water is used for the intensive cleaning procedures in the production process. Considering the currently increasing pressure on drinking water resources, there are ambitions to substitute drinking water with water that has drinking water quality but derives from the re-use of internal process water i.e., the water originating from the milk itself ('cow-water'). The use of such process water in dairies for pre-cleaning processes is not fundamentally new but has been established for some time. However, the planned use as final step of cleaning and disinfection in the final stage before the actual production process (in contact with food-containing tubes and/or the actual food product) is new. Up to now, only drinking water has been explicitly permitted here. This is exactly where solution #6 is aiming at: establishing a stable, efficient, effective, and safe treatment step that enables the officially approved re-use of process water also for the final steps in the dairy production process, substituting large amounts of drinking water.
Hence, the solution is exploring untrodden ground, beyond the scope of established and sufficiently harmonised technical rules, requires approval processes that are not yet established routines for the competent authorities, and the development of new financing and operation models, including aspects of licensing, certification, and liability.

2.3.2. Methodology to assess governance implications

There are mainly four sources of information that were used to identify in a systematic way governance implications and gaps, and to develop specific recommendations for their improvement: i) beneficiaries OOWV and DMK have been working towards the realisation of solution #6 for several years by now through e.g., frequent contact with technology providers, similar initiatives in other countries, discussion with relevant authorities and technical committees; ii) discussion on these matters within the context of the CoP meetings of LL East Frisia iii) targeted qualitative interviews with competent authorities at federal state level (that were predominantly carried out for D5.4 on social acceptance but also had relevant input for the governance dimension), and iv) in a dedicated workshop carried out with governance experts from both OOWV and IWW

where the different elements were brought together and set into the context of the OECD water governance model and its twelve principles (for details cf. table in Annex III).

2.3.3. Executive summary

The most relevant governance gaps are related to the dimension of "**Enhancing effectiveness**", in particular to principles "Clear roles and responsibilities", "Capacity" and "Policy coherence" (in that decreasing order of relevance). The reasons are mainly that currently the responsibility for approval and surveillance of such solutions is

i. lacking *harmonisation*, *backing* and *decision support* from the federation level on this topic: each of the sixteen German Federal States has the liberty, responsibility, and burden of acting on their own and to develop their own way how to deal with this new solution within the existing policy & regulation context and to define the level at which this topic is to be dealt with (state, regional or local authority level) (→principle "Policy coherence"). In the specific example of the Federal State of Lower Saxony, the responsibility is allocated to the local level. Without an overarching harmonisation framework and decision support from the federation level, decision makers at the local authority level are risk-aware and hesitant to approve such solutions.
ii. In Federal States where the responsibility is allocated to the *local* authorities, these do not have the critical mass in terms of specialised staff and in terms of reference cases to facilitate their decision. New processes and procedures need to be established. (→principle "Capacity"),
iii. spread across *several* authorities (e.g., health, consumer protection, veterinary) usually under the lead of one of these, but without an overarching support in terms of an established process and harmonisation mechanism on that topic (→ principle "Clear roles and responsibilities"),

The second relevant gaps are in the dimension "**Enhancing Efficiency**", in particular with regard to the principles "Regulatory Frameworks" (closely related to the above stated observations for "Policy coherence" about the heterogeneity among and within the federal states) and "Innovative governance" (the latter being rather an opportunity than a gap: there is room to create new governance approaches that tackle the current shortcomings as outlined above).

The dimension "**Enhancing trust and engagement**" also has some relevant implications and gaps, but it is rather considered a supportive dimension. Most relevant are principles of "*Stakeholder Engagement*" and "*Integrity and transparency*". There are no real gaps here that significantly block the implementation of the solution, but these principles are considered very suitable starting points for activities and interventions that

i. can be initiated and/or controlled by the problem-owners and promoters of the solution such as water suppliers / boards, dairy industry and technology providers;
ii. can have a high leverage effect on improving the governance principles of the other dimensions that are currently less supportive of the acceptance, approval, implementation and market uptake of this solution.

The focus of the following analysis is on the dimensions and principles outlined above. There are some (minor) gaps and recommendations identified also for other principles of the OECD water governance model. These are documented completely in Annex III. They will not be lost but considered in future activities of the project team, but not elaborated in this narrative part of the document, for the sake of conciseness.

2.3.4. Detailed analysis: Enhancing effectiveness

Clear roles and responsibilities:

Key gaps and their impact: Responsibility for approval and surveillance of water re-use in dairy industry is spread across different authorities (health, consumer protection, veterinary), usually under the lead of one of these (in the specific example of the Federal State of Lower Saxony: the local health authorities). The involvement of several authorities complicates decision-making. Furthermore, the regulations are individual at the level of the 16 Federal States in Germany. Within a given Federal State, the responsibility for approval of a specific plant is at the local or regional level. Hence, the number of cases for each authority is small, and therefore it is not feasible to build-up a critical mass of experience from reference cases and staff with specific training on a topic with very low case numbers. As there is not enough backing, advice or support at state or federal level, authorities are on their own. There is no established mechanism to exchange experience on best practices, approval principles etc. among the different authorities, neither within nor across Federal States. Although there is now a recently issued National Water Strategy in Germany, this is not yet broken down to the federal state level and into specific measures to promote water re-use in the industry as a clear political priority with clearly defined responsibilities and roles for the different official actors. Hence, there is no official authority with a mandate to push this process, but progress depends mainly on the bottom-up initiative of stakeholders such as water suppliers / water boards, industry and technology providers, to bring the relevant authorities together, initiate the dialogue and exchange and facilitate decision-making.

Learnings from the project: Triggered by the CoP experience and targeted interviews, the relevant authorities for LL East Frisia are now open to the idea of an experience exchange within and across the federal state borders with other authorities in whose areas such re-use has or will be approved. The project has also triggered the dialogue

on this issue between the regional authorities and the state ministry, as a starting point towards a joint position. These are promising first steps towards broadening the evidence base and harmonisation. The project team will continue pro-actively fostering this dialogue and working also towards promoting the following

Recommendations: i) Strengthen coordinated technical advice at the federal level ii) backing and decision support for authorities at state / district level; iii) bundled responsibility for industrial water supply in a central point of contact at a Federal Office / Authority, such as e.g., UBA (Umweltbundesamt), BfR (Bundesanstalt für Risikobewertung) or similar ones.

Policy coherence:

Key gaps and their impact: There is a recently issued German National Water Strategy, but there is not yet an overarching water policy at the federal state level that coordinates actions and goals towards more sustainability in water use across different fields and sectors, and empowers decision-making authorities to consider also the contribution of new approaches to overarching environmental policy/strategy objectives in the approval process. Existing regulations are rooted in the mindset of a historic situation where there was usually abundant water available in Germany, and they are usually focused on the 'history' of the water when defining requirements, not primarily on the fit-for-purpose quality.

Learnings from the project: Some regulation in the food sector is requiring drinking water (with the objective of ensuring the highest possible safety and protection level for livestock, employees and food products), even in cases where from the scientific/technical point of view other water resources and quality would be sufficient (e.g., drinking water quality is required to clean trucks transporting livestock). Such requirements are also sometimes selected for pragmatic reasons (being the easiest definition to pick, with drinking water quality also being well-known and highly standardised). This facilitates the legal protection of the decision-making authorities, but it can severely impede the implementation of new solutions for simply formal reasons, not otherwise scientifically/technically/hygienically justified. More future-oriented political strategies exist, but so far only at a higher (and more abstract) level such as a recently issued National Water Strategy, not yet sufficiently broken down to the federal state and/or local level and not yet substantiated with specific measures.

Recommendations: Introduce a new paradigm in defining required water for intended use: focus on quality only, instead of 'history' of the water. The recently issued German National Water Strategy can be the first starting point, but it needs to be broken down and complemented by a water strategy at the federal state level that also addresses management of industrial water. A good complementary building block exists in the

format of a Lower Saxony Federal State water supply concept (Wasserversorgungskonzept Niedersachsen) that already describes the expected increasing water demand. A federal state water strategy could link to that and create the basis for clear political recommendations on how to use and enable savings potentials. This can also generate the necessary political empowerment of health authorities to also consider the contribution of re-use approaches to overarching environmental policy objectives in the approval process. The necessary technical input to such strategies is being developed and provided by relevant technical associations (e.g. DVGW, DAW) but needs to be taken up politically).

Capacity

Key gaps and their impact: This is closely related to the gaps described under the principle of clearly assigned roles: the responsibility for the approval and surveillance of such solutions in the dairy industry is at the very local level (communal/municipal health authority). Due to the small scale, there is a very low number of cases for a given authority, and that does not justify or enable the authorities to build up dedicated staff capacities with the relevant expertise of this specific topic only. Authorities are in general supportive, but as these new solutions are outside the usual scope of their established routines, and they are not explicitly mandated to promote their implementation.

Learnings from the project: The districts and counties do not have the adequate financial and staff resources for this task; the superordinate state authority is responsible for more issues than water. The specific topic of industrial re-use in the dairy / food industry does not really have a mandated ‘problem-owner’ and ‘topic driver’ on the side of the authorities.

Recommendation: This bottleneck can only be overcome by i) a political strategy at the federal state level with specific measures to promote water re-use in the industry, also providing a clear mandate, procedures and capacities to the relevant authorities, ii) the establishment of a higher-level entity for expert advice and decision-support at both state and federal level. This could be achieved through the creation of a focus group / working group to bundle experiences and develop an overarching perspective and guidance, empower the local decision-makers, and put them in a position to lose ‘fear’ of wrong decisions, enable them to take legally proof but also technically sound decisions in line with overarching political objectives.

Detailed analysis: Enhancing efficiency

Regulatory Frameworks

Key gaps and their impact: In analogy to the approval process and the gaps related to principles 'Clear roles and responsibilities' and 'Policy coherence': Monitoring concepts are specified in permits issued by the local authorities. The functions are adequately assigned, but there is a heterogeneity of decision-making, however, leads to quite different scopes e.g., due to different specifics of the waters or also due to actually different approaches/principles, different interpretation of the legal situation at the local level. That also links to difficulties with societal norms such as equal treatment and justice.

Recommendations: largely overlapping with the ones given for principles 'Clear roles and responsibilities' and 'Policy coherence': Once the overarching guidance, harmonisation and decision-support is solved for the approval process, and a supporting political strategy implemented (with clear mandates to the relevant authorities), a sound, harmonised and effective implementation of monitoring, surveillance etc. will follow, because the general mechanisms how to work efficiently under such boundary conditions are well established within the administrative bodies of the German Federal States, and the scientific/technical basis can be provided by technical associations and initiatives working in the field. It is recommended to develop guidelines with harmonised criteria for approval and requirements of monitoring and data provision. Create clarity about the roles and interests of the parties involved (business model), and promote digitalisation of water quality data monitoring, documentation and exchange, in order to facilitate sound implementation of the regulation. This links also to the principle of 'Data and Information'.

Innovative Governance

Key gaps and their impact: There is currently no mechanism in place to promote the adoption and implementation of the innovative solution #6 across responsible authorities and across stakeholders. This process is currently driven by a bottom-up initiative from the project, bringing together the relevant actors with a high dedicated effort. The challenge will be to bring sufficient attention, collaborative attitude and political momentum into this initiative so that the relevant political stakeholders pick up on this initiative and start to complement this by a top-down initiative.

Learnings from the project: There are also financial aspects that require innovative governance of the solution e.g., by high CAPEX and OPEX for the solution (especially high energy costs for the treatment step of reverse osmosis). Public utilities must cover their costs (depending on the statutes), and the price of cow water will have to be higher

than the current drinking water price. Benefits for supporting the sustainability goals must have a corresponding value for the customer that can convincingly be communicated and justified. Refinancing via wastewater charges is currently not possible.

Recommendations: Prepare benefit transfer: Create transparency about use cases / best practices, create topic-related exchange formats (not politically-driven but fact-driven), characterized by the exchange of data, facts, project successes; thus enabling a learning curve for competent authorities. Assignment should be at the level of a federal authority, rather not at LAWA or similar groups. (such a "Commission" should be more technically rather than politically driven), e.g. located at UBA (German Environment Agency) or BfR (German Federal Institute for Risk Assessment), but with an interface to state initiatives (e.g., LAWA - German Working Group on water issues of the Federal States). Investment support programmes are necessary to ensure that there are no competitive disadvantages (no economic development of certain users) and that there are no distortions of competition on the product side (part of the environmental service therein). New governance approaches should also create awareness and transparency of the enormous benefits for the public created by any solution to substitute drinking water in the industry e.g., about ecosystem services provided or secured by implementing this solution. This links also to the principle of 'Financing'.

2.3.5. Detailed analysis: Enhancing Trust and Engagement

Stakeholder engagement

Key gaps and their impact: Initiative currently driven by the 'bottom-up' stakeholders (water supplier, dairy industry, technology provider), the initiative does not come from state actors because apart from the National Water Strategy there is a lack of overarching political objectives broken down into specific measures and clearly assigned tasks. This also causes the problem of resources (→principles 'Capacity' and 'Financing').

Learnings from the project: The establishment of the CoPs was an important step and 'door-opener' for a more intense dialogue with the relevant authorities, the EC-funded project also providing an additional organisational and methodological framework and additional legitimacy to the approach. Based on the CoP-experience, there is now a high willingness of the relevant authorities to participate in stakeholder formats organised by the project (e.g. in the CoPs) and to participate also in exchange with other authorities across federal state borders to work towards the harmonisation of criteria and approaches for approval of this (or similar) solution(s). There is a positive attitude of authorities and a willingness to dive deeper into the subject and analyse information and

data about the performance and safety of the solution (but no sufficient time of the actors → principle "*Capacity*"). The agenda setting on the part of the authorities is pending.

Recommendations: Build on the B-WaterSmart approach to stakeholder involvement. Continue to organise stakeholder dialog and cross-border information exchange beyond the project duration, use the approach also as a blueprint for similar activities in the region. The involvement of authorities would have to be more interdisciplinary and cross-sectoral. This could be achieved e.g. by the organisation of joint "water days" for a common vision/objective. Currently each industry has its multiplier network, but not yet the region (for the topic of water). This could be built up and utilised.

Integrity and transparency

Key gaps and their impact: No specific gaps here, but the general observation of eroding trust in official actors and organisations, amplified by the societal experience of the Covid-19 pandemics during which some of the official measures difficult to justify / understand, and sometimes had to be even reversed on short notice.

Learnings from the project: The solution can be linked to societal norms and values that are increasingly supported by the society at large, such as e.g., more environmental sustainability, resource-efficiency, increasing awareness of scarcity-risk of previously abundant resources. Hence, there is a big opportunity for transparent communication about the background, motivation, ambition and societally approved objectives of the technology. Having the first reference case in the dairy industry is also a bonus, because in Germany this is an industry sector with a comparatively positive image.

Recommendations: Key is a clear communication of the background, objectives and also public benefit of such a solution, and transparency about the legal & technical requirements and how they are met and monitored, and how this solution contributes to values that are important for the society such as sustainability, generational justice, environmental protection, but also without compromising safety and public health. Make use of these aspects in any communication about the solution. Establish first reference cases in industries with a positive image (such as dairy).

