

MIGRATION ROADMAP FOR DEMONSTRATION OF INNOVATION

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LIST OF ACRONYMS

AC	Assessment criteria
BWS AF	Water-Smartness Assessment framework
CEW	Centre of Expertise Water Technology
Ctx	Context
ISO	International Standardisation Organization
KPI	Key performance indicator
LNEC	National Laboratory for Civil Engineering
Org	Organizational
PESTLE	Political, Economic, Social, Technological, Legal, and Environmental
PI	Performance Indicator
SO	Strategic Objective
SWOT	Strengths, Weaknesses, Opportunities and Threats
Tech	Technological
Water4All	European Partnership on Water Security for the Planet
WE	Water Europe
WEI+	Water Exploitation index
WOLL	Water-Oriented Living Lab
WS	Water Supply
WW	Wastewater

ABSTRACT

Water-Oriented Living Labs (WOLLS) are one of the main environments boosting innovations in the water sector and supporting the transition to a water-smart society. The current document is the roadmap for creating and maintaining a successful WOLL to boost such transition. It was produced within the Water4All Partnership, specifically for Pillar D Demonstration activities (Task D1.3) and comprehensively describes the stepwise process for the monitoring, assessment, and improvement of the WOLL maturity and the WOLL impact.

Accordingly, after presenting the background and the strategic planning steps behind the roadmap, two assessment frameworks are proposed: (i) one assessing the WOLL maturity, which translates Water Europe's harmonization cube into an objective, performance indicator-based system, (ii) the other assessing the WOLL impact and achievements towards their objectives, based on the recently developed Water-Smartness Assessment Framework.

The roadmap allows producing the WOLL strategic plan by providing a template with a comprehensive description of all steps and data needed (illustrated in tables to fill in), namely: 1. WOLL characterisation (description and mission); 2. WOLL assessment, which includes establishing the strategic objectives and the corresponding assessment frameworks for maturity and impact (selecting metrics from the proposed portfolios), baseline assessment and SWOT analysis; 3. Prospective evaluation of WOLL evolution under likely scenarios; 4. Identification of opportunities and phased targets for improving WOLL maturity and impact; 5. Identification and preliminary technoeconomic evaluation and ranking/prioritization of candidate strategies for improving WOLL maturity and impact; 6. Estimation of resources needed; 7. Planning the selected strategies implementation; 8. Monitoring and revision of the plan.

The roadmap is meant for existing WOLLS though it may also be used by those aspiring to become a WOLL. The WOLLS' monitoring results support the update of the Water4All Atlas of WOLLS, and a simple and intuitive way to visualize, interpret and communicate the WOLL's assessment evolution towards maturity and impact is proposed.

The roadmap and the frameworks are dynamic tools that should evolve through testing and adaptation. A forthcoming task will provide a common path for supporting the voluntary WOLLS in the roadmap and frameworks implementation. It will entail mentoring and training activities, and targeted workshops (on topics developed within other tasks of Water4All pillar on WOLLS or other pillars), aiming at enhancing stakeholder capacity in sustainable water management, innovation, and governance, while fostering collaboration and knowledge exchange among WOLLS and activities developed within Water4All, the EU co-funded partnership on water security for the planet.

MIGRATION ROADMAP FOR DEMONSTRATION OF INNOVATION

1 BACKGROUND

1.1 PRINCIPLES OF A WATER-SMART SOCIETY AND THE ROLE OF WATER-ORIENTED LIVING LABS

Water4All is a European Partnership aiming at long-term water security through systemic change and collaboration between problem owners and solution providers. Water4All activities include aligning water programmes, demonstration projects, international cooperation, dissemination, networking, and capacity building. Organized into five Pillars, it addresses climate change, supports the UN Sustainable Development Goals, and strengthens the EU's competitiveness (Water4All, 2022). Namely, Pillar D *“supports Water4All in enabling water security for all in the long term and in promoting systemic transformations and changes by supporting and promoting the demonstration and access to the market of innovative solutions across the entire water research and innovation pipeline. The strategy to reach this goal is based on the WOLL concept”*. Water-Oriented Living Labs (WOLLs) are *“real-life demonstration and implementation instruments that bring together public and private institutions, government, civil society, and academia to jointly build structured ground and develop, validate, and scale-up innovations that embrace new technologies, governance, business models, and advancing innovative policies to achieve Water-Smart Society”* (Water Europe, 2022a).

According to the B-WaterSmart¹ definition of water-smart societies (Damman et al., 2023) *“Societies are water-smart when they generate societal well-being via sustainable management of water resources. In water-smart societies, well-informed citizens and actors across sectors engage in continuous co-learning and innovation to develop an efficient, effective, equitable and safe circular use of water and the related resources. This is achieved by adopting a long-term perspective to ensure water for all relevant uses, safeguard ecosystems and their services to society, boost value creation around water, while anticipating change towards resilient infrastructure.”*.

This definition was adopted with adaptations by Water Europe in its Water-Smart Society vision to transform the current water sector. The Water-Smart Society vision focuses on improving the management of water resources and developing sustainable solutions to water challenges brought by climate change. The vision demonstrates how to use technologies, solutions, businesses, strategic planning, and governance models to approach the transition to a Water-Smart Society. The aim is to enforce this transition by 2030. As stated in the Water Europe Value of Water Vision document, *“A Water-Smart Society is one in which the value of water is recognized and realized to ensure water security, sustainability, and resilience; all available water sources are managed so that water scarcity and pollution are avoided; water and resource loops are largely closed to foster a circular economy and optimal resource efficiency; the water system is resilient against the impact of climate and demographic change; and all relevant stakeholders are engaged in guaranteeing sustainable water governance”* (Water Europe, 2023).

The vision emphasizes the *“Value of Water”* as the key principle of the Water-Smart Society and resilient future. It demonstrates the centrality of water as a human right and a fundamental element in society. Water is essential in almost any aspect of life from enabling economic activities to providing social functions. It safeguards sanitation, health, and food production. The realization of the core value nowadays is challenging. Climate change affects the quality and availability of water resources, impacting natural assets, livelihoods,

¹ B-WaterSmart is a project funded by the European Union under Horizon 2020 research and innovation programme - <https://b-watersmart.eu/>

and economies. Therefore, action must be taken in addressing water challenges and securing a resilient future, while fully recognizing and realizing the value of water. A Water-Smart Society aimed at a better use of water sources and the development of sustainable solutions to address and anticipate water challenges worldwide. The transition to a Water-Smart Society is essential in tackling water scarcity and creating a resilient society. It invites researchers and innovators to work together to build a sustainable society, and WOLs provide a privileged environment for innovation. This roadmap is specifically focused on such labs.

Twenty-one WOLs were selected for the [Water4All Atlas of Water-Oriented Living Labs](#) published in 2024 (in alphabetical order of the country):

1. CITY OF MECHELEN, Mechelen, Belgium
2. HERK AND MOMBEEK LIVING LAB, Limburg, Belgium
3. PORT OF ANTWERP-BRUGES, Antwerp & Zeebrugge, Belgium
4. WATERCLIMATEHUB, West Flanders, Belgium
5. WATER VALLEY DENMARK, Aarhus, Denmark
6. BLUE ECONOMY MIKKELI CENTRE OF EXCELLENCE, Mikkeli, Finland
7. FRESHWATER COMPETENCE CENTRE, Rivers Oulanka, Vantaa and Tana, Finland
8. HYGLO, Finland
9. WATER MANAGEMENT INNOVATION, Ruukki, Finland
10. PIREN-SEINE, Paris, France
11. CANALE REALE RIVER CONTRACT, Brindisi, Italy
12. WISE IRRIGATION - WIRRI, North-Eastern Italy
13. NATIONAL WATER TABLE EWA, Malta
14. LISBON WATER SMART LIVING LAB, LISBON, Portugal
15. SOUTH AFRICAN SANITATION TECHNOLOGY ENTERPRISE PROGRAMME, Pretoria, South Africa
16. CATALAN WATER PARTNERSHIP, Girona, Catalonia, Spain
17. DESAL + LIVING LAB, LAS PALMAS, Canary Islands, Spain
18. SUSTAINABLE DESALINATION LIVING LAB, Almería, Andalucía, Spain
19. ZINNAE - THE CLUSTER FOR THE EFFICIENT USE OF WATER, Zaragoza, Aragón, Spain
20. BLUEARK, Le Châble, Verbier, Switzerland
21. WATER CAMPUS LEEUWARDEN, Leeuwarden, The Netherlands

1.2 THE ROLE AND THE KEY STEPS OF STRATEGIC PLANNING FOR A SUSTAINABLE WOLL

Strategic planning increases organizations performance, as process that allows strengthening and ensuring rationality in the decision-making process, incorporating the long-term. It constitutes a robust management tool for supporting the adaptation of the organizations and its activities to evolving socio-economic and environmental needs, as for improving water resources management and developing sustainable solutions to water challenges brought by climate change. Given the changing context and conditions for the water managers, strategic planning provides the ability to foreseeing and anticipating new conditions, key aspects for a robust management, as proper strategies may be designed and adequate measures identified (UN.ESCAP, 2004). The strategic planning level is characterized by a corporate and long-term perspective, aiming to establish and communicate strategic priorities to both managers' professionals and citizens.

