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BOOST-IN

Uptake of innovative and circular solutions for water

POLICY ASSESSMENT FRAMEWORK FOR ANALYSING WATER AND CIRCULAR ECONOMY SOLUTIONS (WACES) WITHIN THE BOOST-IN PROJECT

Deliverable 3.1: Assessing the contribution of selected WACES for meeting EU- and National Policy Targets

WP: 3

Author: Thomas Glößl, Guido Schmidt, Nike Sommerwerk, Nuria Hernández-Mora, Jasmin Clare

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RESPONSIBLE AUTHOR	Thomas Glößl, Guido Schmidt, Nike Sommerwerk, Nuria Hernández-Mora, Jasmin Clare		
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ABSTRACT	This deliverable, D3.1, presents the policy assessment framework developed within the WP3 to evaluate the potential contributions of Water and Circular Economy Solutions (WACES) to achieving EU policy objectives. The framework is designed to provide a structured and consistent methodology for assessing WACES in relation to key environmental, circular economy, and climate policies.		

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Executive Summary

This deliverable, D3.1, presents the policy assessment framework developed within WP3 to evaluate the potential contributions of Water and Circular Economy Solutions (WACES) to achieving EU policy objectives. The framework is designed to provide a structured and consistent methodology for assessing WACES in relation to key environmental, circular economy, and climate policies.

The assessment framework is based on the OECD-DAC evaluation criteria, alongside six dimensions: relevance, coherence, effectiveness, efficiency, impact, and sustainability. It integrates qualitative and quantitative evaluation methods to assess how WACES align with EU policy targets, potential trade-offs, and long-term viability.

To ensure robustness, the framework incorporates a multi-step data collection process, including questionnaires, interviews, and on-site visits; whilst aiming to ease the burden for the WACES owners. It also establishes a colour-coded classification system for evaluating policy alignment, trade-offs, and sustainability aspects, including climate resilience.

As the first step within the WP3, this deliverable's goal is to lay the groundwork for the upcoming assessment of selected WACES. It serves as an internal reference for project partners, ensuring a coherent and systematic approach to evaluating the policy relevance and implementation potential of WACES in subsequent phases.

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Acronyms

BRL – Business Readiness Level

CBA - Cost-Benefit Analysis

EGD - European Green Deal

GW - Ground Water

LCA - Life Cycle Assessment

LCC - Life Cycle Costing

OECD-DAC – Organisation for Economic Co-operation and Development - Development Assistance Committee

ROps - Regions of Opportunities

SW - Surface Water

SDGs - Sustainable Development Goals

TRL - Technology Readiness Level

WACES - Water and Circular Economy Solutions

WP - Work Package

1.0 Introduction

The BOOST-IN project addresses the critical issues of water scarcity and quality in Europe, challenges that are increasingly driven by climate change and human activities. By promoting Water Circular Economy Solutions (WACES), the project seeks to advance the adoption and development of innovative solutions that enable efficient water management and resource recovery. Therefore, Deliverable 3.1 represents a policy assessment framework tailored to WACES innovations. This framework evaluates the extent to which WACES contribute or possibly contradict EU policy objectives, particularly in the context of the European Green Deal and in achieving the Sustainable Development Goals (SDGs).

The framework, developed by Fresh Thoughts Consulting (FT) establishes criteria and questions for assessing WACES across 24+ case studies, selected from a pool of case studies collected within the project. The selected case studies are based on regional relevance, predefined by the needs of the Regions of Opportunities (ROps) and innovation potential, serving as practical examples for analysing the potential policy contributions of WACES. The deliverable's primary goal is to provide a framework that allows to evaluate the alignment of WACES with circular economy and environmental policies, measure their effectiveness in achieving EU objectives, and identify potential trade-offs between their benefits and other policy areas.

In addition to alignment and effectiveness, this report explores the broader impacts of WACES, including their capacity to drive systemic change and their transformative effects on water management practices. Implementation barriers, such as regulatory, technical, and social challenges, are analysed to provide insights into overcoming obstacles and facilitating wider WACES adoption and roll-out. Furthermore, the report evaluates their sustainability, emphasizing climate resilience and the ability to deliver long-term benefits under evolving environmental conditions. By conducting climate-proofing assessments, the framework ensures that WACES remain viable in the face of hazards, rising temperatures, and other climate-related risks.