2.3.6. Summary of recommendations and guidance for future work within and beyond B-WaterSmart

In a nutshell, the following learnings and recommendations can be drawn that will also guide the work of the LL East Frisia project team during the remainder of B-WaterSmart and beyond:

- Continue and strengthen the stakeholder interaction started by the CoPs. Make use of the willingness of the relevant authorities to enter into a dialogue across authorities and across federal state borders.
- Actively organise and facilitate such exchanges through also seeking for similar / parallel cases in Germany, the EU and beyond.
- Develop (within WP4) elements for a sound business model that also overcomes current financial bottlenecks and clearly defines roles and responsibilities (also related to e.g., who is providing the service of water fit-for-purpose, liability for compliance with pertinent regulation, licensing and cost/fee structure).
- Use the stakeholder dialogue to promote and foster the establishment of an entity at the federal level that can: gather experience with the technology, establish guidelines for performance, operation, approval and monitoring of the solution, provide decision-support for local authorities.
- Use appropriate dialogue formats with political actors to promote the development of a water strategy at federal level that also formulates political objectives for the identification and realisation of water saving potentials in the industry through safe reuse.
- Shape a communication strategy based on transparency about
    - Compliance with legal and technical requirements
    - Performance of the technology also in terms of hygiene and safety (public health)
    - Contribution to societally relevant norms and objectives such as sustainability, resource efficiency, ensuring safety of water supply for all and safeguarding water resources for future generations.

2.4. FLANDERS

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2.4.1. BWS solutions with governance implications (short characterisation, and justification of selection

Flanders is an economically vibrant region, densely populated, highly industrialised and with intensive farming industries (especially in the west of Flanders). Ranked 23rd globally in the 2019 National Water Stress Ranking, and transforming the regional water system from linear to a more circular system and fundamental system changes, are key steps to securing a freshwater supply for all sectors. After the 2017, 2018,2019, 2020 droughts, there has been strong interest to explore alternative water sources and work towards a more robust, water smart system.

The vision of the LL Flanders is to become more water smart, achieved through the application of alternative water resources (e.g., rainwater – stormwater, effluent reuse, greywater) and improving water use efficiency. Several local implementations of alternative water sources are currently being explored by the case partners, including upgrading of effluent for integration in drinking water production (Aquafin – Woumen), the use of reverse osmosis to increase climate robustness of drinking water production (De Watergroep – De Blankaart), and stormwater retention and reuse via subirrigation for agriculture (Mechelen). These case studies develop a regional concept for improving and monitoring water smartness with the specific aim of providing a more robust water system for the entire region.

Within the context of this deliverable, the governance implications will focus on the topic of stormwater reuse for agriculture. Understanding the governance gaps/issues around stormwater reuse for agriculture, and defining concrete recommendations for improvements will contribute to the better management and use of stormwater and offer reference for the successful expansion of the concept/approach to other regions in Flanders and beyond.

The stormwater management and reuse system focusses on different aspects, contributing to aspects of LL Flanders' long-term strategic objectives of the B-WaterSmart project[19], which align with broad regional developments towards a smart water system in Flanders. This includes investigating the legal status of stormwater in Flanders and how this also links with regional policy and regulations, such as VLAREM II on the artificial replenishment of groundwater, contributing to safeguarding health (objective 1). Stormwater provides an alternative water resource for the agricultural sector (objective 1), also making agriculture resilient to the impacts of climate change (objective 2). It also provides a solution for stormwater (rainwater) management and flooding (objective 2), and compensates for impervious surfaces (objective 2). In this demonstration innovative water (reuse) governance

[19] The B-WaterSmart long term strategic objectives for LL Flanders include: (1) ensuring water for all relevant uses (including: water for all, and safeguarding health), (2) safeguarding ecosystems and their services to society (including: becoming resilient to climate change, and conserving the environment), (3) boosting value creation around water, and (4) engaging citizens and actors across sectors in continuous co-learning and innovation (including: developing innovative governance systems centred on the water value).

structures will be explored. Cooperatives between different kinds of stakeholders (e.g., government, stormwater managers, agriculture, private partners, financial sector...), and other governance systems are explored, including defining a coherent business model for the management and use of stormwater (this also includes investigating different alternative funding mechanisms that will valorise the different added values generated, aspects of ownership and management and by whom, etc.) (objectives 3 and 4).

2.4.2. Key governance gaps and issues

The activities of LL Flanders have been ahead of the development of legislation regarding stormwater reuse. Since the start of the project, European legislation regarding water reuse has changed, and the national and regional regulations are in the process of being updated accordingly. Hence, many of the governance issues in this LL are related to outdated legislation, yet with the prospect of significant changes in the upcoming years.

Appropriate scales within basin systems

- In Belgium, water is a regional (in this case Flemish) responsibility. In Flanders, river basin plans are drafted by the *Coördinatiecommissie Integraal Waterbeleid* (Coordination Committee on Integrated Water Policy, CIW). Regional and provincial authorities are represented in the CIW, as well as the wastewater treatment utility (Aquafin), drinking water companies, and river basin management structures among others (ciw-engagementsverklaring-15dec20 (integraalwaterbeleid.be). In this way, the CIW oversees the integration of water management within Flanders. However, many basins cross regional and national administrative borders. Close cooperation with the Walloon region, France, and the Netherlands is therefore required, but agreements about the quantity and quality of water that crosses the borders are in some cases not well aligned with one another.
  Examples are discharge, extraction, and aquifer replenishment regulations, whereby differing regulations between regions and countries may have a detrimental effect on one another. Water management at the regional level needs to be complemented with governance and agreements at overarching scales.

Policy coherence

- In relation to the previous point, disparities between regional policies may emerge when EU legislation is translated differently in different regions in the country, which puts pressure on the policy coherence.

- Moreover, while environment and water are regulated at the regional level, health is regulated at a federal level. This means risk assessments for innovative solutions have to be made for health and environment separately at different levels of government. This may cause disparities and a duplication of work.

Data & information

- The main water source used in agriculture is groundwater, followed by surface water. However, the volume of groundwater use is likely to be underestimated. Groundwater use is regulated through permits, but it is not known to what extent farmers extract water without the necessary permit.

- In general, dashboards and information-sharing platforms are in place or are being developed for various water-related and other environmental concerns. This includes real-time monitoring of water quality. However, different applications and platforms are being used for different purposes by different regions and countries. This causes a lack of coherence. Furthermore, real-time control and communication channels can be costly to maintain.

Financing

- There is no overarching legal and financial framework to implement ecosystem services. In many cases, public funding will be required to stimulate water reuse by stakeholders. The Flemish government is drafting new water policy (the current “Blue Deal” ends in 2024”) which will contain an investment plan for different water types. While there is a lof of public funding for investments, in some cases, such as the stormwater management case in Mechelen, the business case is not strong enough to cover the operational costs. More attention should be paid to operation costs when funding is given for investments.

- In moving towards circularity, the costs and value of water and innovations for reuse are a limiting factor. The investments needed for reuse often do not meet the short-term return on investment (typically 3 to 5 years for private companies) that many stakeholders use, especially considering the relatively low costs of (drinking) water.

- Also, the questions of which stakeholders are responsible for the risks associated with extreme weather, and who is willing and able to finance solutions for flood protection and drought resilience, should be clarified. clarified. For example in the case of Mechelen, a bufferbasin is built to avoid among other purposes manage flooding, but who is benefiting, and should they be motivated or asked to fill investment gaps to avoid a heavy reliance on public funding and subsidies. This is a limiting factor for upscaling pilots to system-wide developments.

Regulatory frameworks

- There is a lack of clarity regarding the definitions and regulation of rainwater, stormwater and corresponding reuse and infiltration methods. Rainwater (generally understood as precipitation that is captured directly or via rooftops) and stormwater (precipitation that is captured via street gutters) are considered to be of different quality and therefore are regulated differently. Also, stakeholders might have different

perceptions of both sources. However, it is not clear when exactly precipitation may be considered rainwater or stormwater.

- Also, with regard to infiltration methods, streamlining of regulations is desirable. Currently, using stormwater for subirrigation would be considered artificial aquifer recharge, which means the water needs to meet groundwater quality standards. Passive ("natural") infiltration of stormwater through the soil, however, does not need to meet this standard.

- It is expected that the current policies on groundwater use and infiltration, as well as the legal status of rainwater and stormwater, will change in 2024.

2.4.3. Recommendations for governance improvements

Appropriate scales and policy coherence

In general, more alignment of policies between regions and between scales is needed. This includes agreements between regions and states about water quality, quantity, infiltration and extraction, as policies and practices in one region affect those across the administrative borders.

Policy agreements between regions might affect the (need for) agreements with other regions, especially when river basins or aquifers cross multiple borders. Furthermore, this effort for alignment should take into account the need for coordination of how EU legislation is translated to state and regional levels.

More alignment of federal and regional risk assessment procedures on health and environment should reduce disparities and duplication of work for water-smart innovations.

Data & information

Coordination between different initiatives, including water-smart innovations, should improve access to and coherence among data sharing resources. Considering the interconnectedness of regions that share common catchment areas, river basins, or aquifers, cross-border data sharing should be made easier.

Financing

New ways of calculating the costs and value of water, ecosystem services, and water-smart innovations are needed, to make such innovations viable to stakeholders. This effort should steer away from short-term return on investment and focus instead on the value of risk and cost prevention.

Banks and insurance companies have a crucial role in this process and could be more actively involved in the development of innovative solutions. Banks should be involved and consider developing alternative financing instruments to stimulate transitions. Especially with

regard to the prevention of losses, insurance companies should be involved to invest in prevention systems that will reduce revenue payment in the medium and long term. More generally, a broader involvement of stakeholders that benefit from water-secure systems such as food processing industries, could provide further investment possibilities.

Regulatory frameworks

Updating and clarifying definitions of water types is necessary to prevent confusion about which water sources are appropriate for what kind of uses. This pertains particularly to the distinction between rainwater and stormwater. The regulation of infiltration methods (direct infiltration or surface infiltration) and related quality standards should be streamlined accordingly.

2.5. LISBON

Co-authors: Rita Ribeiro and Maria João Rosa (LNEC)

2.5.1. BWS solutions with governance implications

The key smart-water challenges of the Lisbon Living Lab targeted in B-WaterSmart are (i) a growing resident population and economy, dependent on distant freshwater resources (up to 100 km), (ii) climate challenges (e.g., droughts and floods) and (iii) need to increase urban green areas. Actions to address these challenges include (i) improving the water supply & demand management and ultimately the city's water-energy-phosphorus (WEP) footprint while increasing the green areas, (ii) promoting the safe use of alternative sources (e.g., reclaimed water) and (iii) promoting climate-ready (water-energy efficient, climate-change proof) housing. Figure 3 presents the **LL Lisbon ambition**.

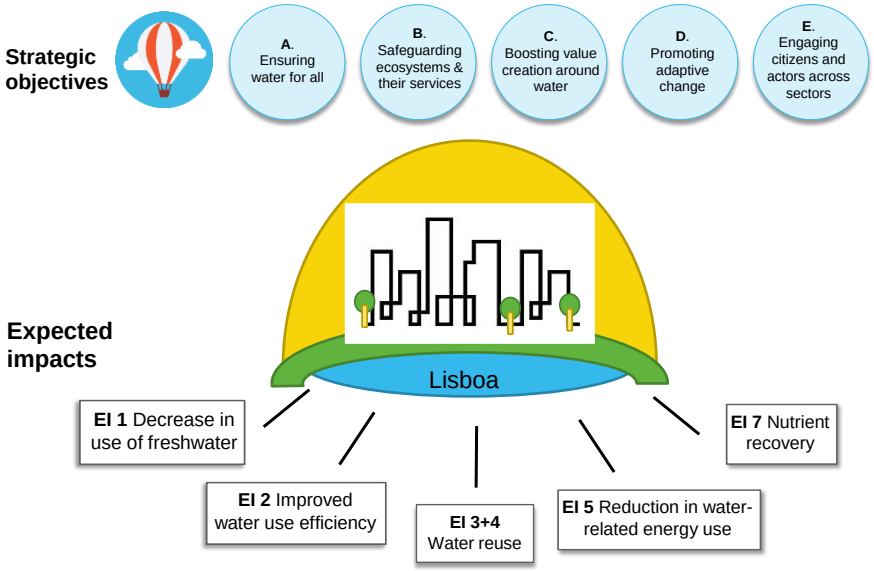

Figure 3 - The Lisbon LL ambition

The special focus of Lisbon LL is the development of tools and processes to facilitate **safe water reuse** and improve **water-energy-phosphorous efficiency**, improving Lisbon's **climate readiness** regarding water scarcity.

The **Lisbon LL** gathers six partners working for these goals:

- CML (Lisbon Municipality) is the Lisbon case-study problem owner; as such, CML makes the city's data and resources available as a living lab in the project, promotes the Lisbon Community of Practice, participates in the B-Watersmart Innovation Alliance, tests the Lisbon LL solutions developed within the project and plays a key role in disseminating and promoting the adoption of these solutions among its extensive networking platforms. CML also develops the urban water cycle observatory, through a linked 3rd party – LEN (Lisboa E-Nova).

- LNEC (Laboratório Nacional de Engenharia Civil) is the mentor and R&I partner for the Lisbon LL, responsible, among others, for the development of the knowledge, methodologies and analytics behind the tools of (health and environment) risk assessment, reclaimed water quality modelling in the distribution network, WEP balance, and decision support of alternative courses of action based on performance-cost-risk indicators. LNEC also participates in the development of the water reclamation protocol for potable water reuse in beverage industry for artisanal craft beer production.
- AdTA (Águas do Tejo Atântico) is the water utility enabler of Lisbon LL, providing real data (on wastewater treatment and water reclamation) for several tools and is responsible for conducting the pilot tests needed to develop the water reclamation protocol for potable water reuse in craft beer production.
- Adene (Agência para a Energia) is a solution provider responsible for developing the knowledge and the tool for climate-readiness certification.
- Baseform is a solution provider responsible for developing the software for the risk assessment, reclaimed water quality modelling in the distribution network, WEP balance and decision-support tools.
- ICS-UL (Instituto de Ciências Sociais da Universidade de Lisboa) is a cross-cutting R&I partner integrating the social sciences and humanities and is the Lisbon CoP moderator.

Lisbon LL is developing the following methods, algorithms and software for a smart allocation of fit-for-purpose water in the city (figure 4):

- **Tool #17** - Environment for decision support and selection of alternative courses of action, a decision support tool for WEP sustainable management based on performance-cost-risk assessment (Baseform & LNEC);
- **Tool #20** - Urban Water Cycle Observatory, at city level and single users/consumers level (LEN);
- **Tool #24** – Reclaimed water quality model in the distribution network, for modelling reclaimed water quality in the distribution network (LNEC & Baseform);
- **Tool #25** - WEP balance planning, a module for the quantification of the city water cycle components and assessment of water-energy-phosphorus balance for non-potable uses (LNEC & Baseform);
- **Tool #27** - Risk assessment of urban water reuse, a module for the implementation of alternative water sources (LNEC & Baseform);
- **Tool #33** – Climate readiness certification, with climate-readiness index and the subsequent auditing/certification mechanism for Climate Readiness of households, buildings and neighbourhoods (Adene).

Furthermore, a protocol for food-grade water production from treated wastewater by ozonation/reverse osmosis for craft beer production – **Tool #1** is being demonstrated (AdTA & LNEC) for communicating and disseminating (C&D) safe water reuse and thus build the trust in this resilient, rainfall-independent water source (figure 4).