The strategic planning process adopted for advancing towards a water-smart society is based on the AWARE-P approach² (Alegre et al., 2012). It is grounded in the vision and mission of the organizations. The key steps of strategic planning include to:

1. define strategic objectives, and the assessment system (criteria, metrics, and reference values);
2. carry out a diagnosis, including a SWOT analysis and the evaluation of objectives' fulfilment through a performance assessment, a prospective analysis for the planning horizon, the identification of key issues and opportunities for improvement, and the establishment of targets to be achieved;
3. develop the plan, including the identification, comparison, and selection of alternative solutions to address the issues identified in the diagnosis, defining objective-driven strategies and resources needed for the implementation;
4. implementing the plan;
5. monitoring progress, assessing outcomes, and reviewing the plan to ensure continuous improvement.

Setting up objectives, assessment criteria, metrics and targets is a crucial stage to set up clear directions of action, as well as accountability of results through timely review, within a given time frame (short, medium or long-term) (ISO 24510:2007, 24511:2007, 24512:2007).

Objectives are identified as the ambitions to be achieved in the medium-long term by the organization, grounded on the respective vision and mission. Each objective is specified by assessment criteria that translate the different points of view associated with it, that allow for the assessment of the objectives.

Each criterion, in turn, is described with a set of metrics that, by comparison of each metric result with reference values established, provide a classification to the responses, reflecting the respective performance. Additionally, metrics will serve to assess the distance from a set target (Silva et al., 2023). By itself, a metric does not reflect the entire point of view of the criterion, which it belongs to. The classification only allows an effective assessment when the metric is put into perspective within the criterion (i.e. linked to the corresponding criterion and objective), analysed together with the other metrics belonging to the same criterion, and framed by the organization context (Cardoso et al., 2020).

These metrics and targets are an essential basis for establishing the diagnosis, prioritizing intervention solutions, and monitoring the results.

² <http://aware-p.org/np4/approach/>

2 THE ROADMAP FOR CREATING AND MAINTAINING A SUCCESSFUL WOLL

2.1 PURPOSE

Water-Oriented Living Labs (WOLLS) are one of the main environments boosting innovations in the water sector and supporting the transition to a Water-Smart Society. This roadmap is for creating and maintaining a successful WOLL to boost such transition. The roadmap guides the process of being a WOLL - facilitating the monitoring, assessment, and improvement of the WOLL maturity and impact. Accordingly, the assessment must have a 2-fold objective, thus two frameworks:

1. assessing the **WOLL maturity**, which translates the harmonization cube (Water Europe, 2022a) into an objective, KPI (key performance indicator)-based framework (quantitative) – presented in Chapter 3;
2. assessing the **WOLL impact** and achievements towards their objectives, based on the Water-Smartness Assessment Framework (BWS AF; Silva et al. 2023) as much as possible.

The roadmap implementation allows producing the WOLL strategic plan. The roadmap is meant for existing WOLLS though it may also be used by those aspiring to become a WOLL. The WOLLS' monitoring results support the update of the Water4All Atlas.

2.2 PROCESS PHASES

The roadmap developed as part of Task D1.3 in the frame of Water4All Pillar D on Demonstration activities follows a comprehensive, 8-step process illustrated in Figure 1:

1. WOLL characterisation (description and mission);
2. WOLL assessment, which includes establishing the strategic objectives and the corresponding assessment frameworks for maturity and impact (selecting metrics from the proposed portfolios), baseline assessment and SWOT analysis;
3. Prospective evaluation of WOLL evolution under likely scenarios;
4. Identification of opportunities and phased targets for improving WOLL maturity and impact;
5. Identification and preliminary technoeconomic evaluation and ranking/prioritization of candidate strategies for improving WOLL maturity and impact;
6. Estimation of resources needed;
7. Planning the selected strategies implementation;
8. Monitoring and revision of the plan.

The additional connections (Figure 1) in the roadmap provide essential guidance and support tools for each step of the strategic planning, including those developed within other tasks of Water4All Pillar D on Demonstration activities in WOLLS or within other pillars of the partnership. The Start-up Guide (Winderickx, 2025), developed as part of the Task D2.5, supports the initial establishment and characterization of a WOLL, offering practical steps and considerations for setting it up. Within Water4All activities, the Task D1.1 offers the foundations for the development of the WOLL maturity framework, which helps assess the current status and guide future improvements. Pillars A, C, and E of Water4All partnership represent core thematic areas or guiding principles underpinning the roadmap. Task D1.2, the WOLLS' network, was useful for delivering a portfolio of solutions and best practices (Task D2.6), which is instrumental in selecting context-specific strategies and interventions based on the WOLL's maturity and impact assessment, and in estimating related resources needed, including funding and financial mechanisms (Task D3).

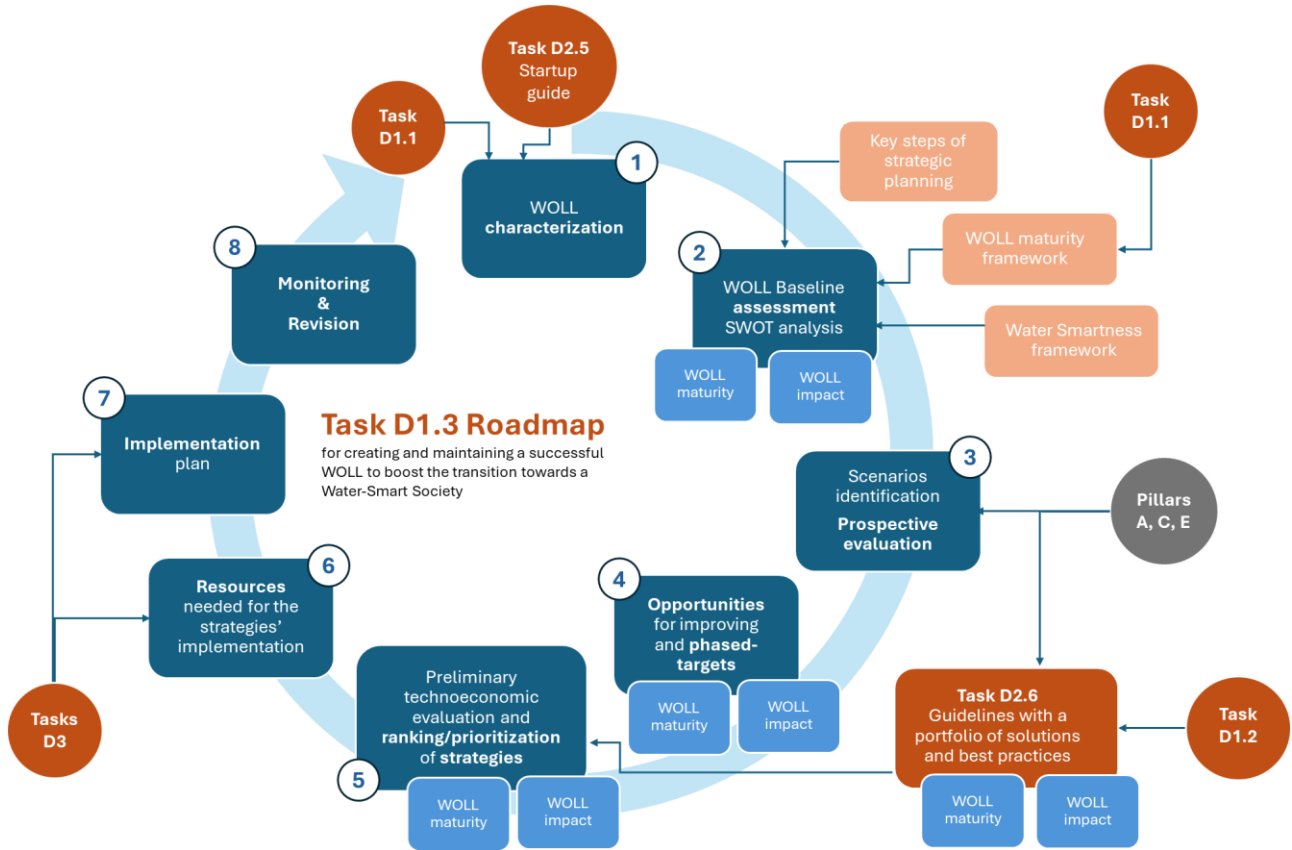


Figure 1. Roadmap steps for creating and maintaining a successful WOLL

3 WOLL MATURITY FRAMEWORK

3.1 HARMONIZATION CUBE

Water Europe initiated the mapping and development of the network of Water-Oriented Living Labs to promote an exchange of knowledge and innovations that support developing solutions to challenges brought by climate change. The Atlas of EU Water-Oriented Living Labs was developed identifying 105 potential WOLLs across Europe, both permanent establishments and single projects. During the earlier tasks of the Water4All EU partnership, new assessments were carried out among candidate WOLLs for the development of a new Atlas.