Structure of the deliverable

This deliverable comprises the following sections:

- Chapter 2: This chapter outlines the overall methodology used to evaluate the contribution of WACES to EU policies. It covers the OECD-DAC-based policy assessment criteria, the multi-step selection process narrowing 183 submissions to 24+ case studies, and the tools used for data collection, including questionnaires, interviews, and on-site visits.
- Chapter 3: This chapter presents the detailed policy assessment framework applied to analyse the 24+ WACES. It summarises their performance across six criteria: Policies Addressed, Trade-offs, Effectiveness on the Ground, Efficiency, Uptake, and Climate Resilience. The criteria analysis is based on an integrated colour-coded system, which allows for a straightforward display.
- Annexes: The annexes provide the questionnaire used for the detailed assessments of the 24+ WACES. Additional sections cover relevant regulations, guidelines, and supporting data for the evaluations.

2.0 Methodology of the policy assessment framework

This chapter provides an overview of the methodology used to assess the WACES contribution to EU policy objectives. It includes a detailed explanation of the policy assessment criteria, which are adapted from the OECD-DAC alongside relevance, coherence, effectiveness, efficiency, impact, and sustainability. The WACES-selection process, involving a multi-step approach to identify 24+ case studies from an initial pool of 183 submissions, is thoroughly described. Additionally, the chapter outlines the tools and techniques employed for data collection and analysis, such as questionnaires, interviews, and on-site visits.

2.1 Policy assessment criteria

The criteria used to assess the WACES' performance are based on the Organisation for Economic Co-operation and Development – Development Assistance Committee (OECD-DAC)[1] evaluation framework, alongside the following six criteria – relevance, coherence, effectiveness, efficiency, impact, and sustainability.

This structure helps evaluating how well WACES align with EU policies, how they perform in practice, their potential trade-offs, and their long-term sustainability in the face of climate risks. Each criterion asses a particular aspect and includes a specific methodology designed to analyse both the contributions and challenges associated with WACES. The following table presents these criteria, their associated focus areas and aims, and the adapted terminology and scope of application ultimately used.

OECD criteria	WACES assessment focus and terminology
Relevance: Evaluates how well the intervention's objectives align with the needs and priorities of beneficiaries, as well as national, global, and institutional policies. It considers whether the intervention adapts to changes and reflects inclusivity, focusing on "leaving no one behind".	**Policies Addressed:** **Which EU policies benefit from WACES?** Evaluates the alignment between WACES and EU policy objectives. The main objective is to assess which EU policies potentially benefit most from the WACES and how/which WACES contribute to a wide spectrum of policies.
Coherence: Assesses how well the intervention works alongside other policies or interventions, both within the same organisation (internal coherence) and to external actors (external coherence). It looks for complementarity, harmonisation, and coordination, highlighting synergies or trade-offs between policy areas.	**Trade-offs:** **Which are the (potential) trade-offs of WACES?** Analyses the potential trade-offs between the benefits of WACES and their impact on various EU policies. The aim is to understand how/which WACES might contribute to certain policy objectives but potentially conflict with or hinder others, particularly within the EU's circular economy and environmental policy framework.
Effectiveness: Measures the degree to which the intervention achieves its intended objectives and results, considering their relative importance. This criterion also examines the intervention's effect on different groups and is used as an overall measure of success.	**Effectiveness on the ground:** **Are WACES significantly contributing to EU policies?** Assesses the extent to which WACES are achieving their intended objectives related to EU policy goals. The evaluation helps determine whether WACES are driving meaningful policy impact on the ground.

[1] OECD (2021), *Applying Evaluation Criteria Thoughtfully*, OECD Publishing, Paris, https://doi.org/10.1787/543e84ed-en. Understanding the six criteria: Definitions, elements for analysis and key challenges, https://www.oecd-ilibrary.org/.