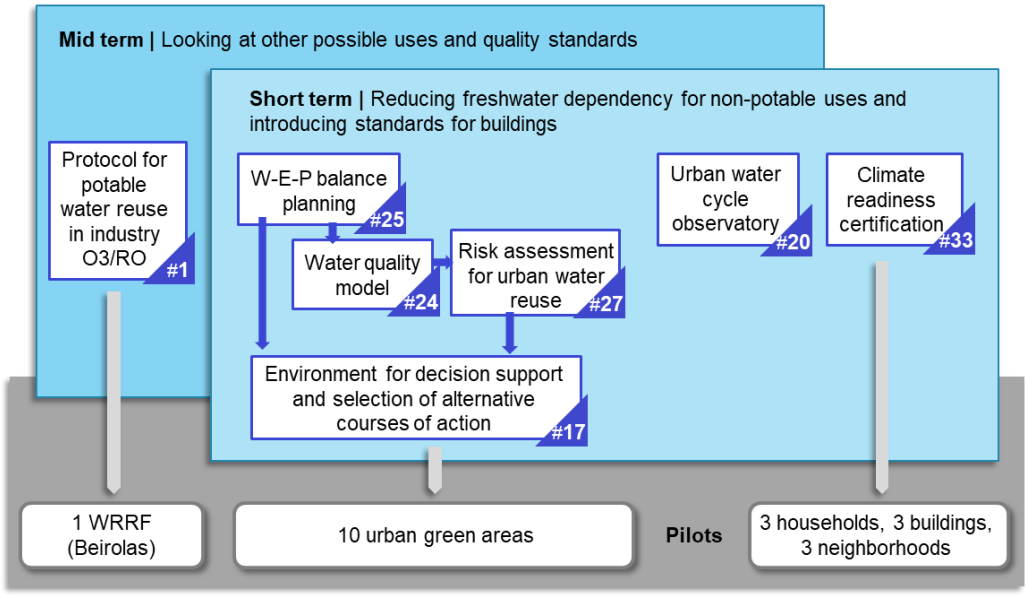

Figure 4 - Lisbon Living Lab water-smart solutions

The solutions developed at Lisbon LL aim to support the delivery and utilisation of the following **products**:

- Reclaimed water for non-potable uses (direct link to tools #17, #24, #25 & #27, indirect link to tools #20 & #33);
- Other non-potable water sources, e.g., groundwater, spring water for non-potable uses (direct link to tools #17 & #25, indirect link to tools #20 & #33);
- Reclaimed water for C&D demonstration of potable use, in this case for craft beer production (link to tool #1);
- Climate readiness certificates for built environments (link to tool #33).

The analysis of governance issues is structured around the use of these products (i.e., **fit-for-purpose water** and **certificates**) aiming to contribute to the expected impacts (Lisbon LL ambition, figure 3). Making Lisbon a water-smarter city implies the involvement of different stakeholders in the provision and use of water and in the regulation of these aspects, as well as stakeholders who develop solutions that accelerate this evolution. Figure 5 presents the relevant stakeholders for analysing the governance issues applied to the Lisbon case, namely: target users of the water "products" and certificates, Lisbon LL solutions' developers (research organizations and app developers), water utilities and water use-related public authorities.

The legal and policy context has a significant impact in the transformation to water-smarter economies and societies. Figure 5 also lists key regulations and policies in Europe, Portugal and Lisbon applicable to the Lisbon case. The references of the cited regulations and policies are presented in chapter 0.

The description of the stakeholders as well as their role in transforming Lisbon in a water smarter city is presented in Table 1.

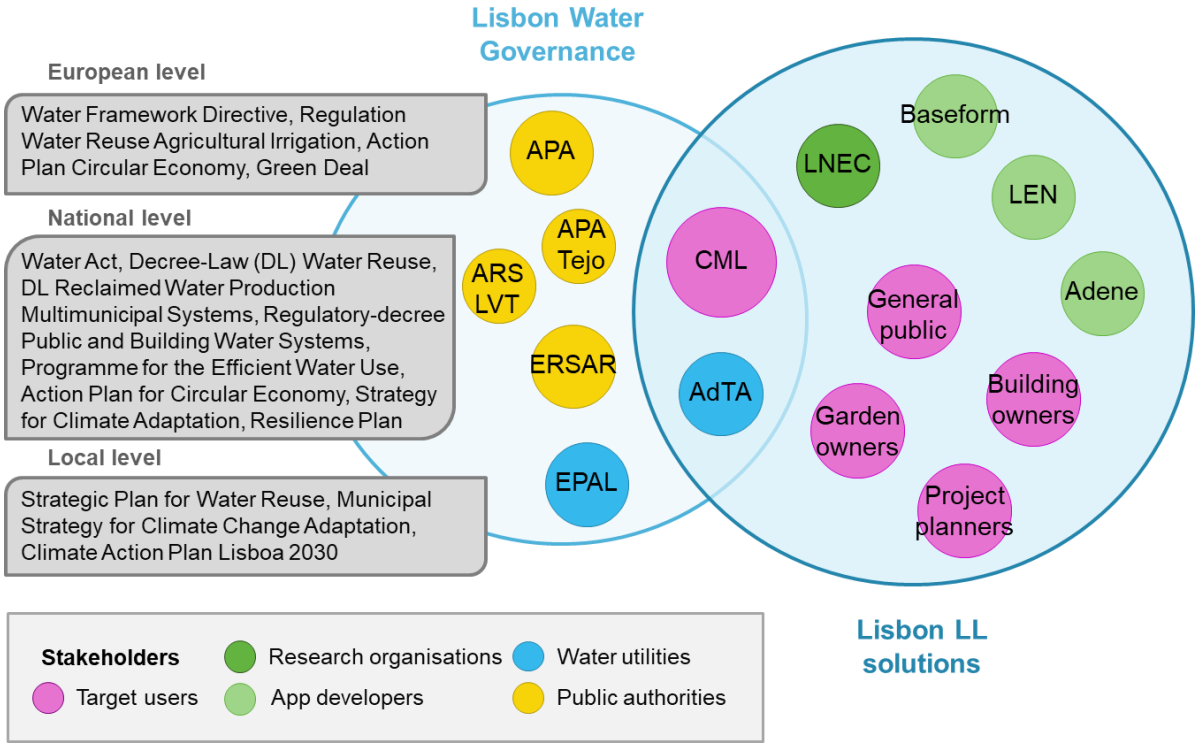

Figure 5 - Stakeholder map – Lisbon water governance and LL solutions development and uptake

Table 1 – Relevant stakeholders for achieving Lisbon LL expected impacts.

Stakeholder groups	Identification	Roles
Target users	CML	- Water use in irrigation, lakes, street cleaning, etc. - Project and construction of municipal green areas (new areas or rehabilitated ones). - Management of municipal green areas. - Groundwater abstraction. - Project and construction of municipal social housing. - Management of municipal social housing.
	General public	- Increase the efficiency on water use. - Adjust the behaviour in the use of green spaces according to the information on the level of risk to human health.
	Garden owners (others than CML)	- Water use in irrigation, lakes, street cleaning, etc. - Management of public or private gardens. - Groundwater abstraction. - Project, construction and management of the irrigation systems. - Transport of reclaimed water from the reclaimed water production site (point of delivery by AdTA) to the use locations, a possibility framed by the current version of the Decree-Law 119/2019

Stakeholder groups	Identification	Roles
	Garden planners	- Project of public or private green areas (new areas or rehabilitated ones).
	Building owners	- Adaptation to climate change of households, buildings & neighbourhoods guided by a climate-readiness index.
	Building planners	- Project of households, buildings & neighbourhoods guided by a climate-readiness index.
Water utilities	AdTA	- Production of reclaimed water for non-potable uses. - Production of reclaimed water for industrial uses. - Reclaimed water distribution to the point of delivery to users (DL 119/2019)
	EPAL - Empresa Portuguesa de Águas Livres, S.A.	- Management of Lisbon's public drinking water supply system. - Possible supply of spring water for non-potable uses in Lisbon.
	CML	- Management of Lisbon's public wastewater and stormwater drainage networks. - Project, construction and management of the water distribution network to transport the reclaimed water from its production site (point of delivery by AdTA) to the use locations - a possibility framed by the current version of the Decree-Law 119/2019.
Public authorities	APA - Agência Portuguesa do Ambiente	- Regulations on the production and use of reclaimed water. - Regulations on the water abstraction - Regulations on treated wastewater discharge in receiving waters - Monitoring of water sources quality, availability and exploitation - Focal point with the European Commission regarding water regulation
	APA Tejo	- Licensing of the production and the use of reclaimed water. - Licensing of groundwater abstraction. - Management of the water resources.
	ERSAR – Entidade Reguladora dos Serviços de Águas e Resíduos	- Water services pricing system. - Assessment and annual reporting of the water quality service (drinking water supply, wastewater (and stormwater in the combined systems) management) in Continental Portugal.
	ARS LVT - Administração Regional de Saúde de Lisboa e Vale do Tejo	- Position (appreciation) on the assessment of the risk to human health associated with the production or the use of reclaimed water.

Table 2 and Table 3 list the main aspects and existing barriers related to the use of the products in Lisbon (fit-for-purpose water and climate readiness certificates, respectively), taking into consideration the role of the different stakeholders. This serves as a basis for the analysis of the key governance gaps that may affect the transformation to a water-smarter city (chapter **Error! Reference source not found.**) and also for the recommendations for governance improvements (chapter 2.5.2).

Table 2 – Product: fit-for-purpose water in Lisbon

Stakeholders	Use description	Administrative requirements	Technical requirements	Existing barriers
CML	Reclaimed water / municipal non-potable uses (irrigation, etc.)	License issued by APA Tejo and ARS LVT	Implementation of a multi-barrier approach (adequate water quality, information to the public, risk management, etc.)	- The definition of the strategy for water reuse remains to be completed (the selection of the areas of the city that will be equipped with this network is not yet closed). - Inexistence of a reclaimed water distribution network in Lisbon. - Uncertainty as to the entity responsible for this distribution network. - Currently no possibility to have secondary users (i.e., to which the reclaimed water is supplied by a licensed primary user who is directly supplied by the reclaimed water producer). - Reclaimed water tariff not yet set. - No cost-benefit analysis completed.
	Groundwater / municipal non-potable uses (irrigation, etc.)	Abstraction license issued by APA Tejo	Installation of wells + pumping	- The wells productivity varies because of urban intervention and the natural recharge of aquifers, which is decreasing in some sites in Lisbon.
	Springwater / municipal non-potable uses (irrigation, etc.)	Contract with EPAL.	Installation of water meters.	- The reactivation of the water distribution system from the water aqueduct is under study. This decision is outside CML's scope – EPAL decision / investment.
General public	Water / literacy	Social: willingness or searching information.	Top-down communication tool with public.	- Relatively low levels of interest about water consumption in the city.
	Water / potable reuse	Social: willingness for trying direct potable water reuse.	Top-down awareness initiatives with public.	- The success of this kind of public relations campaign depends on the clear involvement of politicians and celebrities.

Stakeholders	Use description	Administrative requirements	Technical requirements	Existing barriers
Garden owners (others than CML)	Reclaimed water / irrigation	License issued by APA Tejo and ARS LVT	Reclaimed water of a fit-for-purpose quality, e.g., Class A (best quality, DL 119/2019, EU reg 2020/741) for unrestricted irrigation	- Unless a reclaimed water public distribution network exists in Lisbon, with the possibility to supply the water to several users (e.g., secondary users, in addition to the producer and the primary user), each user must build and operate a dedicated network to transport the reclaimed water from its production site or point of delivery (by the water utility, i.e., the producer) to the point(s) of use.
	Groundwater / irrigation	Abstraction license issued by APA Tejo	Installation of a well + pumping	- The wells productivity varies because of urban intervention and the natural recharge of aquifers, which is decreasing in some sites in Lisbon.
	Springwater / irrigation	Contract with EPAL.	Installation of water meters.	- The reactivation of the water distribution system from the Águas Livres aqueduct is under study. This decision is outside CML's scope.
Garden planners	Reclaimed water / irrigation	License issued by APA Tejo and ARS LVT	Reclaimed water of a fit-for-purpose quality, e.g., Class A (best quality, DL 119/2019, EU reg 2020/741) for unrestricted irrigation	- Social acceptance of water reuse in garden irrigation.
AdTA	Reclaimed water / production for non-potable uses	License issued by APA Tejo and ARS LVT	Water reclamation: ultrafiltration and chlorination	- Reclaimed water tariffs not yet set. - Inexistent cost-benefit analysis.
	Reclaimed water / production for industrial uses	Not licensed, C&D action	Reclamation pilot: Secondary effluent + sand filtration + ultrafiltration + ozone + reverse osmosis	- The success of this kind of public relations campaign depends on the clear involvement of water utilities and public authorities.
EPAL	Springwater / distribution	Authorization of new domain of activity by ERSAR	Rehabilitation and expansion of a distribution network that has been out of operation for decades	- Spring water tariff not yet set. - Inexistent cost-benefit analysis.

Table 3 – Use of climate readiness certificates in Lisbon

Stakeholders	Use description	Administrative requirements	Technical requirements	Existing barriers
CML	Certification of municipal social housing as well as municipal buildings	Courses for Auditors and Consultants	Certification software tool	- Outdated regulation (nearly 30 years old) makes it difficult to implement water reuse and rainwater harvesting measures in buildings (key aspects of the climate-readiness index).
Building owners	Certification of households, buildings & neighbourhoods			
Building planners	Project of households, buildings & neighbourhoods			

2.5.2. Key governance gaps/issues most relevant for the selected solutions of the Lisbon LL

Error! Reference source not found. identifies the OECD principles (OECD, 2018) on Water Governance that should be considered to achieve the Lisbon LL ambition. The OECD dimensions (i.e., "Enhancing effectiveness", "Enhancing efficiency" and "Enhancing trust and engagement") must be worked on, especially on issues aimed at the concrete involvement of stakeholders. The existing fragmentation of governance, especially in the case of water reuse, has hampered the promotion of more efficient and sustainable water use in Portugal, including Lisbon. Governance fragmentation has an impact on all three dimensions.

Table 4 – Key OECD governance principles relevant for Lisbon LL ambition.

Principle	Description (OECD, 2018)	Key gaps	Improvements proposed	Observations
Enhancing effectiveness				
#4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	Lack of regulatory clarity on the approval and governance of reuse schemes, namely on the water distribution service, makes the permitting processes very time demanding and affects the economic viability of water reuse.	A risk management approach can contribute for an increased flexibility in accommodating different stakeholders (i.e., producers, distributers, and users) in licensing reclaimed water systems.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #17, #25, #27).
		Lack of policy coherence - Need for planning and action at local and basin levels	Drought issues should be dealt in advance to drought itself by incorporating the principles and good practices in the use of water in non-potable uses	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS

Principle	Description (OECD, 2018)	Key gaps	Improvements proposed	Observations
			in the city, evolving from the current situation (systematic adoption of ad-hoc water shortage mitigation measures).	tools #17, #20, #24, #25, #27) climate readiness (BWS tool #33).
		Outdated regulations on building water systems are a barrier to the licensing of rainwater harvesting and water reuse systems.	By incorporating the principles and good practices in the use of water from different sources for non-potable uses in buildings, certification is a benchmark for designers and building owners.	Lisbon's goals: climate readiness (BWS tool #33).
Enhancing efficiency				
#5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy	Lack of knowledge and information on reclaimed water quality evolution in the distribution network.	The use of a water quality model to simulate the performance of the distribution network is a key tool towards water safety and may decrease the level of the treatment and/or monitoring requirements.	Lisbon's goal: safe water reuse (BWS tool #24).
		Lack of information about water reclamation production and use as well as other water sources alternatives to drinking water.	Compiling information about water demand in non-potable uses in the city and available water sources using decision-making tools.	Lisbon's goal: water-energy-phosphorous efficiency (BWS tools #17, #25).
Enhancing trust and engagement				
#10. Stakeholder engagement	Promote stakeholder engagement for informed and outcome-oriented contributions to water policy	Lack of public awareness of the local context that may increase water scarcity in Lisbon.	Contextual factors, when considered, may have a significant impact on public opinion. It is important to inform the public on the use of water in the city, the treatment of wastewater and the use of fit-for-purpose water.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tool #20).