Such assessments were conducted using the **Harmonization Cube** method (Water Europe, 2022a, b), which evaluates the following six foundational elements or aspects (Mulder, 2008) illustrated in Figure 2:

- **User involvement:** WOLLs involve users of water and innovations that enable a Water-Smart Society, giving them the ability to influence the solution that will impact their lives later.
- **Service creation:** WOLLs provide ecosystems for the production and reuse of water and facilitate the development of new ideas and solutions that fit in the context of a Water-Smart Society.
- **Infrastructure:** WOLLs offer environments where it is possible to test water innovations. Such environments can be both experimental setups as well as real-life test environments with external infrastructures.
- **Governance:** WOLLs include the quadruple helix, such as public authorities, water users, research organizations and technology developers that are all involved in the maintenance of the lab.
- **Innovation outcomes:** WOLLs facilitate innovations supporting a Water-Smart Society such as knowledge and services or products in the form of an end-user application or a prototype.
- **Methods and tools:** WOLLs provide methods and tools necessary for obtaining data related to the innovations in the water sector; the roadmap it itself a method for a WOLL to consider adopting.

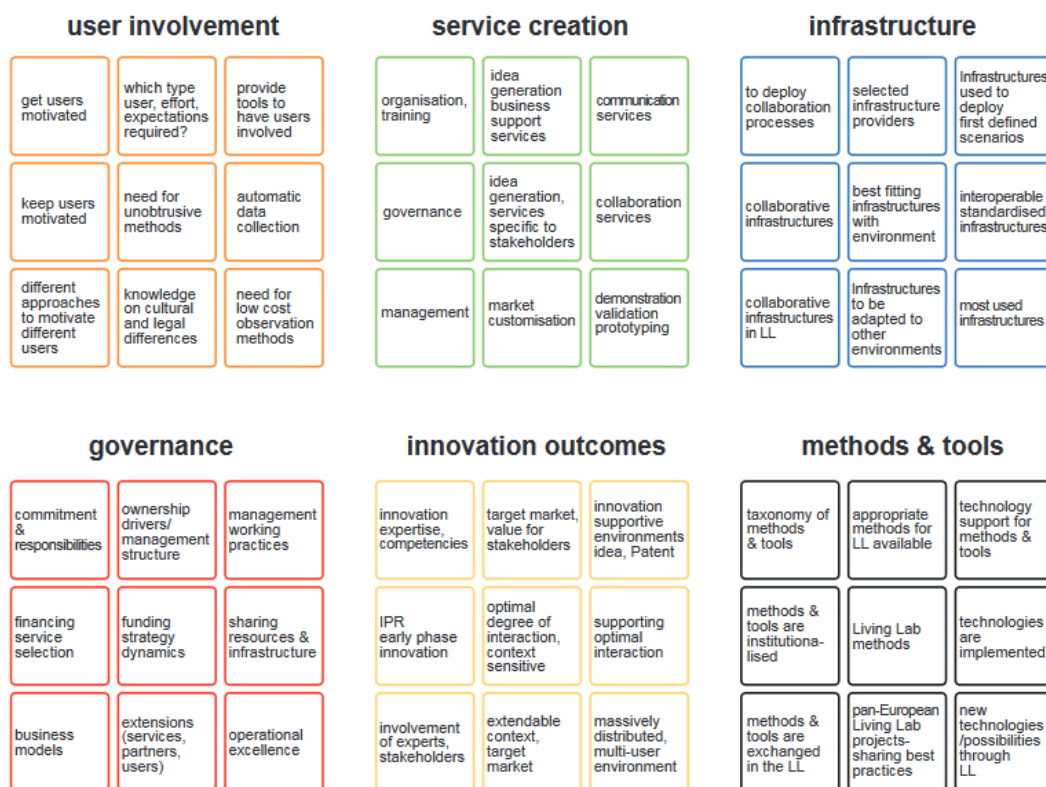


Figure 2. Evaluation criteria for each aspect (Water Europe, 2022a, b)

Each face of the cube shows a 3x3 evaluation matrix with organizational, contextual, and technological concepts on the horizontal axis, and a level of development on the vertical axis: set-up, sustainability, and scalability (Figure 3). The cube assesses qualitatively the development phase, i.e., the WOLL candidate maturity and identifies and opportunities to improve it.

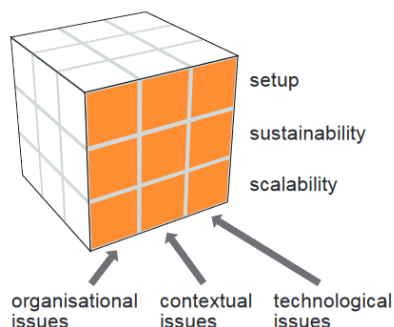


Figure 3. 3x3 evaluation matrix (Water Europe, 2022a, b)

3.2 ASSESSMENT FRAMEWORK PROPOSED

The six aspects of the **Harmonization Cube** (Water Europe, 2022a) were considered as the strategic objectives and the level of development (set-up, sustainability, and scalability) of the organizational, context and technological issues are the assessment criteria (Figure 4). The assessment criteria are broken down into 54 performance indicators (PIs), which aimed at translating objectively and quantitatively the 54 questions considered in the cube (Water Europe, 2022b). The PIs are presented in Table 1 to Table 6 per assessment criteria, as well as their formulation and reference values. An example of how to visualize the WOLL maturity assessment is shown in Chapter 6. This is a first edition of the framework, which is to be applied by the WOLLS and improved as needed, both the KPI formulation and or the reference values proposed.

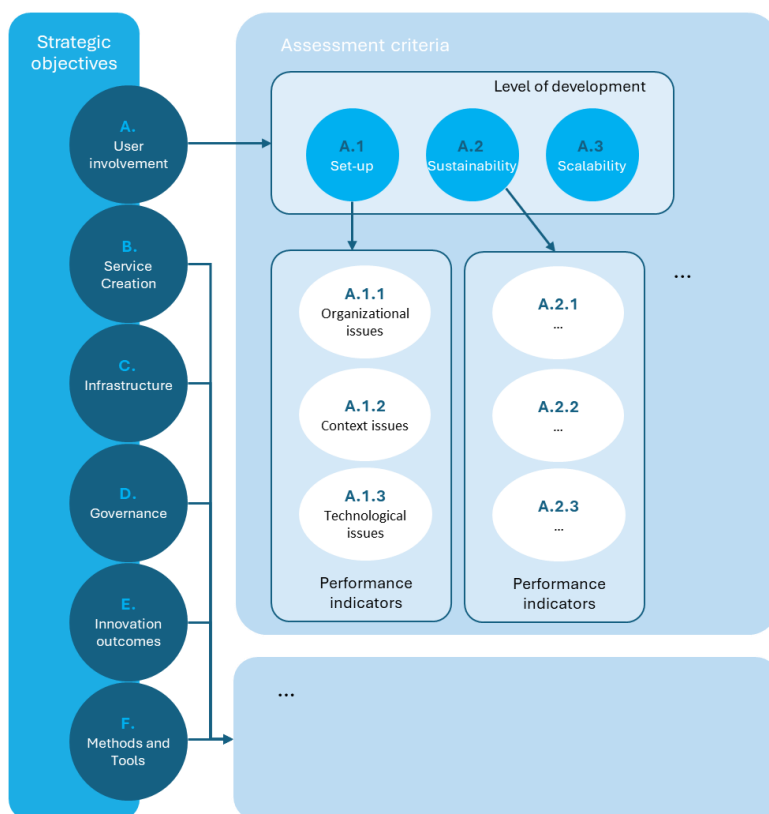


Figure 4. Strategic objectives and assessment criteria

KEY TERMS	
•	Key water user groups (or simply user): Involve users of water (e.g. urban/citizens, industry, and/or agriculture) as well as users of innovations (water-technology related or others) that enable a "water smart society" mapped by/in the WOLL.
•	Infrastructure: physical or virtual environment, to integrate, try out, validate and measure the performance of water innovations. This may include an experimental set up (e.g. in labs, or demo sites) or (preferably) real-life test environments including (external) infrastructures for water production, distribution, and (re)use (e.g. at utilities, urban areas, (agro) industrial sites)

Table 1. Assessment metrics and reference values of WOLL maturity - User involvement

AC	Metric	Reference values
A1. User involvement – Set up		
<i>Org</i>	A.1.1 Get users motivated (%) Key water user groups involved in measurements and design of water innovations (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	A.1.2 Users characterized (%) Key water user groups characterized (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	A.1.3 Tools provided to have users involved (%) Key water user groups with methods and tools to have them involved (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
A2. User involvement – Sustainability		
<i>Org</i>	A.2.1 Keep users motivated (%) Key water user groups that have agreed on a longer-term arrangement (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	A.2.2 Engagement strategy (%) Key water user groups involved in the co-creation proce (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	A.2.3 Automatic data collection (%) Key water user groups giving continuous feedback (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
A3. User involvement – Scalability beyond the WOLL		
<i>Org</i>	A.3.1 Expansion and diversification of user engagement (%) Collaborations or exchanges ongoing with other WOLLs in the WOLLs Network (No.) / WOLLs in the WOLLs Network (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Ctx</i>	A.3.2 Engagement strategy adaptation (%) Collaborations or exchanges ongoing with WOLLs or regions (within or beyond the WOLLs Network) with cultural or legal differences (No.) / Collaborations or exchanges targeted x 100 List the different cultural or legal contexts.	● [50; 100] ● [20; 50[● [0; 20[
<i>Tech</i>	A.3.3 Low-cost observation methods (%) Key water user groups with low-cost continuous observation technologies and standards (e.g. automated data collection of water use) (No.) / Key water user groups (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[

Table 2. Assessment metrics and reference values of WOLL maturity - Service Creation

AC	Metric	Reference values
B1. Service creation – Set up		
<i>Org</i>	B.1.1 Stakeholders trained (%) Stakeholders trained for a collaborative and co-creation process within the WOLL (No.) / Stakeholders involved in the governance structure (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	B.1.2 Idea generation business support services (%) Critical areas of water-smart society where new ideas were developed with market support services (No.) / Critical areas of water-smart society (e.g. reuse, digitalization, stormwater) (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	B.1.3 Communication services (%) Actions of the communication plan implemented (No.) / Actions of the communication plan identified (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
B2. Service creation – Sustainability		
<i>Org</i>	B.2.1 Governance (%) Stakeholders involved in the governance structure (No.) / Relevant stakeholders identified in the 4-helix (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	B.2.2 Co-creation of stakeholder-specific services (%) Components established for a sustainable user-involvement mechanism (No.) / Components needed for a sustainable user-involvement mechanism (e.g. open innovation, interoperability, customer services) (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	B.2.3 Collaboration services (%) Stakeholders that actively use durable collaboration services/tools (e.g. shared platforms, coordination apps, data spaces, service portals) (No.) / Stakeholders involved in the governance structure (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
B3. Service creation – Scalability beyond the WOLL		
<i>Org</i>	B.3.1 Service creation management (%) Collaborations or learning exchanges with stakeholders external to the WOLL (No.) / Collaborations considered valuable for the service creation process (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Ctx</i>	B.3.2 Market customisation (%) Implemented strategies for market uptake (No.) / Relevant strategies for market uptake (e.g. business model, IPR) (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Tech</i>	B.3.3 Demonstration validation prototyping (%) Supporting technologies deployed to enable cooperation for demonstration, validation, and prototyping (No.) / Supporting technologies identified as necessary to enable cooperation for demonstration, validation, and prototyping (e.g. digital platforms, shared simulation environments, cloud tools, collaborative dashboards) (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[

Table 3. Assessment metrics and reference values of WOLL maturity – Infrastructure

AC	Metric	Reference values
C1. Infrastructure – Set up		
<i>Org</i>	C.1.1 Deploy collaboration processes (%) Key water user groups with access to collaboration processes to deploy and operate physical assets, sensors and data collection mechanisms (No.) / Key water user groups (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	C.1.2 Infrastructure providers selected (%) Infrastructure external providers selected (No.) / Infrastructure external providers needed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	C.1.3 Infrastructure used to deploy first defined scenarios (%) Infrastructures deployed to run WOLL's first test scenarios (No.) / Infrastructures needed (e.g., hardware, software, servers) (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
C2. Infrastructure – Sustainability		
<i>Org</i>	C.2.1 Collaborative infrastructures (%) Collaborative infrastructure in place to operate physical assets, sensors, data collection processes, analysis (No.) / Collaborative infrastructures targeted (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	C.2.2 Infrastructures best fitting with WOLL's environment (%) Infrastructures best fitting qualification (No.) / Infrastructures available (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	C.2.3 Interoperable standardised infrastructure (%) Interoperable infrastructures (No.) / Infrastructures available (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
C3. Infrastructure – Scalability beyond the WOLL		
<i>Org</i>	C.3.1 Collaborative infrastructures with other WOLLs (%) Collaborative infrastructures in place in other WOLLs (No.) / Infrastructures available (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Ctx</i>	C.3.2 Infrastructures to be adapted to other environments (%) Collaborative infrastructures already adapted or adaptable to other environments (No.) / Infrastructures available (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Tech</i>	C.3.3 Most used infrastructures (%) Collaborative Infrastructures with tracked, effective use (internally or externally) (No.) / Infrastructure available (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[

Table 4. Assessment metrics and reference values of WOLL maturity - Governance

AC	Metric	Reference values
D1. Governance – Set up		
<i>Org</i>	D.1.1 Commitment and responsibilities (%) Stakeholders from the 4-helix with formal contracts or agreements or clearly defined roles and responsibilities (No.) / Stakeholders involved in the governance structure (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	D.1.2 Ownership drivers/management structures (%) Stakeholders whose goals and roles are formally reflected in the ownership, IPR, or management structure (No.) / Stakeholders involved in the governance structure (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	D.1.3 Management working practices (%) Business management working practices (No.) / Business management working practices identified as relevant (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
D2. Governance – Sustainability		
<i>Org</i>	D.2.1 Financing service selection (%) Long-term agreements (financial or mutual use) signed or formalized with stakeholders regarding shared infrastructures, technologies, or services (No.) / Long-term agreements identified as important to support sustainability and collaboration (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	D.2.2 Funding or financing dynamics (%) Funding or financing strategies or services that are active and implemented (No.) / Funding or financing strategies or services identified as relevant (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	D.2.3 Sharing resources and infrastructure (%) Tools or practices currently in use to effectively manage, monitor, and share infrastructure and resource use in the WOLL (No.) / Tools or Practices needed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
D3. Governance – Scalability beyond the WOLL		
<i>Org</i>	D.3.1 Business models (%) Business models developed explicitly aimed at scaling WOLL activities (No.) / Business models identified as relevant (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Ctx</i>	D.3.2 Extensions (services, partners, users) (%) External parties (e.g. other Living Labs, research teams, companies) that have been granted access to conduct user tests in the WOLL (No.) / External parties that have requested or shown interest in using the WOLL for user tests (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Tech</i>	D.3.3 Operational excellence (%) Structured management practices or tools in place (No.) / Management approaches identified as necessary or relevant for achieving operational excellence and consistent collaboration (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[

Table 5. Assessment metrics and reference values of WOLL maturity – Innovation outcomes

AC	Metric	Reference values
E1. Innovation outcomes – Set up		
<i>Org</i>	E.1.1 Innovation expertise, competencies (%) SRIA-relevant innovation areas where expertise or competencies are available within the WOLL (No.) / SRIA-relevant innovation areas identified as necessary to support the targeted innovations (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	E.1.2 Target market, value for stakeholders (%) WOLL's strategic objectives addressed (No.) / WOLL's strategic objectives defined for a high-impact SRIA or WOLL's mission fulfilment (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	E.1.3 Innovation supporting services (%) Innovation supporting services that are currently in place and functioning (e.g. ideation platforms, patent support, prototyping labs, tech transfer offices, IP consulting). (No.) / Innovation supporting services identified as necessary for a high-impact SRIA or WOLL's mission fulfilment (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
E2. Innovation outcomes – Sustainability		
<i>Org</i>	E.2.1 IPR of early phase innovation (%) IPR issues solved (No.) / IPR issues identified to water-oriented R&D&I (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	E.2.2 Optimal degree of interaction, context sensitive (%) Mechanisms actively used to promote collaboration, share innovation results, and update WOLL's mission and strategic objectives (e.g. stakeholder workshops, feedback platforms, co-review sessions, adaptive governance procedures) (No.) / Mechanisms identified as necessary to ensure effective interaction and regular alignment of WOLL's mission and strategic objectives with evolving contexts (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	E.2.3 Supporting optimal interaction (%) Digital or physical tools currently used to structure, guide, or enhance collaboration among stakeholders (No.) / Tools identified as necessary to effectively steer multi-party interaction towards defined innovation outcomes (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
E3. Innovation outcomes – Scalability beyond the WOLL		
<i>Org</i>	E.3.1 Involvement of experts and stakeholders (%) External experts (including from other WOLLs or relevant networks) with whom collaboration mechanisms or agreements are in place (No.) / External experts identified as relevant for expanding or supporting water-related innovation development (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Ctx</i>	E.3.2 Extendable context, target market (%) Mechanisms, partnerships, processes, or tools already in place to support collaboration with other WOLLs or expansion into new markets, applications, or regions (No.) / Capabilities or arrangements identified as necessary to enable expansion or collaboration (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[
<i>Tech</i>	E.3.3 Massively distributed, multi-user environment (%) Technologies, platforms, or tools currently in place that enable coordination, interaction, data collection, and co-creation with a large number of users (No.) / Technologies, platforms, or tools identified as necessary to successfully manage and support large-scale multi-user engagement for targeted innovation activities (No.) x 100	● [50; 100] ● [20; 50[● [0; 20[

Table 6. Assessment metrics and reference values of WOLL maturity – Methods and tools

AC	Metric	Reference values
F1. Methods and tools – Set up		
<i>Org</i>	F.1.1 Taxonomy of methods and tools (%) Methods & tools categorized (No.) / Methods & tools developed or under development (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	F.1.2 Availability of WOLL-appropriate methods (%) Methods & tools available for large-scale, in-situ, user monitoring and measurement (No.) / Methods & tools needed for fulfilling WOLL's mission and strategic objectives (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	F.1.3 Technology support for methods and tools (%) Methods & tools with tech-watch process to support continuous validation (No.) / Methods & tools developed or under development (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
F2. Methods and tools – Sustainability		
<i>Org</i>	F.2.1 Methods and tools institutionalised validated (%) Methods & tools validated by stakeholders (No.) / Methods & tools developed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	F.2.2 Methods and tools in place (%) Methods & tools with long-term, repeated, or continuous user experimentation (No.) / Methods & tools developed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	F.2.3 Technologies implemented (%) Methods & tools with proper technology support (No.) / Methods & tools developed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
F3. Methods and tools – Scalability beyond the WOLL		
<i>Org</i>	F.3.1 Methods and tools exchanged in the LL (%) Standardized Methods & tools (No.) / Methods & tools developed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Ctx</i>	F.3.2 Pan-European projects (%) Pan-European projects ongoing (No.) / Projects ongoing (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[
<i>Tech</i>	F.3.3 New technologies/possibilities (%) Methods & tools interoperable (No.) / Methods & tools developed (No.) x 100	● [70; 100] ● [30; 70[● [0; 30[

4 WOLL IMPACT FRAMEWORK

For assessing and improving the WOLL's impact, the [Water-Smartness Assessment framework \(BWS AF\)](#), recently developed within the B-WaterSmart project, is proposed. The primary purposes of this framework are to support organizations in (i) defining long-term strategic objectives for achieving a water-smart society and (ii) assessing the progress towards these objectives (Silva et al., 2023).