Principle	Description (OECD, 2018)	Key gaps	Improvements proposed	Observations
	design and implementation	Lack of public engagement on issue of water scarcity.	Presenting water reclamation as a technical viable solution for climate-independent water source by using public relation initiatives, such as the artisanal production of craft beer from reclaimed water.	Lisbon's goal: safe water reuse (BWS solution #1).
		Lack of collaboration with stakeholders and potential users focusing on the benefits of using reclaimed water in fit-for-purpose uses.	Enhancing a common understanding about the availability of reclaimed water (and spring water) and the existing demand of water for non-potable uses (e.g., irrigation) facilitates the interaction between water utilities and their potential clients (e.g., green area owners).	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #17, #25, #27).
#11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	Need of improving a common ground of knowledge on quantity and quality aspects, for reaching consensus with the authorities and involved stakeholders, and engagement with the users (urban, rural or industrial) of reclaimed water.	Guidance material and decision-making tools can make expert-knowledge available for risk managers and stakeholders responsible for non-potable water uses in the city.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #24, #25, #27, #17).
#12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public & make adjustments when needed	Need for adjusting the legal framework of the water distribution service in Lisbon, as new water types (e.g. reclaimed water) should be delivered via a public distribution network.	Digital tools to support water balance and risk management.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #24, #25, #27, #17).

2.5.3. Recommendations for governance improvements to facilitate implementation of BWS solutions

To achieve the Lisbon LL vision, it is necessary to improve water governance mainly at local and national levels to deliver the required level of technical and economic feasibility and social acceptability related to the use of fit-for-purpose water and the use of climate readiness

solutions in buildings. Therefore, the recommendations for governance improvements relevant to Lisbon LL are the following:

- **Technical feasibility**
  - Revision of Decree-Law n. º 119/2019, for regulating the role of the distributor of reclaimed water, and revision of Regulatory-decree n. º 23/95, for regulating water reuse in buildings (linked to OECD principle #4) – legal constrain to be addressed by the Portuguese Environment Agency (APA) and the Ministry for Environment and Climate Action (MAAC). It will be discussed again in the last plenary CoP meeting of the Lisbon LL (in 2024) in which APA take part and will be included in one of the policy briefs B-WaterSmart will produce within T5.4 and which will be sent to APA and MAAC. LNEC and CML will keep communicating/discussing this constrain with the legal regulators and in all adequate fora in which they participate.
  - Implementation of Lisbon water reuse strategy, for the installation of a public reclaimed water distribution network (linked to OECD principle #11) – recommendation for CML to address as a strategy to be included in the Strategic Plan CML is preparing within InAll (T1.4), hopefully, after overcoming the former recommendation.
  - Change the monopoly situation currently existing in the Lisbon water distribution service (linked to OECD principle #12) – legal constrain to be addressed by the Ministry for Environment and Climate Action (MAAC). It will be discussed in the last plenary CoP meeting of the Lisbon LL (in 2024) and will be included in one of the policy briefs B-WaterSmart will produce within T5.4 and which will be sent to MAAC.
  - Increase knowledge on the use of alternative water sources (linked to OECD principle #5) – via the target group-specific communication and dissemination actions considered in WP7.
- **Economic feasibility**
  - Penalization in the use of non-sustainable water sources (linked to OECD principle #11). Urgency in implementation tariffs that promote water reuse in the city (linked to OECD principle #11) – to be conveyed to the water services regulator (ERSAR) via the last plenary CoP meeting of the Lisbon LL (in 2024) and one of the B-WaterSmart policy briefs.
  - Provide information for cost-benefit analysis of reclaimed water production and use (linked to OECD principle #5) – to be conveyed to the regulators APA and ERSAR, via the last plenary CoP meeting of the Lisbon LL (in 2024) and one of the B-WaterSmart policy briefs, and to the policy makers MAAC and EU Commission via the policy brief.
- **Social acceptability**
  - Disseminate the Urban Water Observatory and the artisanal beer produced using reclaimed water (linked to OECD principle #10) – to be conducted, essentially by the corresponding developers, LEN and ADTA, respectively, and with the support of

LNEC and CML, in all national and international fora possible; the UWO instrument to be conveyed also via a B-WaterSmart policy brief.

- Disseminate user-friendly risk assessment tools to support the discussion around risk (linked to OECD principle #11) – to be conducted, essentially by the tool #27 developer, LNEC, and the user, CML, in all national and international fora possible, and its importance to be conveyed also via a B-WaterSmart policy brief.

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2.6. VENICE

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The solutions demonstrated in the LL of Venice are, with reference to the section 1.3.5 of the description of work, identified with the following numbering, which is used as reference in the text below:

- Solution 4: Compact combined treatment technologies for industrial water reuse (pilot)
- Solution 11: Ammonia recovery from concentrated WWTP (pilot)
- Solution 16: Digital platform for water reuse
- Solution 19: Digital platform for sludge management

Beyond the identification of innovative technologies for extracting value from water, the challenge of the Venice LL is to create a context enabling their actual use; a virtual environment where the risks associated with the reuse/recovery are objectively identified and the solutions are found in a mediated manner, through the discussion/participation of all the key stakeholder of the related supply chain; for minimizing the risk of potential penalizations of part of it with the consequent risk of compromising reuse realization themselves.

The ambitions for Veritas, LL owner and water service multi-utility (the producers), are to mitigate/remove barriers (technical, political and regulatory issues) while demonstrating the opportunity and sustainability of resource recovery and CE logics. The actions that underline these challenges can be summarized as follows:

i) Building a shared, updatable, scientific knowledge base;
ii) Clarifying actual risks linked to resource recovery practices to minimize precautionary approaches and prejudices;
iii) Identifying the most sustainable and suitable opportunities of reuse/valorisation, guaranteeing an objective and repeatable process;
iv) Fostering fairer policies and laws drafting/revision towards resource recovery practices, with clear directions and without ambiguities;
v) Allowing an appropriated update and maintaining a participatory model of governance (the CoP) in which the key strategic stakeholders of the water chain are working together.

The following table summarizes the key-stakeholder roles (mainly governance roles) involved for pursuing the strategic objectives (SO) of the Venice LL, and their participation to each specific reuse objective. These stakeholders compose our territorial CoP and provide different points of view and perspectives to precisely identify barriers and drivers that affect the achievement of the objectives of reuse and to find feasible solutions.

The table is followed by the synthetic analysis of the governance gaps in relation to the SOs of the Venice LL with the related recommendations (it is worth to underline that the discussion is limited to chains with potential/current significant gaps concerning the reuse/valorisation purposes).

NATIONAL LEVEL	REGIONAL/LOCAL	GOVERNANCE Venice CoP Staheholder	VE-CoP Focus Group - Sol# #16	#19	#4	#11	Reg
MASE MINISTRY OF THE ENVIRONMENT AND ENERGY SECURITY (former Ministry of the Ecological Transition MITE)	**VENETO REGION** - Responsible for the National Law contestualizations in the territory "	TERRITORY SAFEGUARD and SECURITY					
		• ENV. & ECOLOGICAL TRANSITION DIR		✓		✓	
		- IWS and WATER SAFEGUARD UNIT	✓	✓	✓		✓
		- WASTE CYCLE and CE UNIT		✓			✓
		• SPECIAL PROJECTS FOR VENICE DIR	✓		✓	✓	✓
		• TERR-OFFICE HYDROG. INSTABILITY DIR	✓				
		- GENI CIVILI for each REG.PROVENCE (Total 7)	✓				
		Market-Cult.-Tour.-AGRICULTURE-Sport AREA					
		• AGROENVIRONMENT DIR	✓	✓		✓	
	ARPAV - Techn. Ag. for Env. Prev. and Protection	TECHNICAL AND MANAGEMENT AREA					
		- CE, EoW, By-PRODUCTS UNIT		✓		✓	✓
		ENVIRON. QUALITY REGIONAL DEP					
		- SOIL QUALITY UNIT		✓		✓	✓
		- WATER QUALITY UNIT	✓	✓	✓		
		TERRITORIAL SECURITY DEP					
		- HYDROLOGY UNIT	✓				
		LABORATORIES REGIONAL DEP					
		- CHEMISTRY 2 UNIT	✓	✓			
		- SOIL AND WASTE UNIT	✓	✓			✓
		- ORG. MICROPOLL. - PHYTOPH. UNIT	✓	✓			
		INNOVATION and DEVELOP. AREA					
		- PNNR, PROJECT&SCIENTIFIC NETW. UNIT	✓	✓		✓	
		METROPOLITAN CITY of VENICE					
		• *ENVIRONMENTALE PROTECTION AREA*	✓	✓			✓
ARERA – National Regulator Authority (Energy, IWS, ENV) Regulating technical performaces - conceiving TARIFF method to cover costs - for pushing resources recovery/reuse, conceived incentives (profit sharing) for four activities related to energy saving, water reuse and nutrient	**BASIN COUNCILS** (EGATO) Terr.Auth. for IWS Local authority for transferring the national targets into territory plans	• VENICE LAGOON BASIN COUNCIL	✓	✓			✓
ANBI - National Association of Consortia for territory and irrigation waters management	**ANBI - VENETO**	• STUDY CENTRE	✓		✓		✓
	RECLAMATION CONSORTIA	• ACQUE RISORGIVE CONSORTIUM	✓		✓		✓
		- ENVIRONMENT and PLANT OFFICE	✓		✓		✓
	INDUSTRIAL ASS	CONFINDUSTRIA VENEZIA					
		- ENVIRONMENT and SAFETY	✓		✓		✓
		ENTE ZONA PORTO MARGHERA	✓		✓		✓
	REGIONAL CONSORTIA of **IWS** UTILITIES	**VIVERACQUA**	✓	✓			✓
		PIAVE SERVIZI S.p.A.	✓	✓			✓
		ALTO TREVIGIANO SERVIZI S.p.A.	✓	✓			✓
		ACQUEVENETE S.p.A.	✓	✓			✓
		ACQUE VERONESI s.c.a.r.l.	✓	✓			✓
		AZIENDA GARDESANA SERVIZI S.p.A.	✓	✓			✓
		BIM GSP S.p.A.	✓	✓			✓
		LIVENZA TAGLIAMENTO ACQUE S.p.A.	✓	✓			✓
		VIACQUA S.p.A.	✓	✓			✓
		ACQUE DEL CHIAMPO S.p.A.	✓	✓			✓
		MEDIOCHIAMPO S.p.A.	✓	✓			✓
		ETRA S.p.A.	✓	✓	✓	✓	✓
		VERITAS S.p.A.	✓	✓	✓	✓	✓
	REGIONAL AG. for INNOVATION In the Primary	**VENETO AGRICOLTURA** AGRICULTURAL RESEARCH SECTOR	✓	✓		✓	
	CONS & SECT. ASSOCIATON	CONFAGRICOLTURA		✓		✓	
		COLDIRETTI		✓		✓	
CIC - Italian Composting and	**CIC**	- TECHNICAL COMMITEE		✓		✓	
UNIVERSITY	**Venezia**	DAIS DEP - PLANT and PROCESS	✓	✓		✓	
	Verona	BIOTECNOLOGY DEP - CHEMICAL PLANT	✓	✓		✓	

Legend: AG=Agency; ASS= Association; CE = Circular Economy; CONS=Consortium/a; DEP=Department; DIR= Direction; ENV= Environment or Environmental; EoW=End of Waste; IWS = Integrated Water Service; REG=Regulation

Finding and describing governance implications to the solutions demonstrated is not straightforward for those that are at pilot stage, given that results are not yet available and therefore a business models and potential circular market are not still identified. On the other side, the digital platforms, i.e., solutions #16 and #19, are actually instrumental to overcome existing barriers and gaps in achieving the objectives of collaboration and consensus (and identify roles and responsibilities) to realize a smarter use of water related resources.

In the following sections therefore the analysis and reasoning are mainly focused on solutions #16 and #19, with minor reference to the other two, and they will be presented mainly as solutions to bridge over existing gaps, more than as solutions limited by the gaps. Basically, the discussion below, describes the governance gaps versus the strategic objectives to be achieved (as described by the LL's strategic agenda) and for which the platforms are going to be created and adopted.

2.6.1. Key governance gaps and issues

The key governance gaps identified, as for the OECD principles of water governance, apply to the dimensions of "Enhancing effectiveness" and "Enhancing efficiency". The third dimension "Enhancing trust and engagement" is not of major concern since, for all solutions, the key stakeholders including end-users have been involved (or are going to be involved at a later stage, in case of solution #11) in the CoP, where they are working together and are highly engaged and actively participating in an open and trustworthy environment.

Enhancing effectiveness

Clear roles and responsibilities: analysing whether roles are missing or are perfectly defined is a difficult task from an external perspective even for established technologies, but it is even more difficult, if not impossible, for those solutions which have not yet found a stable answer, through demonstration at higher TRL levels, on the convenience of recovery and/or for which the related potential circular market is not identified (such as nitrogen recovery as salt produced, starting from WWTP's matrices, solution #11). Therefore, in the case of nitrogen (#11), it could be reasonably supposed, in the first instance, that, since this new recovery model is not still well set, also some roles and policy responsibilities may need to be better defined. We can say however, that also in this case general roles are clear and defined and, at regional level, they are also participating to the ongoing work: new roles to be involved may be necessary once the results of pilot-techonlogies will show the convenience of pursuing this N-recovery strategy and it will have to be decided whether to make the product fall under the discipline of products (DM 264/16) or of end of waste (Article 184 ter of the Legislative Decree N. 152/2006).
Certainly, a case in which this principle is clear is the one of direct agricultural reuse of the purified effluent (related to solution 16). The upcoming national implementation of the EU Regulation n.2020/741 (on 23 June 2023) brings still unsolved ambiguities regarding roles and responsibility in the Governance as well as in the General Management Chain of this kind of water reuse.

Policy coherence: gaps related to this principal are usual, due to the sectoral nature of governance and policy itself: they are amplified by the lack of knowledge sharing. This is why the DSSs, we are building at regional scale (solutions 16 and 19), are strategical means to bridge this gap.

The sector of Sludge management (solution 19) is the most affected by the lack of cross-sectoral coordination across policies (environment and agriculture), but also (and overall) by the lack of vertical coherence, coordination and alignment among European, National and Regional policies; which overrides or even neutralizes local efforts (e.g., regional, LL/CoP levels). This is what is happening in our case on sludge management, where a successful local coordination effort towards the correct reuse of sludge might be invalidated by the subject of a national strategic framework, approved by the EU, which goes in the opposite direction.

Enhancing efficiency

Data & information: Governance gaps in data and information availability and sharing are typical in many sectors and as such limit reuse and valorisation in several fields. There is a tendency to protect and retain information and data, resulting in fragmented data availability, organized in silos often unknown and, if known, they are not interoperable to allow easy exchange. It is envisaged that this tendency is even fortified by the contextual inclination to not adopt cognitive global approaches (in a globalized world it seems to be an oxymoron, but it is).

So, although in some case data are more adequate than others, they are not effectively and correctly shared among organizations (and the information provided to the population can be manipulated). The sludge management and effluent reuse on a regional scale suffer gaps related to this principle and the collaborative environment created by our solutions 16 and 19 aims at filling this gap.

Financing: Difficult to point at financing as major gap for achieving set objectives through solutions implementation, but of course costs and funding are always part of the problem. It is our opinion that the main gaps relate to the effectiveness dimensions, and therefore potential governance gaps related to financing are not so relevant in general; exception done for the effluents reuse potentiality, where, together with the needs of clear roles and responsibilities identification, as described above, the covering of costs represents one of the most important issue in the DPR conceived for the national application of EU Regulation n.2020/741.