Aligned with the strategic planning process, the framework serves as an assessment tool that supports the establishment of an organization's assessment system at the strategic level.

The BWS AF is objective-driven and follows a hierarchical tree structure composed of objectives, criteria, and metrics and includes five strategic objectives (SOs) (Silva et al., 2023) that translate the project's definition of water-smart societies (Damman et al., 2023), adopted with adaptations by Water Europe:

- Ensuring water for all relevant uses – This objective aims to guarantee secure and affordable access to water for all sectors, including domestic, industrial, agricultural, and environmental uses.
- Safeguarding ecosystems and their services to society – This objective focuses on protecting water-related ecosystems, enhancing ecosystem services in both urban and rural areas, pursuing carbon neutrality, and promoting resource efficiency for environmental protection.
- Boosting value creation around water – This objective seeks to create value by leveraging synergies within the water-energy-resources-waste nexus through the implementation of circular economy policies and business models.
- Promoting adaptive change towards resilient infrastructure – This objective aims to ensure that governance, financial, and decision-making conditions foster adaptive change towards resilient infrastructure, enabling robust planning and effective implementation, with a focus on resilience.
- Engaging citizens and actors across sectors in continuous co-learning and innovation – This objective emphasizes the deliberate engagement of citizens in planning, decision-making, and implementation processes.

Each strategic objective can be associated with one or more PESTLE dimension: Political, Economic, Social, Technological, Legal, and Environmental (Table 7). These strategic objectives are broken down into 15 assessment criteria (AC) and evaluated using 60 metrics, each with established reference values (Silva et al., 2023). The metrics composing the BWS AF are of different nature: 38 PIs; 3 questionnaire-based indices; 19 interview-based indices (Table 7). Table 8 presents, per assessment criteria, a selection of KPIs, their formulation and reference values. The complete portfolio is available in Silva et al. (2023).

An example of how to visualize the WOLL impact assessment is shown in Chapter 6.

Table 7. Overview of the water Smartness BWS assessment framework (adapted from Silva et al. 2023) and its relation with the PESTLE dimensions. [Score: '++' dominant dimension, '+' relevant, '' not relevant]

ASSESSMENT CRITERIA	P	E	S	T	L	E	No. of metrics
SO A. Ensuring water for all relevant uses							
A.1 Safe and secure fit-for-purpose water provision	+		++	+	++	++	3 PIs, 1 index
A.2 Accessibility and equity (for people and for other uses)	+	+	++				4 PIs
A.3 Financial viability		++				+	1 PI, 3 indices
SO B. Safeguarding ecosystems and their services to society							
B.1 Safeguarded water ecosystems					++	++	3 PIs
B.2 Enhanced ecosystem services to society			+			++	5 PIs
B.3 Resource efficiency				+		++	4 PIs
SO C. Boosting value creation around water							
C.1 Circular policy making	++	+		+	+	+	1 PI, 4 indices
C.2 Circular economy growth		++		+		+	3 PIs
C.3 Resource recovery and efficient use		++	+	+	+	++	5 PIs
SO D. Promoting adaptive change towards resilient infrastructure							
D.1 Enabling planning to promote adaptive change towards circularity and resilience	+	++		++	+	+	1 index
D.2 Implementing adaptive change towards resilient infrastructure	+	++		+	+	+	1 PI, 1 index
D.3 Effectiveness of the adaptive change towards resilient infrastructure (Diagnosis)		+	++			++	8 PIs
SO E. Engaging citizens and actors across sectors in continuous co-learning and innovation							
E.1 Awareness and knowledge	+		++				5 indices
E.2 Multi-sector network potential	++						3 indices
E.3 Stakeholder engagement processes	+		++				4 indices

Table 8. A selection of KPIs per assessment criteria of the BWS AF (adapted from Silva et al. 2023)

Assessment criteria Metric	Reference values
A.1 Safe and secure fit-for-purpose water provision	
A.1.2 Safe drinking water (%) (1 - Samples of drinking water with exceedance (No.) / Drinking water samples analysed (No.)) x 100	<ul style="list-style-type: none"> ● [98.5; 100] ● [94.5; 98.5[● [0; 94.5[
A.1.3 Compliant reclaimed water (%) (1- Samples of reclaimed water with exceedance (No.) / Reclaimed water samples analysed (No.)) x 100	<ul style="list-style-type: none"> ● [95; 100] ● [90; 95[● [0; 90[
A.1.4 Security and resilience index (Score 1-100)	<ul style="list-style-type: none"> ● [140; 200] ● [75; 140[● [0; 75[

Assessment criteria Metric	Reference values		
A.2 Accessibility and equity (for people and for other uses)			
A.2.1 Physical access to drinking water supply for households and small businesses (%) Households connected to the service (No.) / Households in the area (No.) x 100	Predominantly urban areas ● [95; 100] ● [80; 95[● [0; 80[Intermediately urban areas ● [90; 100] ● [80; 90[● [0; 80[Predominantly rural areas ● [80; 100] ● [70; 80[● [0; 70[
A.2.4 Physical access to water for irrigation (%) Area of land irrigated with freshwater, reclaimed water and/or rainwater (ha) / Irrigated area (ha) x 100	● [85; 100] ● [50; 85[● [0; 50[
A.3 Financial viability			
A.3.4 Cost coverage ratio Revenue generated from by-products recovery, around water due to water reuse and from by-products recovered from wastewater treatment (€/year) / Total costs excluding the investment subsidized (€/year)	● [1.0; 1.1] ● [0.9; 1.0[or]1.1; 1.2] ● [0; 0.9[or]1.2; +∞[
B.1 Safeguarded water ecosystems			
B.1.3 Effective wastewater treatment (%) Treated wastewater complying with legal requirements (m ³ /year) / Treated wastewater (m ³ /year)	● 100 ● [95; 100[● [0; 95[
B.2 Enhanced ecosystem services to society			
B.2.2 Maintaining nursery populations and habitats (%) Water area with a good ecological status or better (km ²) / Overall water area of the whole catchment (km ²) x 100	● [40; 100] ● [10; 40[● [0; 10[
B.3 Resource efficiency			
B.3.2 Carbon footprint (kgCO _{2eq} /m ³) Carbon footprint in the wastewater system (kg CO _{2eq} /year) / Treated wastewater (m ³ /year) Carbon footprint in the drinking water system (kg CO _{2eq} /year) / Drinking water production (m ³ /year)	● [0; 0.3] ●]0.3; 0.7] ●]0.7; +∞[
B.3.3 Energy consumption (kWh/m ³) Energy used in the wastewater system (kg CO _{2eq} /year) / Treated wastewater (m ³ /year) Energy used in the drinking water system (kg CO _{2eq} /year) / Drinking water production (m ³ /year)	For WS ● [0; 0.5] ●]0.5; 0.8] ●]0.8; +∞[For WW ● [0; 0.6] ●]0.6; 0.9] ●]0.9; +∞[
C.1 Circular policy making			
C.1.4 Green public procurement (%) Green public procurement contracts (No.) / Public procurement contracts, including non-green contracts, green contracts, and comprehensive green contracts (No.) x 100	● [50; 100] ● [10; 50[● [0; 10[
C.2 Circular economy growth			
C.2.1 Resource recovery revenues (%) Revenue generated from by-products recovery, around water due to water reuse and from by-products recovered from wastewater treatment (€/year)/ Revenue generated within the organization (€/year) x 100	● > interest rate + 0.5 ● [interest rate; interest rate + 0.5] ● < interest rate Based on the reference interest rates of the European Central Bank		