2.6.2. Recommendations for governance improvements

The description of potential recommendations follows the same structure presented in the previous section and relate to the identified gaps in the same order.

Enhancing effectiveness

Clear roles and responsibilities: There are no specific suggestion as improvements related to the gap described for solution #11 since today, roles and responsibilities are coherent with the current practice in relation to this path of N-recovery and the related potential market.

When it comes to water reuse (solution 16), an attempt of recommendation has been already performed by the CoP of the Venice LL. Indeed, in March 2023', the CoP-Venice of the BWS project expressed an opinion shared by the stakeholders regarding to a Presidential Decree in application of EU Regulation n.2020/741, at that moment in the consultation phase.

The consultation document (if needed) is available. Here in quotes, are cited some problematic aspects highlighted: "The text presents numerous interpretative obstacles and moreover administrative, technical and economic critical points which, instead of favouring, could discourage reuse. The document is weak in clarity and consistency with the premise objectives of the Regulation. A substantial rewriting is recommended. Especially for what concerns roles, responsibilities, methods and times in relation to the Risk Management Plans (redaction and responsibility of application); methods and roles for the covering of costs(etc..).

Furthermore, the climate challenges we are experiencing might have already further helped on reducing this gap. Due to the serious drought occurred in 2022, and considering the current risk to face a similar situation this year (with all repercussions on the drinking water and irrigation sectors as well as the economic and social one), in April 2023 was issued a law-decree "urgent provisions for drought", integrated and converted in *Law n.68 in June 2023* which established a Control Room (at the Council of Ministers Presidency) with functions of guidance and coordination of all initiatives and activities aimed at mitigating the drought consequences. For the agricultural reuse of effluents, the text refers directly to the EU-Regulation: if correctly referred to, though emergency-based, this could be a first way of applying the EU Regulation (pending a dedicated national DPR).

Policy coherence: In general, an essential contribution to clearly identify policies and roles is given by the knowledge. It is therefore needed to establish the conditions for sharing an independent and concrete knowledge towards the formulation of more correct, fair and sharable laws and regulations and the creation of coherent and interconnected actions, not opposing and contradicting each other.

Enhancing efficiency

Data & information: as already addressed, there is the need of a more effective way to share knowledge: i) towards citizens (and for that social networks are very effective means); ii) vertically (Europe and National governments; national governments and regions) and iii) transversally (National governments) among the several institutions and regulatory and technical hierarchical roles. Our solutions 16 and 19 are built to cover some of the gaps detected in information availability and sharing.

Financing: in order to propose improvements related to eventual governance gaps in financing, all those related to effectiveness must be addressed first.

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3. Conclusions and key recommendations: improving water governance across B-WaterSmart LLs

3.1. Water reuse

3.1.1. Enhancing effectiveness

Clears roles and responsibilities is one of the key dimensions for improvement to facilitate the adoption of new products and concepts that have emerged recently without a clear institutional and legal framework to support them. In most Living Labs this will be a key area of investment and future recommendations.

According to the diagnosis undertaken by the B-WaterSmart LLs, one crucial need is for establishment of national or federal/national guidelines to support wider application of products such as process water in industry (East Frisia, Germany), especially among risk-aware stakeholders. Responsibilities are in some cases spread across multiple institutions, which is all the more challenging when creating new circularities across the nexus **water-energy-waste.** Our LL in Alicante, Spain has come across the same challenge, and recommends protocols for clarification of roles and responsibilities between institutions and companies across the value chain of reclaimed water.

In some cases, the creation of a new institution of structure that supports the implementation of these new circularities may be the adequate response, especially in face of the climate crisis. In the case of Italy, the serious drought of 2022 has prompted the creation of emergency structures that might drive a faster implementation of EU regulation on reuse for agriculture, which has been in force since June 2023. In Germany, a water strategy at the federal state level with clear measures and a specific mandate to authorities to actively foster and enable industrial re-use would support the management of industrial water, in order to ensure distribution according to use (fit for purpose) and maximise environmental resources as demand for fresh water surges.

Understandably the above-mentioned issues also reflect at the level of **policy coherence**, especially between national policies and institutions. Responsibilities for areas such as water management and environment are often managed at a different level as health guidelines, but these areas need to be articulated in order to guarantee sound risk assessment mechanisms that will facilitate a wide use of reclaimed water. Licensing regimes in some countries still require more flexibility in order to maximise the use of water resources available to WWTP.

In terms of **capacity**-building, the most salient needs identified are for creating high-level expert groups that can disseminate best practices and provide coherent guidelines on water reuse. State or regional authorities do not usually have the scale to hold enough technical capabilities on specific water-smart solutions.

3.1.2. Enhancing efficiency

Key recommendations for enhancing the efficiency of water-smart solutions pertain the provision of clear and transparent **data & information**, including accurate information on policies and stakeholders' interests, which can ensure greater accountability and support the development of new business models for reclaimed water and sludge. The dissemination of user-friendly risk assessment tools, publicly available, is an area of focus for B-WaterSmart and is expected to crucially support the adoption of water innovations in a transparent way (e.g., Lisbon).

It is also crucial to improve coherence between databases and available platforms, in order to stimulate data sharing and implementation of solid guidelines for best practices. Estimation of water demands in specific geographical areas and sectors will also be crucial to support drought response and adaptation to water scarcity (e.g., supporting decisions on where to invest in infrastructures for water reuse). This is an area of focus for B-WaterSmart (e.g., Lisbon).

Considering that these water-smart products are still emergent in policy arenas and markets across Europe, responsibilities for **financing** some solutions are yet unclear. In some cases, most financing will be ensured by public funds. In other cases it will have to be seen how the costs will develop (e.g. for service water in industry, East Frisia). It is not yet possible to make a conclusive statement on this.

Creating adequate conditions for financing the water-smart solutions will also require clearer **regulatory frameworks** for reclaimed water and clarifying the definition of different water types and the regulations applicable to each.

Innovative governance – In the same line as administrative responsibilities for licensing new products are yet being clarified, there might be a need for new governance structures to support the adoption of new products such as 'cow water' in the dairy industry. It is necessary to make clear the public benefits of reusing water, e.g., having more fresh water available for ecosystem services in a context of growing demand. A new structure could leverage innovative solutions, public-private partnerships and community engagement, e.g., a National Water Governance Board comprising representatives from government agencies, private sector, civil society, academia, and local communities. This board would oversee water

management policies, ensure transparency, and facilitate inclusive decision-making (Alicante, Spain).

3.1.3. Trust and management

New governance arrangements to support a circular economy for water will need to operate with **integrity and transparency**, by establishing first reference cases in industries with a positive image (such as dairy).

In regards to **stakeholder engagement**, the Communities of Practice organised around the six LLs of B-WaterSmart are being developed in a way they can endure for the longer term, supporting the development of circular business models, as well as innovations in policy and regulation. The CoPs should continue to organise stakeholder dialogue and cross-border information exchange beyond the project duration, and the same approach can also serve as a blueprint for similar activities in the regions involved and beyond. The involvement of authorities will have to be interdisciplinary and cross-sectoral.

3.2. Sludge management

3.2.1. Enhancing efficiency

Some of the considerations made above regarding the creation of new value chains around emerging products are applicable to sludge, a byproduct of wastewater treament. The recovery of nutrients and sudge for use in agriculture and energy production has come across some technical and policy barriers. Regarding **clear roles and responsilities**, public-private partnerships are for some LLs a way forward to promote a wider adoption of sludge across the water vaue chain.

The sucessful implementation of sludge related solutons will require a better **policy coherence,** though, in some cases the revision of national legislation on organic fertilisers (Bodø). There is a need for integrated strategies for sudge management. The EU Urban Wastewater Treatment Directive (UWWTD 91/271) should be revised in such a way that integrated water management and resource recovery is accelerated, in line with the EU Circular Economy Action Plan.

In terms of financing, there remains a lack of funds for new investments in the sludge value chain, which coud be overcome by clearer national guidelines and a more integrated strategy for the management of water resources across the nexus water-energy-waste.

3.2.2. Enhancing effectiveness

There needs to be a consensus at European level to promote a common roadmap for sludge management. **Regulatory frameworks** stil hold in some cases barriers for a wider application of this product, especially regarding the uncertainty and territorial heterogeneity of criteria between regions (in federal states).

Stronger articulation between regions will also be needed to create the adequate scale to develop new markets, such as demand for sludge for energy production (e.g., Bodø).

3.2.3. Trust and engagement

To foster trust for the use of sludge, a key driver is better information sharing for accountability of actions, policies and decisions (**integrity and transparency**). Tensions and **trade-offs** between policy areas such as agriculture, environmental conservation and wastewater management create uncertainly e.g., for the implementation of sludge reuse, but are also especially relevant for those solutions that require extensive investment in urban infrastructure and decisions on land use planning that will have long-term repercussions.

Besides the above-mentioned ongoing CoPs, a proposal that emerged from the D5.5. assessment is the creation of a "Sludge Round Table" at regional or national level to ensure involvement of the experts and the community.

3.3. Stormwater management

3.3.1. Enhancing effectiveness

Clears roles and responsibilities: in the field of stormwater management, responsibilities are yet unclear for new concepts such as nature-based solutions (e.g., Bodø), which require strong articulation between planning authorities, land owners and water utilities. A working group or coordination entity would help the uptake of Blue-Green solutions for adaptation to climate change, in line with the EU and national adaptation strategies. There is a need for national guidelines on how municipalities and counties should integrate climate change adaptation into their land use and planning processes (**policy coherence).**

Pertaining the **appropriate scales** at which the solutions are being implemented, attention has to be paid to transboundary coordination and harmonisation between EU legislation at the national and regional level, especially in the case of Flanders (Belgium). More alignment of federal and regional risk assessment procedures on health and environment should reduce disparities and duplication of work for water-smart innovations.

In terms of **capacity**-building, nature-based solutions key stakeholders have also manifested interest in attending specialised training and gaining in-depth knowledge on the available technical possibilities, costs and implications.

3.3.2. Enhancing efficiency

Data & information: alongside the above-mentioned training for key stakeholders, implementation of NBS for stormwater management would benefit from the creation of a solid knowledge database. Coordination between different initiatives, including water-smart innovations, should improve access to and coherence among data sharing resources. Considering the interconnectedness of regions that share common catchment areas, river basins, or aquifers, cross-border data sharing should be made easier.

Regulatory frameworks: updating and clarifying definitions of water types is necessary to prevent confusion about which water sources are appropriate for what kind of uses., for example in regards to the distinction between rainwater and stormwater (Flanders). The regulation of infiltration methods (direct infiltration or surface infiltration) and related quality standards should be streamlined accordingly.

Considering that innovative water-smart products are still emergent in policy arenas and markets across Europe, responsibilities for **financing** some solutions are yet unclear. For nature-based solutions for stormwater management, additional sources of funding will need to be created, such as additional water fees or alternative mechanisms based on payment for ecosystem services (PES), through new ways of calculating the costs of available water, focused on the value of risk and cost prevention over the longer term. Regarding financing, more involvement of banks and insurance companies, as well as stakeholders e.g., industries that benefit from water-secure systems should be involved. In any case, the goal should be to keep the water locally, allowing an area to become as much as possible ‘water neutral’. (e.g., by reusing stormwater).

The above elements will be crucial to support **innovative governance** models, supported on scientific expertise but also with an effective and regular involvement of key sectors and stakeholders (such as farmers who are already involved in stormwater management in LL Flanders). New partnerships between sectors, as well collaboration with competent authorities, will be determinant to contribute to the regular review and updating of regulations (e.g., related to sludge management). This will also contribute for a more expressive societal and policy impact of B-WaterSmart, especially in the case these governance arrangements have continuity over time and beyond the end of the Project.

3.3.3. Trust and engagement

A broader involvement of stakeholders in the value chain and in upstream and downstream areas could improve shared problem ownership and investment opportunities. The Communities of Practice (CoP) of each LL have kickstarted this process and are striving to ensure the continuity of collaboration beyond 2024. There are challenges to face, such as raising the interest of the public for water related challenges (e.g., Norway), but also to ensure a diverse and inclusive process of **stakeholder engagement**, never losing sight of the need to ensure adequate representation of vulnerable social groups and women.

Overall, across the different solutions of the B-WaterSmart LLs, there is a need for increased coordination between institutions, as well as harmonisation between legislation and regulatory frameworks, in addition to solid knowledge bases (data & information), for which the digital platforms under development in B-WaterSmart are clearly contributing.

This report includes specific recommendations for revision of legislation and regulatory frameworks in each LL, which will be built on and further developed in the deliverable **D5.6. Recommendations for Policy and Regulation**, to be submitted in Month 42 (February 2024).

The following table summarises the key recommendations that are most relevant for B-WaterSmart products and for each LL. Most of them are key for a wider implementation and replication of water-smart solutions across Europe and are also relevant beyond the geographical scope and duration of this Project.

Table 5 - Summary of recommendations across the LLs

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
1. Clear roles and responsibilities	(AL) Define common protocols for the definition of roles and responsibilities for reclaimed water. Need to define who has to pay for the additional cost of this new source of water Process water (EF) Establishment of coordinated technical advice at the federal level Backing for authorities at state/district level Bundled responsibility for industrial water supply in a central point of contact at a Federal Office / Authority, such as e.g., UBA (Umweltbundesamt), BfR (Bundesanstalt für Risikobewertung) or similar ones.	.	In the Bodø case, the roles/responsibilities when it comes to NBS for stormwater are not clearly defined (planning vs. water/wastewater and infrastructure/roads). Other municipalities tried different coordination solutions; working group or individual coordinator should be established. It is also unclear who to see as the responsible source/'producer' of stormwater, e.g., property owners vs. road owners.	✓	✓	✓		✓	
2. Appropriate scales within basin systems	Process water considered at local level and no river-basin; A recently issued national water strategy is a good starting point in Germany for complementing this by a federal state water strategy that can promote	Energy from sludge. Volume in Bodø alone is small, need to coordinate, collaborate with others in the Salten Region. This will not be a problem, as Iris Salten already is	NBS (Bodø): Processes handled at municipal level. This is appropriate since local conditions must be considered and dialogue is essential to develop and		✓		✓		

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	industrial reuse at the level where the actual decisions are taken. Technical input provided by water associations needs to be taken up politically (Germany).	established as an intermunicipal waste management company serving the whole region.	implement good solutions Improve transboundary coordination and the translation of EU legislation to the national and regional level.						
3. **Policy coherence**	(AL) If there is more water than has been granted, it should be possible to distribute it to meet specific needs without the requirement of an administrative concession. Equal and inclusive access to information for all individuals; continuously review and improve ethical practices (EF) Introduce a new paradigm in defining required water for intended use; legal anchor point can be an overarching strategy at the federal state level for	(B) Sludge for energy: Biogas production is encouraged, but municipalities have prioritised BEVs for public tendered transport. Tension between agriculture, wastewater and environmental policy has resulted in prolonged revision of the national regulation of organic fertilisers, which creates uncertainty regarding the future framework conditions for alternative sludge management strategies.	NBS: There are statal guidelines for climate and energy planning and climate adaptation in municipalities, which encourage integrated management and require that NBS shall be assessed and non-selection of NBS must be justified. On the other hand, water cycle services are to be based on "Best Available Technologies". There may also be tensions between desire to implement blue-green infrastructure and other infrastructure	✓		✓	✓		✓