Assessment criteria Metric	Reference values		
C.3 Resource recovery and efficient use			
C.3.1 Water-related materials recovery (%) Material recovered (kg/year) / Potential recoverable material entering the treatment process or activity (kg/year) x 100	● [15; 100] ● [10; 15[● [0; 10[
C.3.3 Reclaimed water in non-potable uses (%) Reclaimed water used for different scopes (e.g., irrigation, street cleaning) (m ³ /year) / Water used for non-potable uses, from all sources, including reclaimed water (m ³ /year) x 100	● 1/3 of C.3.4 ● 1/3 of C.3.4 ● 1/3 of C.3.4 reference values		
C.3.4 Reclaimed water production (%) Reclaimed water produced (m ³ /year) / Treated wastewater (m ³ /year) x 100	WEI+ < 10 ● [5; 100] ● [0.5; 5[● [0; 0.5[10 ≤ WEI+ < 30 ● [10; 100] ● [5; 10[● [0; 5[
	30 ≤ WEI+ < 70 ● [20; 100] ● [10; 20[● [0; 10[WEI+ ≥ 70 ● [30; 100] ● [15; 30[● [0; 15[
C.3.5 Energy production (%) Energy produced from water treatment or waste recovery processes (kWh/year) / (Energy used in the drinking water system (kWh/year) + Energy used in the wastewater system (kWh/year)) x 100	For WS ● [10; +∞[● [5; 10[● [0; 5[For WW ● [20; +∞[● [10; 20[● [0; 10[
D.1 Enabling planning to promote adaptive change towards circularity and resilience			
D.1.1 Infrastructure planning index for adaptive change (Score 1-100)	● [70; 100] ● [40; 70[● [0; 40[
D.2 Implementing adaptive change towards resilient infrastructure			
D.2.2 Infrastructure implementation index for adaptive change (Score 1-100)	● [70; 100] ● [40; 70[● [0; 40[
D.3 Effectiveness of the adaptive change towards resilient infrastructure (Diagnosis)			
D.3.1 Linear water losses (m ³ /(year. km)) Water losses (m ³ /year) / Length of the supply and distribution pipelines, excluding the user branches (km)	For distribution ● [0; 1100] ●]1100; 1800] ●]1800; +∞[For bulk systems ● [0; 1800] ●]1800; 2700] ●]2700; +∞[
D.3.3 Incident occurrences (No./100 km/year) Registered incidents per year (No./year)/ Pipeline length for the considered system excluding the user branches (km)	For water supply bursts in distribution ● [0; 30] ●]30; 60] ●]60; +∞[For wastewater systems Floods ● [0; 0.5] ●]0.5; 2] ●]2; +∞[Collapses ● [0; 1.0] ●]1.0; 2.0] ●]2.0; +∞[
WS: Water Supply WW: WasteWater WEI+: Water Exploitation Index			

5 ROADMAP STEPS DESCRIPTION

5.1 WOLL CHARACTERIZATION

The WOLLs have already their path towards a water-smart society and have already developed an intensive and significant work. It is therefore important to refer the background and acknowledge the steps taken before the development or revision of the Strategic Plans.

The characterization includes a brief description of the WOLL features regarding (i) its location, geographical area of analysis and context; (ii) the vision establishing the core values of the WOLL and should encapsulate the future as well as define what success looks like; (iii) the mission as general description of the WOLL's nature and purpose that should be clear, concise, and easy to understand, as well as being part of the mindset of all members; (iv) need or motivation for the Strategic Plan development, and time horizon addressed; and (v) a summary of the state of play, with the identification and analysis of the work already in place in the organization or relevant to the WOLL, a survey of existing related processes and plans, use of other frameworks for assessment with due references, and analysis of the WOLL strategic agenda or existing strategic plan.

5.2 ASSESSING THE WOLL MATURITY AND IMPACT

5.2.1 Establishing the strategic objectives and the assessment criteria and metrics for WOLL maturity and for WOLL impact

Establishing objectives, assessment criteria, metrics and reference values is a crucial stage in order to know where the WOLL stands, to set up clear directions of action, as well as accountability of results through timely review, within a given time frame (short, medium or long-term) (ISO 24510:2007, 24511:2007, 24512:2007). The maturity assessment framework (chapter 3) should support the objectives definition for assessing the WOLL maturity and the B-WaterSmart assessment framework (chapter 4) should support the objectives definition for assessing the WOLL impact, in alignment with the WOLL vision and mission. The assessment criteria translate the objectives into the relevant points of view. The assessment frameworks should support the assessment criteria definition, in alignment with the strategic objectives. Metrics and reference values are an essential basis for establishing the diagnosis, prioritizing intervention solutions, and monitoring the results. Therefore, metrics assess the criteria, and their number should be as limited as possible at a strategic level. Once the metrics are defined, the reference values provided by the framework can be refined if needed (e.g. due to specific context). Other metrics used should be defined and referenced.

5.2.1.1 WOLL maturity

For assessing the WOLL maturity, the objectives (Table 9), assessment criteria (Table 10), metrics and reference values (Table 11) should be established.

Table 9. Strategic objectives for WOLL maturity

Objective A: [Designation]
Objective description: [TEXT]
Objective B: [Designation]
Objective description: [TEXT]
...

Table 10. Assessment criteria for WOLL maturity

Strategic objectives	Assessment criteria
Objective A [Designation]	Criterion A.1 [Criterion description]
	Criterion A.2 [Criterion description]
Objective B [Designation]	Criterion B.1 [Criterion description]
	Criterion B.2 [Criterion description]
	Criterion B.3 [Criterion description]
...	...

Table 11. Assessment metrics and reference values for WOLL maturity

Objectives	Assessment criteria	Metrics	Reference values for...		
			Poor performance	Fair performance	Good performance
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	[range]	[range]	[range]
		A.1.2 metric (units)	[range]	[range]	[range]
		A.1.3 metric (units)	[range]	[range]	[range]
	Criterion A.2 [Designation]	A.2.1 metric (units)	[range]	[range]	[range]
...

5.2.1.2 WOLL impact

For assessing the WOLL impact, the objectives (Table 12), assessment criteria (Table 13), metrics and reference values (Table 14) should be established.

Table 12. Strategic objectives for WOLL impact

Objective A: [Designation]
Objective description: [TEXT]
Objective B: [Designation]
Objective description: [TEXT]
...

Table 13. Assessment criteria for WOLL impact

Strategic objectives	Assessment criteria
Objective A [Designation]	Criterion A.1 [Criterion description]
	Criterion A.2 [Criterion description]
Objective B [Designation]	Criterion B.1 [Criterion description]
	Criterion B.2 [Criterion description]
	Criterion B.3 [Criterion description]
...	...

Table 14. Assessment metrics and reference values for WOLL impact

Objectives	Assessment criteria	Metrics	Reference values for...		
			Poor performance	Fair performance	Good performance
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	[range]	[range]	[range]
		A.1.2 metric (units)	[range]	[range]	[range]
		A.1.3 metric (units)	[range]	[range]	[range]
	Criterion A.2 [Designation]	A.2.1 metric (units)	[range]	[range]	[range]
...




















































5.2.2 Baseline assessment

The purpose of the baseline assessment is to establish the WOLL’s reference situation and to identify the most critical aspects to be improved considering the reference situation. The baseline assessment entails the gathering and evaluation of information relative to the global external context, the specific context which the organizations are a part of and the internal context of each WOLL.

The baseline assessment (Table 15 for WOLL maturity and Table 16 for WOLL impact) facilitates diagnosis and targets’ definition as they are the essential basis for prioritizing intervention solutions and monitoring the results, and should be established for the strategic planning horizon (tN). One or more intermediate points should be set in time for the evaluation of system performance, along with the establishment of intermediate targets.




















































5.2.2.1 WOLL maturity

Table 15. Metric results and targets for WOLL maturity

Objectives	Assessment criteria	Metrics	Reference values			Results (t0) (year)	Comment	Targets		
			Poor 	Fair 	Good 			t1 (year)	t... (year)	tN (year)
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
		A.1.2 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
		A.1.3 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
	Criterion A.2 [Designation]	A.2.1 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
...	

5.2.2.2 WOLL impact

Table 16. Metric results and targets for WOLL impact

Objectives	Assessment criteria	Metrics	Reference values			Results (t0) (year)	Comment	Targets		
			Poor 	Fair 	Good 			t1 (year)	t... (year)	tN (year)
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
		A.1.2 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
		A.1.3 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
	Criterion A.2 [Designation]	A.2.1 metric (units)	[range]	[range]	[range]	value  /  / 		value  /  / 	value  /  / 	value  /  / 
...	

5.2.3 SWOT analysis regarding WOLL maturity and impact

The assessment ends with the analysis of the evaluation results. A possible methodology is a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), in which results are summarized by identifying the WOLL strengths and weaknesses, as well as improvement opportunities and main threats. The description of internal and external contexts should focus on the factors that influence the reference situation the most.

The strategic plan should contain the information gathered for the analysis as well as the factor’s nature, whether a strength, a weakness, an opportunity, or a threat. These data can be presented as an appendix to the strategic plan. The evaluation of internal context information allows the identification of strengths and weaknesses of the organization relative to the strategic objectives. The evaluation of the external context information allows the identification of opportunities and of the main threats to the strategic objectives.

5.3 PROSPECTIVE EVALUATION OF THE WOLL EVOLUTION

5.3.1 Scenarios identification regarding WOLL maturity and impact

The term “scenario” means the set of factors not controlled by the WOLL that have the potential to influence performance during the period under review. Scenarios are a way to represent the uncertainty associated with the evolution of the external environment in which the WOLL operates. The need to consider different scenarios during the planning process can arise from uncertainty regarding external factors (e.g., changes in water consumption, climate changes, legal framework changes...).

The scenarios should be drawn (Table 17) based on the SWOT analysis (section 5.2.3). Evaluating information in the external context allows the identification of improvement opportunities and of the main threats that might influence the future performance of the WOLL regarding the established strategic objectives.

Table 17. Scenario’s identification

Scenario 1: [Designation]
Scenario description: [TEXT]
Scenario 2: [Designation]
Scenario description: [TEXT]
...

5.3.2 Prospective evaluation

The purpose of the prospective evaluation is to identify the most critical aspects to be improved taking into account the WOLL’s maturity baseline (5.2.2.1) and impact baseline (5.2.2.2) and the scenarios considered (5.3.1). This evaluation allows characterizing the expected trend of each metric affected by each scenario (Table 18 to Table 21).