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	management of industrial water. Align federal (health) and regional (environment and water) risk assessment procedures.	(VE) A DSS is in building at regional scale, as a strategic solution.	needs/priorities, such as parking space.						
4. Capacity	(process water) Establish a higher-level expert advice and decision-support at both state and federal level. Creation of a focus group / working group to bundle experiences and develop an overarching perspective and guidance -> put decision makers in a position to take technically sound decisions. Drought issues should be dealt in advance to drought itself by incorporating the principles and good practices in the use of water in non-potable uses in the city, evolving from the current situation (systematic adoption of ad-hoc water shortage mitigation measures). Harmonisation of risk management approaches		The Blue-Green Factor has only recently been introduced. Some users/property developers would like to get more knowledge/training on NBS; Proposed training on NBS targeting a mix of stakeholders, with the aim to also build knowledge and share experience across sectors.		✓	✓			

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	for licensing reclaimed water systems; expand certification schemes								
5. Data & information	Promote openness and transparency in sharing information. This involves providing accurate and comprehensive information about actions, policies, and decisions that impact individuals, communities, or stakeholders. Transparency helps build trust and fosters accountability. (EF) Developing guideline with harmonised criteria for approval and requirements of monitoring and data provision. Create clarity about the roles and interests of the parties involved (business model). Promote digitalisation of water quality data monitoring, documentation and exchange. Compiling information about water demand in non-potable uses in the city and available water		Building up a national knowledge base on NBS; several documents and guidelines with examples on NBS, but lack of a national, overarching guideline. Improve access to and coherence among different data platforms. Stimulate cross-border data sharing; special attention to consumptions that might be underestimated (groundwater for agriculture)			✓	✓	✓	

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	sources using decision-making tools.								
6. Financing	Public utilities must cover their costs (depending on the statutes). This also applies to the dairy industry. Viable business models must be developed to finance reuse projects. Dairy industry is optimistic that costs for the solution can be compensated by retail prices of the product once they get a credible label for being produced under particularly sustainable conditions, e.g., with a low water footprint.	Implement well-defined regulations and policies that promote proper sludge management and establish clear responsibilities for the different actors involved. Legal certainty can encourage investment in sludge management projects. Collaborative models can be established to share costs and benefits between public entities and private companies, using mixed funding sources.	(Bodø) The amount of grant funding for municipal and county climate adaptation is very limited (NOK 6.4 million in 2023) and could well be increased to accelerate knowledge development and implementation of NBS. There has been discussion at national level, whether water fees can be used to finance NBS, or not. So far there is no stormwater fee in Norway. Alternative ways to calculate the value of ecosystem services and innovations for circularity are needed. Stimulate the involvement of banks, insurance companies and other	✓	✓		✓		✓

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
			stakeholders for investment.						
7. Regulatory frameworks	Once the overarching guidance and harmonisation is solved for the approval process, a sound, harmonised and effective implementation of monitoring, surveillance etc. will follow.	Heterogeneous regulatory framework in the application of sludge that generates a lack of confidence in the agents involved in the sector (farmers, operators, etc.). (Bodø) Sludge for energy: Need to finalise revision of the national regulation on organic fertilisers.	Clarify definitions and streamline regulations on water types and their relation to groundwater quality.		✓		✓		✓
8. Innovative governance	-The scientific community and other expert actors in the sector must be involved in order to be able to make innovative and rigorous policies Create transparency about use cases / best practices, Create topic-related exchange formats (not politically-driven but fact-driven), characterized by	-It is important that the competent authorities and water managers work on the continuous review and updating of the regulations related to sludge management, taking into account technological developments, international best practices and environmental	Innovation partnership contracts are increasingly deployed in the Norwegian water sector, also in relation to stormwater management, but so far mainly where the NBS includes advanced technology components.	✓					✓

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	the exchange of data, facts, project successes; thus enabling a learning curve for competent authorities.	sustainability objectives. . Create a "Sludge Round Table" like the "Water Round Table" at regional or national level. It should be an initiative represented by administration, companies, scientific and expert community, users, etc. It could update regulations and cover legal issues with the whole sector in order to respond to real and current problems.							
9. Integrity and transparency	Key is a clear communication of the background, objectives and also public benefit of such a solution, the legal & technical requirements and how they are met and monitored. Establish first reference cases in			✓	✓	✓	✓	✓	✓

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
	industries with a positive image (such as dairy).								
10. Stakeholder engagement	Diversity and inclusiveness: There is a need to assess the principles of proportionality and representativeness of diverse groups of people in decision-making processes and participatory activities, considering race, ethnicity, gender, age, socio-economic status, education, physical abilities, among others.- Always justify the selection processes, Involvement of authorities would have to be more interdisciplinary and cross-sectoral => joint "water days" for a common vision/objective – each industry has its multiplier network, but not yet the region (for the topic of water).	A broader involvement of stakeholders in the value chain and in upstream and downstream areas could improve shared problem ownership and investment opportunities	NBS (Bodø): the degree of awareness and interest from the public has been limited up to now.	✓	✓	✓	✓	✓	✓
11. Trade-offs across water users,	(AL) Farmers' perception of reclaimed water is that if they accept it, they give up other water resources			✓		✓	✓		

	Reclaimed water	Sludge	Stormwater/NBS	AL	B	EF	FL	LX	VE
rural and urban areas, and generations	(groundwater, drinking water, etc.). Change perceptions by offering greater flexibility and agility in administrative water concessions by applying certain limits and supervision. This can ensure direct and agile exchange of water resources, always with administrative oversight to ensure that water is not misused.								
12. Monitoring and evaluation		Clearly define the minimum types of treatment that sludge must receive prior to its application in agriculture and the physical-chemical and microbiological parameters that must be met depending on the type of crop, establishing a plan for its implementation so that public and private initiatives have legal certainty and a roadmap for where to go.		✓				✓	✓

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Annexes

I. Summary table: key governance gaps in LL Alicante

PRINCIPLE	DESCRIPTION	KEY GAPS	IMPROVEMENTS PROPOSED	OBSERVATIONS	REFERENCES
Enhancing effectiveness					
1. Clear roles and responsibilities	Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.	*For an effective implementation of this solution, should a new organisation be created, or should responsibilities be re-assigned (e.g., for operational management, provision of a specific service, regulation, tariff setting, licencing)?* *Reclaimed Water* *- There are many actors involved in the value chain of reclaimed water and* ***roles and responsibilities are not well defined,*** *so there are overlaps and sometimes lack of involvement of the parties.*	*Reclaimed Water* *- Regarding the definition of roles and responsibilities, it is proposed to define common protocols so that it is not left to the will of the entities to promote reclaimed water.*	*Reclaimed Water* *There are many actors involved in this field. The main one is the hydrographic confederation (which grants the use of reclaimed water), there is also EPSAR - Entidad Pública de Saneamiento de Aguas Residuales de la Comunidad Valenciana - (which acts at regional level) and the local administrations (which have the ownership of the wastewater treatment plants). There is a large overlap in some roles and there are also some issues that are not addressed because the*	*Reclaimed Water* *REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on minimum requirements for water reuse*

				roles are not assigned correctly. *In short, the leadership role to promote and encourage the use of reclaimed water is not defined. The result of this is very long administrative processes for the concession of the management and distribution of reclaimed water.* *It should be noted that at least in Spain irrigators facilitate cooperation between water managers and farmers for the use of reclaimed water.*	
2. Appropriate scales within basin systems	Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.	*Are there issues regarding multi-level cooperation at the basin and transboundary level, which will have to be overcome to allow for long-term adaptive strategies?* *Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
3. Policy coherence	Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for	*Effective cross-sectoral coordination across policies for water, energy, waste, agriculture, industry and spatial planning, etc.; is there*	*Reclaimed Water* *- Effectively apply the **"use of leftovers" so that it is more flexible** to modify and*	*Reclaimed Water* *There is a lack of policy coherence with regard to the water allocated by a*	*Reclaimed Water* *REGULATION (EU) 2020/741 OF THE EUROPEAN*

	water and the environment, health, energy, agriculture, industry, spatial planning and land use	*a need for more coordination mechanisms, incentives to address conflicts between sectoral policies and practices?* *Reclaimed Water* *There is **no efficient management of the water allocated by a concession**, as occasionally it is not used to meet specific water needs.*	*adapt to the specific needs of the moment. In other words, if there is more water than has been granted, it should be possible to distribute it to meet specific needs without the requirement of an administrative concession.* *- **Withdraw or suspend concessions** if they are not being used responsibly so that these resources can be used for other purposes.*	*concession or a legitimate title for the private use of water, as it is sometimes not used by its holder. In other words, the administrative concession of the volume of water is very difficult to modify. This means that there is no fair distribution of water resources.*	*PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on minimum requirements for water reuse*
4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	*Are there enough competencies and knowledge to implement this solution, or does it require training of public officials and water professionals; or training of stakeholders/end-users; or e.g., hiring additional staff?* *Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Enhancing efficiency					
5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it	*Are available data sufficient and adequate to support the implementation and management of this solution? (precision, regularity, comparability) Are*	*Not applicable*	*Not applicable*	

	to guide, assess and improve water policy	*they shared between organisations and with the public in a transparent way? (identify existing overlaps and propose synergies)* *Not applicable*			
6. Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner	*Are there adequate and sustainable financial resources for the implementation of the solution at a wider scale (public, private); ensuring future affordability for users; mechanisms to allow revenue for mandates of water institutions (polluter-pays, user-pays, environmental services)?* *Sludge* *There is **no adequate regulatory framework for sludge management and valorisation** and this leads to a lack of funding for new investments.*	*Sludge* *- Public-private partnerships can be an effective strategy for financing sludge management projects. **Collaborative models can be established to share costs and benefits between public entities and private companies,** using mixed funding sources.*	*Sludge* *A financing scheme is needed to promote the implementation of innovative sludge management solutions, such as energy recovery or the production of fertiliser products from sludge.* *Without solid financial support to back it up, there is no incentive for the situation to improve.*	*Sludge* *Real Decreto 1310/1990, de 29 de octubre, por el que se regula la utilización de los lodos de depuración en el sector agrario.* *Orden AAA/1072/2013, de 7 de junio, sobre utilización de lodos de depuración en el sector agrario.*
7. Regulatory frameworks	Ensure that sound water management regulatory frameworks are effectively	*Are key regulatory functions adequately allocated, are enforcement mechanisms in*	*Sludge* *- **This regulation must be updated so that it is homogeneous** in all*	*Sludge* *There is a very heterogeneous regulatory framework in the*	*Sludge* *Real Decreto 1310/1990, de 29 de octubre, por el que se regula la utilización*

	implemented and enforced in pursuit of the public interest	*place (e.g., rewards and penalties)* *<u>Sludge</u>* *There is **great regulatory uncertainty and heterogeneity of criteria** at territorial level.*	*territories. To this end, there needs to be a **consensus at European level** to promote a common roadmap for sludge management. The search for **harmonisation and standardisation** in the regulation of sludge must be **promoted collectively and cohesively** among all agents.* *-It is important that the competent authorities and water managers work on the continuous **review and updating of the regulations related to sludge** management, taking into account technological developments, international best practices and environmental sustainability objectives.*	*application of sludge that generates a lack of confidence in the agents involved in the sector (farmers, operators, etc.). For example, in the Valencian Community the Royal Decree is very lax, unlike in other autonomous communities in Spain, which is more restrictive. This variability can make it difficult to compare practices and results between different geographical areas.*	*de los lodos de depuración en el sector agrario.* *Orden AAA/1072/2013, de 7 de junio, sobre utilización de lodos de depuración en el sector agrario.*
8. Innovative governance	Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders	*Is there a need for fostering metropolitan governance, inter-municipal collaboration, partnerships, and performance-based contracts; platforms for science-policy interface; user-friendly interfaces (e.g., smart and open data); integration of different*	*<u>Cross-cutting</u>* *- The **scientific community and other expert actors in the sector must be involved** in order to be able to make innovative and rigorous governance and*	*<u>Cross-cutting</u>* *Although some efforts are being made to involve key stakeholders and communities in governance, there is still much room for improvement in*	

		sources of knowledge and practices *<u>Cross-cutting</u>* ***The current governance approach needs a new structure** that will leverage innovative solutions, public-private partnerships and community engagement.*	*incorporate cutting-edge technologies and innovative solutions (smart and open data)policies.* *- Promote **public-private collaboration** and exchange between water management entities through **discussion forums and benchmarking initiatives.*** *- Create a **National Water Governance Board** comprising representatives from government agencies, private sector, civil society, academia, and local communities. This board would oversee water management policies, ensure transparency, and facilitate inclusive decision-making.*	*order to work towards a bottom-up approach.*	
Enhancing trust and engagement					
9. Integrity and transparency	Mainstream integrity and transparency practices across water policies, water	*Are there independent authorities to investigate water issues and support law enforcement (e.g.,*	*<u>Cross-cutting</u>* *- Promote **openness and transparency** in sharing*	*<u>Cross-cutting</u>* *Water-related information needs to be readily*	

	institutions and water governance frameworks for greater accountability and trust in decision-making	*ombudsmen?); does this solution require better accountability and control mechanisms (e.g., for corruption in public procurement), codes of conduct?* *<u>Cross-cutting</u>* *Address **ethical practices** in providing data & information related to water cycle.*	*information. This involves providing accurate and comprehensive information about actions, policies, and decisions that impact individuals, communities, or stakeholders. Transparency helps build trust and fosters accountability.* *- Strive to provide **equal and inclusive access to information for all individuals,** irrespective of their backgrounds or characteristics. Take into account diverse needs, including language accessibility, accommodating disabilities, and ensuring that information reaches marginalized or disadvantaged groups.* *- Continuously **review and improve ethical practices** related to information and data and make necessary adjustments.*	*available and accessible to individuals who have a legitimate need for it. This includes making information public, providing access to relevant documents, and disseminating information in a clear and understandable manner with gender perspective.*	
10. Stakeholder engagement	Promote stakeholder engagement for informed and outcome-oriented contributions to	*Are there public, private or non-profit actors that might be affected by this solution, including newcomers (e.g., property developers) or*	*<u>Cross-cutting</u>* *- Achieve **equitable gender representation in team members** in all activities (40/60%).*	*<u>Cross-cutting</u>* *There is a need to assess the principles of proportionality and representativeness of*	

	water policy design and implementation	*under-represented groups that should be more involved in decisions for a future effective implementation of this solution?* *<u>Cross-cutting</u>* ***Underrepresentation of diverse groups** in stakeholder engagement activities (dissemination events, visits to the plant, CoPs, etc.) and in decision-making processes*	*- Achieve **equitable gender representation in the involvement of different stakeholders** in the project: partners, local community, industries, etc.* *- Strive to have **samples with diversity**, including different age groups, socioeconomic levels, educational backgrounds, and representation of the main ethnicities within the researched context.* *- Always **justify the selection processes**, with special attention to those processes that cannot achieve representativeness in the different variables presented.*	*diverse groups of people in decision-making processes and participatory activities, considering race, ethnicity, gender, age, socio-economic status, education, physical abilities, among others.*	
11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	*Is there cooperation between e.g., water institutions and spatial planners; need for further empowerment of local authorities & users to address issues with water services* *<u>Reclaimed Water</u>* *Farmers' **perception** of reclaimed water is that if they accept it, they give up other*	*<u>Reclaimed Water</u>* *-Change perceptions by offering greater **flexibility and agility in administrative water concessions** by applying certain limits and supervision. This can ensure direct and agile exchange of water resources, always with administrative oversight to*	*<u>Reclaimed Water</u>* *Rigidity in administrative concessions can create challenges for certain users, especially in situations where adjustments or adaptations are required due to changes in hydrological conditions or specific user needs.*	

		water resources (groundwater, drinking water, etc.).	*ensure that water is not misused.*		
12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed	*existing institutions adequately cover monitoring and evaluation needs? are monitoring results timely shared and support decision-making?* *<u>Sludge</u>* *There is **no proper assessment and monitoring** because there is no consensus and no plan to carry it out.*	*<u>Sludge</u>* *- **Create a "Sludge Round Table"** like the "Water Round Table" at regional or national level. It should be an initiative represented by administration, companies, scientific and expert community, users, etc. It could update regulations and cover legal issues with the whole sector in order to respond to real and current problems.*	*<u>Sludge</u>* *There is a need to clearly define the minimum types of treatment that sludge must receive prior to its application in agriculture and the physical-chemical and microbiological parameters that must be met depending on the type of crop, establishing a plan for its implementation so that public and private initiatives have legal certainty and a roadmap for where to go.*	*<u>Sludge</u>* *https://elpais.com/diario/1984/06/15/espana/456098424_850215.html* *https://cadenaser.com/comunitat-valenciana/2023/01/29/la-comision-tecnica-de-la-mesa-del-agua-de-alicante-se-reune-este-lunes-para-coordinar-las-actuaciones-judiciales-a-seguir-contra-el-plan-del-tajo-radio-alicante/* *https://www.aguasresiduales.info/expertos/tribuna-opinion/la-gestion-de-los-lodos-de-depuracion-en-espana-un-dNTbb*

II. Summary table: key governance gaps in LL Bodø

PRINCIPLE	DESCRIPTION	KEY GAPS	IMPROVEMENTS PROPOSED	OBSERVATIONS	REFERENCES
Enhancing effectiveness					
1. Clear roles and responsibilities	Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.	***For an effective implementation of this solution, should a new organisation be created, or should responsibilities be re-assigned (e.g., for operational management, provision of a specific service, regulation, tariff setting, licencing)?*** **NBS for stormwater management: While municipalities are responsible, roles and responsibilities at municipal level are not clearly defined. It is also unclear who to see as the responsible source/'producer' of stormwater, e.g. property owners vs. road owners. Moreover, there has been discussion at national level, whether water fees can be used to finance**	**NBS: identify means of coordination that fits the local context best.** **Energy from sludge; no particular improvement proposed. Except need to consider synergies and benefits across municipalities when planning/selecting solutions.**	**In the Bodø case, the roles/responsibilities when it comes to NBS for stormwater are not clearly defined (planning vs. water/wastewater and infrastructure/roads). Other municipalities tried different coordination solutions; working group or individual coordinator.** **Energy from sludge: Iris Salten would be running a biogas facility, Bodø Municipality does the treatment of wastewater from Bodø, but is also one of the nine owners of Iris Salten (intermunicipal waste management company). Iris Salten would also utilise sludge from other sources to increase the volume, but there will likely not be any need for new or changed organisation structures.**	Guideline for stormwater management (Norwegian Environment Agency): Håndtering av overvann - veileder - Miljødirektoratet (miljodirektoratet.no)

		NBS, or not. So far there is no stormwater fee in Norway. **Energy from sludge: No.**			
2. Appropriate scales within basin systems	Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.	***Are there issues regarding multi-level cooperation at the basin and transboundary level, which will have to be overcome to allow for long-term adaptive strategies?*** **No, there are no issues with this for the solutions in focus in Bodø. Coordination is done in local water areas, and in wider water regions.**	**No need for improvement, when the LL solutions are concerned.**	**NBS: Processes handled at municipal level. This is appropriate since local conditions must be considered and dialogue is essential to develop and implement good solutions.** **Energy from sludge. Volume in Bodø alone is small, need to coordinate, collaborate with others in the Salten Region. This will not be a problem, as Iris Salten already is established as an intermunicipal waste management company serving the whole region.**	**Organisation described at the national portal for water governance:** Departementene og departementsgruppen for vannforvaltning - Vannportalen
3. **Policy coherence**	Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies	***Effective cross-sectoral coordination across policies for water, energy, waste, agriculture, industry and spatial planning, etc.; is there a need for more***	**NBS: Need for** central guidelines on how municipalities and counties should integrate climate change adaptation into their land use	**NBS: There are statal guidelines for climate and energy planning and climate adaptation in municipalities, which encourage integrated management and require**	**Statal planning guideline for climate and energy planning and climate adaptation:** Statlige planretningslinjer for klima- og energiplanlegging og klimatilpasning - Lovdata

	for water and the environment, health, energy, agriculture, industry, spatial planning and land use	***coordination mechanisms, incentives to address conflicts between sectoral policies and practices?*** **Yes, there is the need for better policy coherence.**	and planning processes NBS: Need to emphasize that NBS should be preferred solution **Sludge for energy: Norwegian Water has commissioned work on a national sludge management strategy, which is due in summer 2023 (not yet publicly available).** **Sludge for energy: Need to finalise revision of the national regulation on organic fertilisers.**	**that NBS shall be assessed and non-selection of NBS must be justfied. On the other hand, water cycle services are to be based on "Best Available Technologies".** **There may also be tensions between desire to implement blue-green infrastructure and other infrastructure needs/priorities, such as parking space.** **Sludge for energy: Biogas production is encouraged, but municipalities have proritised BEVs for public tendered transport. Tension between agriculture, wastewater and environmental policy has resulted in prolonged revision of the national regulation of organic fertilisers, which creates uncertainty regarding the future framework conditions for altenative sludge management strategies.**	**National White Paper on climate adaptation (part 2):** Meld. St. 26 (2022–2023) - regjeringen.no **Recent article explaining how the uncertainty concerning the organic fertiliser regulation is a barrier to biogas production:** https://www.tu.no/artikler/ingen-biogass-uten-ny-gjodselforskrift/529234
4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of	***Are there enough competencies and knowledge to implement this solution, or does it require training of public***	**Optional training on NBS targeting a mix of stakeholders, with the aim to also**	**NBS: Some of the consulted stakeholders stated that there is enough capacity and knowledge. Others**	Report by Asplan Viak and SINTEF on NBS for Norwegian Environment Agency (2020):

	water challenges to be met, and to the set of competencies required to carry out their duties	***officials and water professionals; or training of stakeholders/end-users; or e.g., hiring additional staff?*** **NBS: Capacity and knowledge level is variable, often higher in larger municipalities.** **Energy from sludge: Capacity is not an issue.**	**build knowledge and share experience across sectors.** **National White Paper emphasizes: Information resources, networks for sharing experience, and cooperation with regional authorities.**	**suggest that public decision makers in some cases lack practical experience and build extensively on theory, and therefore are risk averse instead of facilitating innovation. Some users/property developers would like to get more knowledge/training on** **NBS. The Blue-Green Factor has only recently been introduced.** **Energy from sludge: Capacity is not an issue in Bodø.**	Løsningen er naturbasert - Asplan Viak **National White Paper on climate adaptation (part 2):** Meld. St. 26 (2022–2023) - regjeringen.no Report by Menon, on NBS, for Norwegian Environment Authority (2017): m830.pdf (miljodirektoratet.no)
Enhancing efficiency					
5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy	***Are available data sufficient and adequate to support the implementation and management of this solution? (precision, regularity, comparability) Are they shared between organisations and with the public in a transparent way? (identify existing overlaps and propose synergies)*** **NBS: Need for more experiental data, e.g. in**	**NBS: Building up a national knowledge base on NBS**	**NBS: There are several documents and guidelines with examples on NBS, but lack of a national, overarching guideline. Information is generally openly available, but different municipalities still tend to work on their own, wanting to invent own solutions.**	Report by Asplan Viak and SINTEF on NBS for Norwegian Environment Agency (2020): Løsningen er naturbasert - Asplan Viak Report by Menon, on NBS, for Norwegian Environment Authority (2017): m830.pdf (miljodirektoratet.no)

		terms of climate conditions and operations/maintenance. **Energy from sludge: Availability of data & information is not an issue.**			
6. Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner	***Are there adequate and sustainable financial resources for the implementation of the solution at a wider scale (public, private); ensuring future affordability for users; mechanisms to allow revenue for mandates of water institutions (polluter-pays, user-pays, environmental services)?*** **NBS: On the side of developers, there is no grant funding available – they need to finance stormwater management themselves. Stormwater fee has been discussed, but not implemented in Norway. Municipalities and counties may apply for grant funding from the national Environment Agency for knowledge development**	**The amount of grant funding for municipal and county climate adaptation is very limited (NOK 6.4 million in 2023) and could well be increased to accelerate knowledge development and implementation of NBS.**	**NBS: The consulted stakeholders were aware of nor had made use of grant funding for NBS.**	Grant scheme for climate adaptation in municipalities and counties (Norwegian Environment Agency): Tilskudd til klimatilpasning - Miljødirektoratet (miljodirektoratet.no) Report by Asplan Viak and SINTEF on NBS for Norwegian Environment Agency (2020): Løsningen er naturbasert - Asplan Viak

		and feasibility studies for climate adaptation (but not for implementation). **Energy from sludge: Establishment of biogas production facilities is eligible for grant support from Enova, Norwegian state enterprise state enterprise promoting the development and upscaling of sustainable energy and climate technology.**			
7. Regulatory frameworks	Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest	***Are key regulatory functions adequately allocated, are enforcement mechanisms in place (e.g., rewards and penalties)*** **Yes they are. Therefore, this aspect does not need to be particularly highlighted.**	**No need to propose improvements.**		
8. Innovative governance	Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government	***Is there a need for fostering metropolitan governance, inter-municipal collaboration, partnerships, and performance-based contracts; platforms for science-policy interface; user-friendly interfaces***	**Innovative practices may be encouraged on a general note, but there is no specified need in relation to the solutions being**	**Bodø Municipality is testing out new ways to engage citizens, e.g. by organising a Circularity Week in the autumn of 2023.** **Innovation partnership contracts are increasingly deployed in the norwegian**	**Link to program promoting innovative procurement in Norway, with example NBS project:** Fremtidsrettet overvannshåndtering med digital skybruddsplan - Innovative anskaffelser

	and relevant stakeholders	***(e.g., smart and open data); integration of different sources of knowledge and practices*** **Not particularly to be highlighted.**	**demonstrated in Bodø.**	**water sector, also in relation to stormwater management, but so far mainly where the NBS includes advanced technology components.**	
Enhancing trust and engagement					
9. Integrity and transparency	Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making	***Are there independent authorities to investigate water issues and support law enforcement (e.g., ombudsmen?); does this solution require better accountability and control mechanisms (e.g., for corruption in public procurement), codes of conduct?*** **There are independent authorities investigating, e.g. the Office of the Auditor General of Norway recently reviewed the Government's efforts to provide safe drinking water and criticised the current effort to reduce leakages and renew water infrastructure.**	**No need to propose improvements.**	**The solutions in Bodø LL do not require better accountability and control mechanisms.**	Link to recent report from the Office of the Auditor General of Norway (OAG) on conditions in the water sector: Dokument 3:8 (2022−2023) (riksrevisjonen.no)
10. Stakeholder engagement	Promote stakeholder engagement for	***Are there public, private or non-profit actors that might be affected by this***	**Continued efforts to engage stakeholders in**		

	informed and outcome-oriented contributions to water policy design and implementation	***solution, including newcomers (e.g., property developers) or under-represented groups that should be more involved in decisions for a future effective implementation of this solution?*** **Yes, NBS will implicate property and road owners, as well as regular citizens.The municipality has good procedures for stakeholder involvement and participation. However, the degree of awareness and interest from the public has been limited up to now.**	**relevant ways, e.g. Community of Practice, training, innovative forms of citizen engagement.**		
11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	***Is there cooperation between e.g., water institutions and spatial planners; need for further empowerment of local authorities & users to address issues with water services*** **Not particularly to be highlighted**			
12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where	***Do existing institutions adequately cover monitoring and evaluation needs? Are monitoring results timely shared and***			

	appropriate, share the results with the public and make adjustments when needed	***support decision-making?*** **Not particularly to be highlighted. Monitoring and evaluation is amongst other carried out through the Norwegian Environment Agency, and reported in relation to the SDGs and every 4 years to the UN Climate Convention.**			

III. Summary table: key governance gaps in LL East Frisia

LL EAST FRISIA, ANALYSIS FOR SOLUTION #6

TO ENABLE REUSE OF PROCESS WATER AS SUBSTITUTE FOR DRINKING WATER IN THE DAIRY INDUSTRY

PRINCIPLE	DESCRIPTION	KEY GAPS	IMPROVEMENTS PROPOSED	OBSERVATIONS	REFERENCES
Enhancing effectiveness					
1. Clear roles and responsibilities	Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.	Responsibility for water re-use in dairy industry is spread across different authorities (e.g., health, consumer protection, veterinary, usually under the lead of one of these, in the specific case in Lower Saxony: the local health authority). Involvement of several authorities complicates decision-making. Regulations are individual at the level of the 16 Federal States in Germany. Even within a Federal State, the responsibility for approval of a specific plant is at the local or regional level. Hence, the number of cases for each authority is small, not feasible to build-up sufficient experience or staff with specific training. Without an overarching harmonisation framework and decision support from the federation level, authorities are are risk-aware	Strengthen coordinated technical advice at the federal level Backing for authorities at state/district level Bundled responsibility for industrial water supply in a central point of contact at a Federal Office / Authority, such as e.g., UBA (Umweltbundesamt), BfR (Bundesanstalt für Risikobewertung) or similar ones.	Triggered by the CoP experience and targeted interviews, the relevant authorities for LL East Frisia are now open to the idea of an experience exchange across the federal state borders with other authorities in whose areas such re-use has or will be approved. The project has also triggered the dialogue on this issue between the regional authorities and the state ministry, as a starting point towards a joint position. These are promising first steps towards broadening the evidence base and harmonisation.	D5.4 Interviews with authorities for health as well as for consumer protection and food Reference projects exist in the Netherlands, but the roles of the authorities are not clear.