5.3.2.1 WOLL maturity

Table 18. Prospective evaluation of WOLL maturity for scenario 1

Scenario 1 [Designation]							
Objectives	Assessment criteria	Metrics	Results (t0) (year)	Internal context changes expected	External context changes expected	Expected trend	Expected result in levels
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
		A.1.2 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
		A.1.3 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
	Criterion A.2 [Designation]	A.2.1 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
...

Table 19. Prospective evaluation of WOLL maturity for scenario 2

Scenario 2 [Designation]							
Objectives	Assessment criteria	Metrics	Results (t0) (year)	Internal context changes expected	External context changes expected	Expected trend	Expected result in levels
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
		A.1.2 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
		A.1.3 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
	Criterion A.2 [Designation]	A.2.1 metric (units)	value ● / ● / ●	✓ / ✗ text	✓ / ✗ text	↗ / → / ↘	● / ● / ●
...

5.3.2.2 WOLL impact

Table 20. Prospective evaluation of WOLL impact for scenario 1

Scenario 1 [Designation]							
Objectives	Assessment criteria	Metrics	Results (t0) (year)	Internal context changes expected	External context changes expected	Expected trend	Expected result in levels
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
		A.1.2 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
		A.1.3 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
	Criterion A.2 [Designation]	A.2.1 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
...

Table 21. Prospective evaluation of WOLL impact for scenario 2

Scenario 2 [Designation]							
Objectives	Assessment criteria	Metrics	Results (t0) (year)	Internal context changes expected	External context changes expected	Expected trend	Expected result in levels
Objective A [Designation]	Criterion A.1 [Designation]	A.1.1 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
		A.1.2 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
		A.1.3 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
	Criterion A.2 [Designation]	A.2.1 metric (units)	value ●/●/●	✓/× text	✓/× text	↗/→/↘	●/●/●
...

5.4 IDENTIFYING OPPORTUNITIES FOR IMPROVING WOLL MATURITY AND IMPACT AND ESTABLISHING PHASED-TARGETS

Based on the baseline assessment (section 5.2) and on the prospective trend (section 5.3), the WOLL should identify metrics to improve and establish intermediate and horizon targets for those metrics, as shown in Table 15 for WOLL maturity and in Table 16 for WOLL impact.

5.5 IDENTIFICATION AND PRELIMINARY TECHNOECONOMIC EVALUATION AND RANKING/PRIORITIZATION OF CANDIDATE STRATEGIES FOR IMPROVING WOLL MATURITY AND IMPACT

Strategies correspond to the solutions to be implemented, selected from the decision process, with higher contribution to the strategic objectives considering the existing restrictions. Based on the baseline assessment and prospective evaluation, it is necessary to address the identified improvement opportunities through the development of strategies considering the defined targets. These strategies should be aligned with the previously outlined strategic objectives and should take advantage of the opportunities while minimizing the threats, improving the weaknesses, and leveraging the strengths.

The development of strategies involves several steps: i) identification of alternatives, ii) characterization of alternatives, iii) comparison of alternatives, iv) from the possible alternatives, the selection of the solutions to be implemented that constitute the strategies, v) description of strategies and alignment with the objectives.

Usually, there is more than one solution for the problems identified. These constitute the alternatives to be analysed and compared. Therefore, alternatives correspond to the options considered for solving the problems identified in the diagnosis phase, to achieve the strategic objectives. In the identification of alternatives, these may be exclusively infrastructural solutions (e.g., rehabilitation, expansion and new construction, improving or upgrading treatment plants), non-infrastructural (e.g., correspond to changes in the mode of operation and maintenance, data management, public awareness, such as improvement of information systems, public awareness initiatives) or a combination of the two types of alternatives (e.g. water losses management, undue flows management, water reuse implementation (upgrading treatment plant, construction of system, public awareness campaigns). Status quo should constitute an alternative for comparison. For the development of the strategies, it is fundamental to consider the Portfolio of solutions and best practices developed in Water4All task D2.6.

Alternatives can be analysed and should cover performance, risk, and cost aspects. It is important to address the investment needs in this comparison. Table 23 and Table 24 for maturity and Table 26 and Table 27 for impact may support the comparison of the alternatives in each scenario. This comparison yields the strategies to be implemented and to be described in Table 22 and Table 25. Defining strategies is the ultimate goal of the strategic plan.

5.5.1 WOLL maturity

Table 22. Strategies for WOLL maturity

[Strategy designation]
Strategy description: [TEXT]
Strategic objective(s) addressed: [TEXT]
Metrics that will be affected by the strategy: [TEXT]
[Strategy designation]
Strategy description: [TEXT]
Strategic objective(s) addressed: [TEXT]
Metrics that will be affected by the strategy: [TEXT]

Table 23. Comparison of alternatives for WOLL maturity considering scenario 1

Scenario 1 [Designation]							
Alternatives/Metrics	A.1.1 metric (units)	A.1.2 metric (units)	A.2.1 metric (units)	B.1.3 metric (units)	C.3.4 metric (units)	...	Global score (arithmetic average of the normalized values)
A0. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
...

Table 24. Comparison of alternatives for WOLL maturity considering scenario 2

Scenario 2 [Designation]							
Alternatives/Metrics	A.1.1 metric (units)	A.1.2 metric (units)	A.2.1 metric (units)	B.1.3 metric (units)	C.3.4 metric (units)	...	Global score (arithmetic average of the normalized values)
A0. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
...

5.5.2 WOLL impact

Table 25. Strategies for WOLL impact

[Strategy designation]
Strategy description: [TEXT]
Strategic objective(s) addressed: [TEXT]
Metrics that will be affected by the strategy: [TEXT]
[Strategy designation]
Strategy description: [TEXT]
Strategic objective(s) addressed: [TEXT]
Metrics that will be affected by the strategy: [TEXT]

Table 26. Comparison of alternatives for WOLL impact considering scenario 1

Scenario 1 [Designation]							
Alternatives/Metrics	A.1.1 metric (units)	A.1.2 metric (units)	A.2.1 metric (units)	B.1.3 metric (units)	C.3.4 metric (units)	...	Global score (arithmetic average of the normalized values)
A0. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
...

Table 27. Comparison of alternatives for WOLL impact considering scenario 2

Scenario 2 [Designation]							
Alternatives/Metrics	A.1.1 metric (units)	A.1.2 metric (units)	A.2.1 metric (units)	B.1.3 metric (units)	C.3.4 metric (units)	...	Global score (arithmetic average of the normalized values)
A0. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A0. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t1 (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] t... (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
A1. [Designation] tN (year)	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value	Metric value ●/●/● normalized value		●/●/● normalized value
...

5.6 RESOURCES NEEDED FOR IMPLEMENTING THE STRATEGIES AND FINANCING INSTRUMENTS

The strategies should include information on human (Table 28), technological (Table 29), and financial (Table 30) resources necessary for its implementation. These can be outlined with varying degrees of detail, depending on the information available. This may be established, e.g., based on each strategy or type of actions considered for the strategies. Information and guidelines are available from other tasks (e.g., D3).

Table 28. Human resources needed for the Plan implementation

Resources	[t1]	[t2]	...	[tN]
e.g. persons working as full-time equivalent per type of competence, teams, etc.	number	number		number
TEXT				

Table 29. Technological resources needed for the Plan implementation

Resources	[t1]	[t2]	...	[tN]
e.g., acquisition of equipment per type, informatic licenses, fleet,....	number	number		number
TEXT				

Table 30. Financial resources needed for the Plan implementation

Resources	[t1]	[t2]	...	[tN]
e.g., estimated budget (or “educated guess”) in the human and technological resources above and other investments needed, ...	number or range	number or range	number or range	number or range
TEXT				

5.7 IMPLEMENTING THE STRATEGIES

The programming of strategies has to be defined and will support future monitoring and revision of the strategic plan, by specifying the different strategies to be implemented and what actions to be carried out, the percentage or degree (e.g. area/year, km/year) of implementation over time (Table 31).

Table 31. Plan for implementation of strategies

Strategies	Starting date [t1]	Intermediate date/period [t2]	...	Completion date/period [tN]
e.g., ST 01: increase the treatment capacity to increase the overall treatment level to comply with the new UWWTD requirements and to increase the reclaimed water production and non-potable reuse	- Forecast the performance with the new UWWTD - Define specifications and procurement	Start implementation	...	Concluded and fully operational
TEXT	TEXT	TEXT	TEXT	TEXT

5.8 MONITORING AND REVISION OF THE IMPLEMENTATION PLAN

Monitoring consists of gathering the necessary data, systematically calculating the level of execution of the strategies and the performance metrics for all strategic objectives, as well as comparing them with their respective targets. Deviations to the plan need to be clearly identified, either due to unplanned actions during the monitoring period, changes in the planned level of execution, or to unexpected metrics values obtained.

The level of execution must consider an adequate program for the implementation of strategies (section 5.7). Data can be presented as an appendix to the strategic plan. The monitoring process should periodically deliver a document synthesizing and interpreting the results obtained, as this will inform future revisions of the strategic plan (Table 32). This monitoring process should be described in the plan (e.g. activities to carry out and respective responsible person(s), period for monitoring, e.g. 3-5 years).

Table 32. Monitoring procedure

Monitoring activities	Periodicity (months)	Comments (responsible person(s), relevant information)
e.g., data collection for metrics calculation	12	Head of the Information Management Division
e.g., Collection of information on unplanned actions - deviations	12	Head of the Project and Design Department
e.g., report and internal dissemination of monitoring results	12	Head of the Exploitation Department
TEXT	TEXT	TEXT

The plan revision consists of systematically analysing the results of the plan monitoring, through the respective reports, to identify the causes of gaps or deviations and the improvement measures needed to bridge those gaps or adjustments (Table 33). It is the opportunity to review the context and identify the need to adjust the objectives, criteria, metrics, targets, strategies, resources, and implementation program. The aim is to ensure that the plan is continuously updated, to achieve the established strategic objectives.

This revision should take place periodically (e.g. every 5-6 years, depending on the monitoring period), and extraordinary revisions may be needed if exceptional changes occur in the meanwhile. This process should be described in the plan (e.g. activities and responsible person(s), period for revision).

Table 33. Revision procedure

Revision activities	Periodicity (years)	Comments (responsible person(s), relevant information)
e.g., analysis of plan monitoring	5	Head of the Planning Department
e.g., analysis of deviations to the plan implementation/execution	5	Head of the Project and Design Department
e.g., review SWOT analysis, as context might have changed	5	Head of the Planning Department
e.g., report and internal dissemination of revision results	5	Head of the Planning Department
TEXT	TEXT	TEXT

6 MONITORING AND REVISION OF WOLL MATURITY AND IMPACT

Every 3 to 5 years, the WOLLs should undergo a comprehensive review process, following steps 5.1 to 5.7, to update and revise their corresponding WOLL factsheets in the ATLAS system. This periodic revision ensures that the information remains accurate, relevant, and reflective of the current state of the WOLL development.

Figure 5 provides a simple and intuitive way to visualize, interpret and communicate the WOLL's assessment evolution towards maturity and impact.

Deliverable D4.10 - Migration Roadmap for Demonstration of Innovation

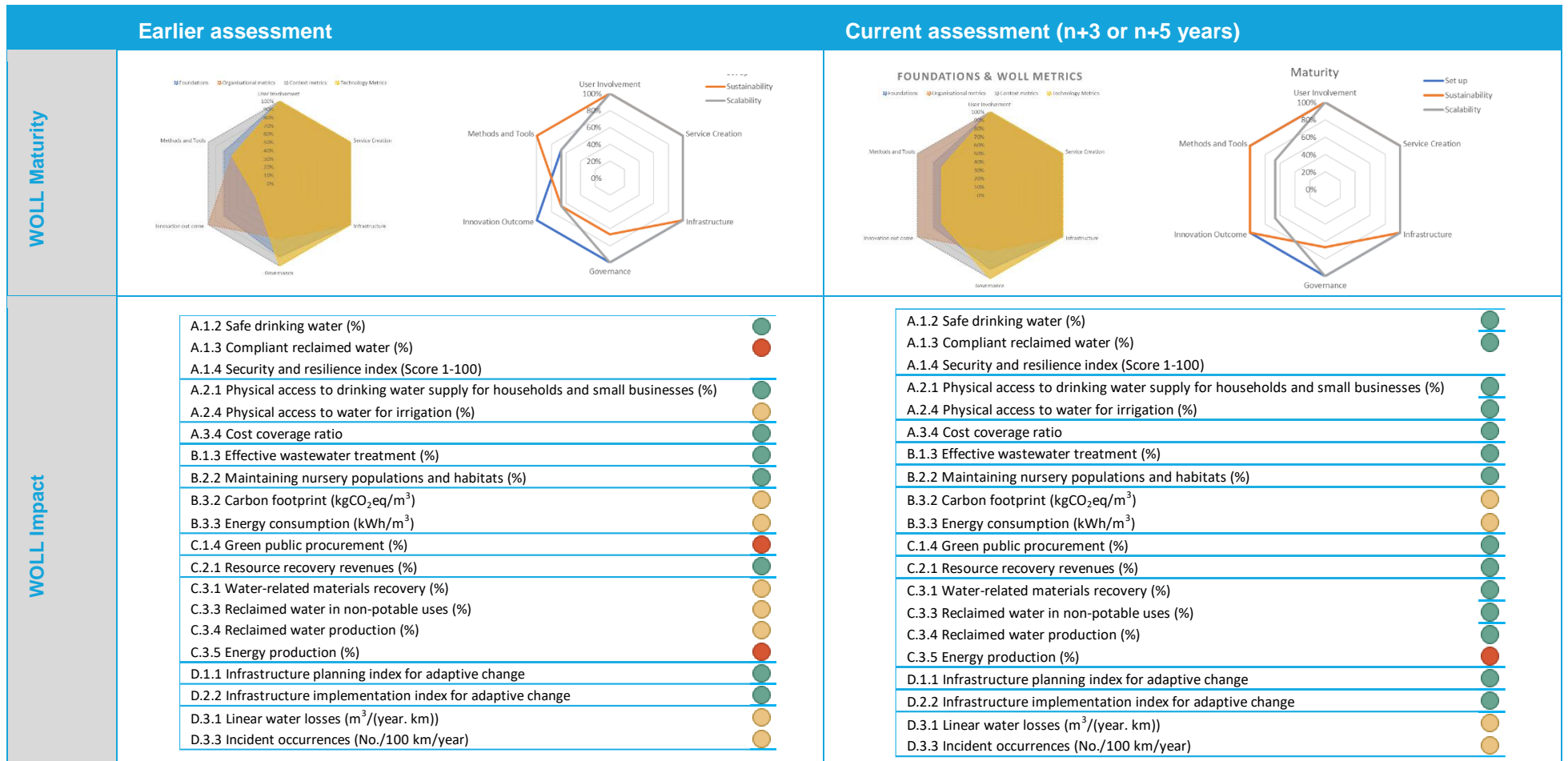


Figure 5. An example of a factsheet of WOLL maturity and impact evolution (assessment criteria and metrics described in sections 3 and 4, respectively)

7 NEXT DEVELOPMENTS OF THE ROADMAP

The roadmap and the frameworks are intended to serve as dynamic, iterative tools rather than static solutions. They represent a continuous process that must evolve alongside their application by WOLLs. As such, these tools should be regularly tested, applied in real-world contexts, and refined based on practical experiences and emerging challenges. Continuous feedback and adaptation are essential to ensure their relevance, effectiveness, and scalability across different contexts.

The next phases of the Water4All partnership should therefore include a task providing a common path for supporting the voluntary WOLLs in the roadmap and frameworks implementation, building knowledge and skills among Water-Oriented Living Labs (WOLLs) and their stakeholders. This new task should entail initiatives tailored to their specific needs, namely, mentoring and training on the roadmap steps' implementation, as well as thematic workshops on relevant topics developed within other tasks of Water4All pillar on WOLLs or other pillars, e.g. sustainable water management practices, innovative technologies, and effective governance models, as exemplified in Figure 6. This common path/program will not only facilitate the transfer of knowledge but also foster collaboration and networking among participants, encouraging the sharing of experiences and best practices.

Jan-Mar (2 days) steps 1-3	Apr-Jun (2 days) steps 4-5	Jul-Sep	Oct-Dec (2 days) steps 6-8
<ul style="list-style-type: none"> Start-up guide (Mechelen) Roadmap & Training on strategic planning (overall & steps 1-3) (LNEC) Training on WOLL maturity harmonization cube (WE) and on the framework (CEW, LNEC) Training on the BWS AF (LNEC, WE) <p><i>2 days in person</i></p>	<ul style="list-style-type: none"> Training on strategic planning steps 4-5 (LNEC) Guidelines with the portfolio of BATs (CEW et al.) <p><i>1 day online</i></p>		<ul style="list-style-type: none"> Training on strategic planning steps 6-8 (LNEC) <p><i>1/2 day online</i></p>
<p>Pillars' A-C-E-D workshops top-down & bottom-up inputs to:</p> <ul style="list-style-type: none"> SRIA KHubs, sci-policy WGs end-user interface/economy PhD scheme, RIs internationalization WOLLs SWOT, scenarios <p><i>1-2 days in person</i></p>	<p>WOLLs open events best practices/solutions for WOLL maturity & WOLL impact (inviting pillars A,C,E & beyond W4A):</p> <ul style="list-style-type: none"> <p><i>n days in person (& streaming)</i> <i>n days online</i></p>		<p>D3 & WOLLs on financial mechanisms (inviting other pillars ???):</p> <ul style="list-style-type: none"> <p><i>1 day in person (& streaming)</i></p>
<ul style="list-style-type: none"> Supporting WOLLs in steps 1-3 (LNEC et al.) Peer learning among WOLLs (LNEC, WE et al.) <p><i>Online bilateral meetings</i> <i>Online meeting with all WOLLs in the process</i></p>	<ul style="list-style-type: none"> Supporting WOLLs in steps 4-5 methodologies (LNEC et al.) <p><i>Online bilateral meetings</i></p>		<ul style="list-style-type: none"> Supporting WOLLs in steps 6-8 methodologies (LNEC et al.) <p><i>Online bilateral meetings</i></p>

Figure 6. Example of a calendar of roadmap steps implementation [white rows = events for roadmap steps implementation; blue rows = networking events between pillars and beyond Water4All (top-down & bottom-up approaches & inputs)]

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