		and hesitant to approve such solutions.			
2. Appropriate scales within basin systems	Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.	Unused opportunity: substitution of drinking water in the dairy industry by means of re-use of process water reduces pressure on resources and water balances. Good argument in favour of the solution but not properly exploited because the balance is not considered river basin wide but purely local.	Common water strategy at the federal state level that coordinates actions and goals across different fields. Political empowerment of health authorities to also consider the contribution of re-use approaches to overarching environmental policy objectives in the approval process.	A recently issued national water strategy is a good starting point for complementing this by a federal state water strategy that can promote industrial reuse at the level where the actual decisions are taken. Technical input provided by water associations needs to be taken up politically. Good example of harmonised measures derived from a concrete political objective: in the NL the effects of the 4th purification stage were examined at a high spatial and organisational level, the assessment result was used as basis for decision-making.	https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Binnengewaesser/nationale_wasserstrategie_2023_en_bf.pdf
3. Policy coherence	Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use	Some regulation in the food sector Is requiring drinking water (with the objective of ensuring highest possible safety/protection level for livestock, employees and food), even in cases where from the scientific/technical point of view other water resources and quality would be sufficient (e.g., drinking water quality is currently required to clean trucks transporting livestock). Facilitates legal protection of authorities but can impede implementation of new solutions for	Introduce a new paradigm in defining required water for intended use: focus on quality only, instead of 'history' of the water. Legal anchor point can be an overarching strategy at the federal state level for management of industrial water. Set in relation to the increase in demand described in the Lower Saxony federal states water supply concept		https://www.umwelt.niedersachsen.de/download/183413/Wasserversorgungskonzept_Niedersachsen.pdf

		simply formal reasons, not otherwise justified.	(Wasserversorgungskonzept Niedersachsen) => combination of both strategies can form basis for clear political recommendations on how to use and enable savings potentials.		
4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	Cf. comment on principle 1: Very local responsibility → low number of cases → no dedicated staff with niche expertise → no learning curve of the local actors due to decentralised decision-making → low/no implementation. Authorities are in general supportive, but these new solutions are outside the usual scope of their established routines and they are not explicitly mandated to promote their implementation.	Establish i) a political strategy at the federal state level with specific measures to promote water re-use in the industry, also providing a clear mandate, procedures and capacities to relevant authorities; ii) a higher-level expert advice and decision-support at both state and federal level. Creation of a focus group / working group to bundle experiences and develop an overarching perspective and guidance -> put decision makers in a position to take technically sound decisions.	Districts & counties do not have adequate financial resources for this task, the superordinate state authority is responsible for more issues than water.	
Enhancing efficiency					
5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it	For re-use of process water in dairy industry: no normative specification exist as to which data must be collected and made accessible to whom/how.	Developing guideline with harmonised criteria for approval and requirements of monitoring and data provision.	Environmental Information Act (Umweltinformationsgesetz UIG) has already obligations for water suppliers / water boards, about data provision	https://www.gesetze-im-internet.de/uig_2005/index.html

	to guide, assess and improve water policy	Heterogeneity in official implementation and requirements on data to be monitored and reported (case-by-case decisions); no obligation for industry for complete transparency / disclosure of data (but that would also not make sense). Data often not available digitally (e.g., water monitoring, partly reduction of monitoring to save costs) The data is shared among the relevant stakeholders (operators, users, approvers), which would also be the future model (case-by-case decision)	Create clarity about the roles and interests of the parties involved (business model). Promote digitalisation of water quality data monitoring, documentation and exchange.	and handling, but not for private companies.	
6. Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner	High capex and opex for the solution (especially high energy costs for RO); Public utilities must cover their costs (depending on the statutes). Benefits for supporting the sustainability goals must have corresponding value for the customer. Refinancing via wastewater charges is currently not possible.	Investment support programmes are necessary to ensure that there are no competitive disadvantages (no economic development of certain users) and that there are no distortions of competition on the product side (part of the environmental service therein). Create awareness of the enormous benefits for the public created by any solution to substitute drinking water in the industry, e.g. about	Dairy industry is optimistic that the cost for the solution can be compensated by retail prices of the product once they get a credible label for being produced under particularly sustainable conditions e.g., with a low water footprint.	

			ecosystem services provided or secured		
7. Regulatory frameworks	Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest	Analogous to approval: Monitoring concepts for monitoring are specified in permits. The functions are adequately assigned, but there is a heterogeneity of decision-making, however, leads to quite different scopes e.g., due to different specifics of the waters or also due to actually different approaches/principles, different interpretation of the legal situation at the local level. That also links to difficulties with societal norms such as equal treatment and justice.	Same as for principles 1 and 3. Once the overarching guidance and harmonisation is solved for the approval process, a sound, harmonised and effective implementation of monitoring, surveillance etc. will follow.		
8. Innovative governance	Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders	Adequate resources and funding of the (local) authorities with regard to water issues is necessary	Prepare benefit transfer: Create transparency about use cases / best practices, Create topic-related exchange formats (not politically-driven but fact-driven), characterized by the exchange of data, facts, project successes; thus enabling a learning curve for competent authorities. Assignment should be at the level of a federal authority, rather not at LAWA or similar groups. (such a "Commission" should be more technically rather than politically	Related to governance principle Resources/Capacities	

			driven), e.g. located at UBA or BfR, but with an interface to state initiatives (LAWA, concrete projects).		
Enhancing trust and engagement					
9. Integrity and transparency	Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making	No specific gaps here, but general observation of eroding of trust in official actors and organisations.	Key is a clear communication of the background, objectives and also public benefit of such a solution, the legal & technical requirements and how they are met and monitored. Establish first reference cases in industries with a positive image (such as dairy).	Cf. deliverable D5.4 section on East Frisia and social acceptance barriers, in particular trust.	
10. Stakeholder engagement	Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation	Initiative currently by stakeholders (bottom-up), initiative does not come from state actors because apart from the National Water Strategy there is a lack of overarching political objectives broken down into specific measures and clearly assigned tasks. This also causes the problem of resources (financial/staffing, cf. principles 4 and 6). Willingness to participate in stakeholder formats (e.g., CoPs) is there, benevolent attitude of authorities (but no sufficient time of the actors → link to capacity)	Need for extensive data collection of water management data (e.g. sluices, water volume balances, ...) Ambition that the B-WaterSmart's approach to stakeholder involvement can be used as a blueprint for similar activities in the region. Involvement of authorities would have to be more interdisciplinary and cross-sectoral => joint "water days" for a common vision/objective – each		

			industry has its multiplier network, but not yet the region (for the topic of water).		
11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	Not a relevant gap. Conflicts of use are drivers for this specific solution demonstrated at DMK.	The "Conflict of Use" argument may be used positively as an argument for the implementation of the solutions		
12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed	No relevant barrier, as well-established monitoring and evaluation mechanisms are implemented. Monitoring as an internal part of production, therefore covered by food monitoring	None.	Food industry has implemented appropriate monitoring mechanisms (up to the recall), no relevant barrier at DMK-Pilot (there is a well-established system of food surveillance/monitoring in Germany). Cf also deliverable D5.4 section East Frisia, section about	

IV. Summary table: key governance gaps in LL Flanders

PRINCIPLE	DESCRIPTION	KEY GAPS	IMPROVEMENTS PROPOSED	OBSERVATIONS	REFERENCES
Enhancing effectiveness					
Clear roles and responsibilities	Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.	NO INFORMATION *For an effective implementation of this solution, should a new organisation be created, or should responsibilities be re-assigned (e.g., for operational management, provision of a specific service, regulation, tariff setting, licencing)?*			
Appropriate scales within basin systems	Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.	**River basin management is located at the regional level but requires collaboration with neighbouring regions and countries.**	**Improve transboundary coordination and the translation of EU legislation to the national and regional level.**		

Policy coherence	Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use	**While environment and water are regulated at the regional level, health is regulated at a federal level, causing disparities in risk assessments for innovative solutions.**	**Align federal and regional risk assessment procedures.**		
Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	**NO INFORMATION** ***Are there enough competencies and knowledge to implement this solution, or does it require training of public officials and water professionals; or training of stakeholders/end-users; or e.g., hiring additional staff?***			
Enhancing efficiency					

Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy	**Data on groundwater use in agriculture is likely to underrepresent actual use.** **Dashboards information-sharing platforms are in place but costly to maintain and may lack coherence**	**No immediate improvements have been suggested.** **Improve access to and coherence among different data platforms.** **Stimulate cross-border data sharing**		
Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner	**Return on investment for water-related innovations is low, causing heavy reliance on public funding.**	**Alternative ways to calculate the value of ecosystem services and innovations for circularity are needed.** **Stimulate the involvement of banks, insurance companies and other stakeholders for investment.**		
Regulatory frameworks	Ensure that sound water management regulatory frameworks are effectively	**A lack of clarity and disparities between the regulation of rainwater,**	**Clarify definitions and streamline regulations on water types and**		

	implemented and enforced in pursuit of the public interest	**stormwater, and infiltration methods.**	**their relation to groundwater quality.**		
Innovative governance	Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders	**No gaps identified**			
Enhancing trust and engagement					
Integrity and transparency	Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making	**NO INFORMATION** ***Are there independent authorities to investigate water issues and support law enforcement (e.g., ombudsmen?); does this solution require better accountability and control mechanisms (e.g., for corruption in public procurement), codes of conduct?***			
Stakeholder engagement	Promote stakeholder engagement for informed and	**Different actors are involved but this tends to be limited to**	**A broader involvement of stakeholders in the value chain and in**		

	outcome-oriented contributions to water policy design and implementation	**stakeholders with immediate relations to the problem.**	**upstream and downstream areas could improve shared problem ownership and investment opportunities (see also *financing*).**		
Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	**No gaps identified**			
Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed	**NO INFORMATION** ***existing institutions adequately cover monitoring and evaluation needs? are monitoring results timely shared and support decision-making?***			

V. Summary table: key governance gaps in LL Lisbon

Principle	Description (OECD, 2018)	Key gaps	Improvements proposed	Observations
Enhancing effectiveness				
#4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	Lack of regulatory clarity on the approval and governance of reuse schemes, namely on the water distribution service, makes the permitting processes very time demanding and affects the economic viability of water reuse.	A risk management approach can contribute for an increased flexibility in accommodating different stakeholders (i.e., producers, distributers, and users) in licensing reclaimed water systems.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #17, #25, #27).
		Lack of policy coherence - Need for planning and action at local and basin levels	Drought issues should be dealt in advance to drought itself by incorporating the principles and good practices in the use of water in non-potable uses in the city, evolving from the current situation (systematic adoption of ad-hoc water shortage mitigation measures).	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #17, #20, #24, #25, #27) climate readiness (BWS tool #33).

		Outdated regulations on building water systems are a barrier to the licensing of rainwater harvesting and water reuse systems.	By incorporating the principles and good practices in the use of water from different sources for non-potable uses in buildings, certification is a benchmark for designers and building owners.	Lisbon's goals: climate readiness (BWS tool #33).
Enhancing efficiency				
#5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy	Lack of knowledge and information on reclaimed water quality evolution in the distribution network.	The use of a water quality model to simulate the performance of the distribution network is a key tool towards water safety and may decrease the level of the treatment and/or monitoring requirements.	Lisbon's goal: safe water reuse (BWS tool #24).
		Lack of information about water reclamation production and use as well as other water sources alternatives to drinking water.	Compiling information about water demand in non-potable uses in the city and available water sources using decision-making tools.	Lisbon's goal: water-energy-phosphorous efficiency (BWS tools #17, #25).

Enhancing trust and engagement				
#10. Stakeholder engagement	Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation	Lack of public awareness of the local context that may increase water scarcity in Lisbon.	Contextual factors, when considered, may have a significant impact on public opinion. It is important to inform the public on the use of water in the city, the treatment of wastewater and the use of fit-for-purpose water.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tool #20).
		Lack of public engagement on issue of water scarcity.	Presenting water reclamation as a technical viable solution for climate-independent water source by using public relation initiatives, such as the artisanal production of craft beer from reclaimed water.	Lisbon's goal: safe water reuse (BWS solution #1).
		Lack of collaboration with stakeholders and potential users focusing on the benefits of using reclaimed water in fit-for-purpose uses.	Enhancing a common understanding about the availability of reclaimed water (and spring water) and the existing demand of water for non-potable uses (e.g., irrigation) facilitates the interaction between water utilities and their potential clients (e.g., green area owners).	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #17, #25, #27).

#11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	Need of improving a common ground of knowledge on quantity and quality aspects, for reaching consensus with the authorities and involved stakeholders, and engagement with the users (urban, rural or industrial) of reclaimed water.	Guidance material and decision-making tools can make expert-knowledge available for risk managers and stakeholders responsible for non-potable water uses in the city.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #24, #25, #27, #17).
#12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public & make adjustments when needed	Need for adjusting the legal framework of the water distribution service in Lisbon, as new water types (e.g. reclaimed water) should be delivered via a public distribution network.	Digital tools to support water balance and risk management.	Lisbon's goals: safe water reuse & water-energy-phosphorous efficiency (BWS tools #24, #25, #27, #17).

VI. Summary table: key governance gaps in LL Venice

PRINCIPLE	DESCRIPTION	KEY GAPS	IMPROVEMENTS PROPOSED	OBSERVATIONS	REFERENCES
Enhancing effectiveness					
1. Clear roles and responsibilities	Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.	***For an effective implementation of this solution, should a new organisation be created, or should responsibilities be re-assigned (e.g., for operational management, provision of a specific service, regulation, tariff setting, licencing)?*** **For solution #11, general roles are clear, however once established the convenience of pursuing the N-recovery by stripping strategy, it must be needed taking clear and defined positions in relation to the regulation to be adopted to discipline the management/delivery of salts produced.** **For the agricultural reuse of the effluent (solution #16) there are ambiguities on roles/responsibilities distribution among the reuse water chain.**	**Nothing to be suggested for solution #11;** **Solution #16 - Opinions have been expressed by the VE-CoP about the potential Decree for the application of the EU Regulation n.2020/741 (see description)**	**Solution #16 - Due to the drought occurred in 2022, a recent "urgent provisions for drought" decree was issued (pending the specific DPR?)**	**Decree-Law n. 39, 14 April 2023 - *Urgent provisions for contrasting water scarcity and relative strengthening and adaptation of water infrastructures***

2. Appropriate scales within basin systems	Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.	***Are there issues regarding multi-level cooperation at the basin and transboundary level, which will have to be overcome to allow for long-term adaptive strategies?*** **Not applicable - Not within our competence/knowledge**			
3. **Policy coherence**	Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use	***Effective cross-sectoral coordination across policies for water, energy, waste, agriculture, industry and spatial planning, etc.; is there a need for more coordination mechanisms, incentives to address conflicts between sectoral policies and practices?*** **It results relevant for the Sludge sector (solution #19) where lack shared knowledge and coordination of policy. For that, a DSS is in building at regional scale, as a strategic solution.**	**The improve is implicit in the DSS building itself, (solution #19).**	**Lack coordination can frustrate even the best virtuosities (as it is for our case, see description)**	
4. Capacity	Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties	***Are there enough competencies and knowledge to implement this solution, or does it require training of public officials and water professionals; or training of stakeholders/end-users; or e.g., hiring additional staff?*** **Not applicable - Not within our competence/knowledge**			

Enhancing efficiency					
5. Data & information	Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy	***Are available data sufficient and adequate to support the implementation and management of this solution? (precision, regularity, comparability) Are they shared between organisations and with the public in a transparent way? (identify existing overlaps and propose synergies)*** **In this dimension, the gap is usual in several sectors. It is evident in sludge management (Sol.#19) and effluent reuse (Sol.#16) on regional base.**	**The improve is implicit in the DSSs building themself, (solutions #16 and #19).**		
6. Financing	Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner	***Are there adequate and sustainable financial resources for the implementation of the solution at a wider scale (public, private); ensuring future affordability for users; mechanisms to allow revenue for mandates of water institutions (polluter-pays, user-pays, environmental services)?*** **It is worth to highlight them only for the chain of reuse (Sol.#16) where the covering of costs is an important part of problem.**			
7. Regulatory frameworks	Ensure that sound water management regulatory frameworks are effectively implemented and	***Are key regulatory functions adequately allocated, are enforcement mechanisms in place (e.g., rewards and penalties)***			

	enforced in pursuit of the public interest	**Not particularly to be highlighted**			
8. Innovative governance	Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders	***Is there a need for fostering metropolitan governance, inter-municipal collaboration, partnerships, and performance-based contracts; platforms for science-policy interface; user-friendly interfaces (e.g., smart and open data); integration of different sources of knowledge and practices*** **Not particularly to be highlighted**			
Enhancing trust and engagement					
9. Integrity and transparency	Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making	***Are there independent authorities to investigate water issues and support law enforcement (e.g., ombudsmen?); does this solution require better accountability and control mechanisms (e.g., for corruption in public procurement), codes of conduct?*** **Not particularly to be highlighted**			
10. Stakeholder engagement	Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation	***Are there public, private or non-profit actors that might be affected by this solution, including newcomers (e.g., property developers) or under-represented groups that should be more involved in decisions for a future effective implementation of this solution?***			

		Not particularly to be highlighted			
11. Trade-offs across water users, rural and urban areas, and generations	Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations	***Is there cooperation between e.g., water institutions and spatial planners; need for further empowerment of local authorities & users to address issues with water services*** **Not particularly to be highlighted**			
12. Monitoring and evaluation	Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed	***existing institutions adequately cover monitoring and evaluation needs? are monitoring results timely shared and support decision-making?*** **Not particularly to be highlighted**			