	across different locations and scales of implementation.
Efficiency: Analyses whether the intervention delivers results economically and in a timely manner. It focuses on the cost-effective use of resources (funds, time, expertise, etc.) compared to feasible alternatives, with an emphasis on timely delivery and resource justification.	**Efficiency:** **Are WACES an efficient solution?** Evaluates the efficiency of WACES by comparing the costs and benefits through CBA and assessing their sustainability over their lifecycle using LCA. CBA helps to determine the economic return on investment, while LCA assesses WACES based on their environmental impact throughout their lifecycle.
Impact: Looks at the significant, higher-level effects of the intervention, whether positive or negative, intended or unintended. The impact goes beyond effectiveness by addressing transformative changes in systems, norms, or people's lives, asking whether the intervention made a meaningful difference.	**Uptake:** **Which barriers hinder WACES uptake?** Evaluates the barriers that hinder the successful implementation and uptake of WACES. The goal is to understand what barriers, such as regulatory, technical, financial, or social factors, are limiting effective implementation and how significant they are. Given that most of the assessed WACES are still in the initial implementation stage, a full assessment of potential impacts cannot be undertaken with reliable data.
Sustainability: Evaluates whether the benefits of the intervention are likely to continue over time. It involves analysing financial, economic, social, and environmental factors, and how these interact to ensure the long-term continuation of benefits.	**Climate resilience:** **How climate-proof are WACES?** Assesses the long-term resilience of WACES to climate-related risks and their ability to continue delivering benefits in the face of changing environmental conditions. By evaluating the vulnerability of WACES to extreme weather events, floods, sea level rise, droughts and other climate hazards, the assessment aims to ensure that WACES remain functional and sustainable over time. Other sustainability aspects (e.g., financial, economic or social) are beyond the assessment capacity of BOOST-IN and have often high uncertainty in the data provided.

2.2 Selection of WACES for the assessment

The WACES selection process began with the dissemination of a questionnaire via various networks (e.g., social media) to encourage as many WACES holders as possible to participate in the project. This questionnaire served as both an initial insight into the wide variety of WACES and as a first contact with key stakeholders, facilitating future interactions. Based on this first questionnaire, 183 WACES were submitted to BOOST-IN. To reduce the WACES number for the policy assessment to a reasonable amount and provide a relevant selection, also coordinated with other project partners, the following criteria were agreed upon to do a preselection:

Selection criteria	Impact assessment	Social assessment	Policy assessment	**Justification FT**
	ECOFILAE	**ECOFILAE**	**FT/NTUA**	

ROp Challenges	5 challenges (ROp's leaders)	-
TRL	5(6) – 8	Only TRL5+ upwards can give the real-life validation relevant to the assessment.
BRL	Not applicable	-
Case study	Yes	Essential to ensure the analysis is relevant.
Type of solution	Tech/Product (No training)	Excluding „training or advisory material"; as they do not introduce directly a change.
Location	EU – Horizon Europe	Focus on locations within the ROps and/or ROps relevant topics but within Europe
Other?	Motivation	-

The preselection resulted in 92 WACES that were directly contacted by mail using a second questionnaire to gather additional data, which resulted in a response from 88 WACES holders showing further interest for cooperation. In a next step, meetings with the ROps were conducted in order to narrow the WACES down to 5 in order to have a final selection. This resulted in 24 WACES, which will be assessed by WP3.

Overall, the selection of WACES is broadly representative of all submissions received; but the core criteria are the challenges faced by the ROPs, which should be responded to, as well as the feasibility and usefulness of the policy assessment.

2.3 Policy assessment

Objective: To assess each WACES' contribution to the targets of EU level regulations and strategies, respective documents under the European Green Deal (EGD) and SDGs strongly related to WACES were analysed. EU policies such as the Water Framework Directive and the Urban Wastewater Treatment Directive were scanned according to key criteria, largely aligned with the EU Better Regulation Guidelines. Also, EGD strategies such as the Climate Change Adaptation Strategy and the Circular Economy Action Plan were considered. For further information on which documents were analysed, see ANNEX II.

Approach: A detailed review of EU directives, strategies, and regulations was undertaken to extract policy targets and objectives related to circular economy, environmental protection, and sustainable development. The objectives of each EU circular-economy policy[2] were analysed for their applicability in the policy framework. This analysis addressed the question, "Does this WACES contribute to…?" For instance, targets such as those outlined in Article 1 of the Nitrates Directive, which aims to reduce water pollution caused by agricultural nitrates, were included in the analysis. The comprehensive table for target allocation can be found in ANNEX V. This table will not be updated for the policy analysis in the project lifetime, as a second assessment is not foreseen. However, new policies will be tracked, and if relevant assessed against the WACES, though not at an individualised level.

[2] Policy instruments are techniques used by the governing authorities (government or public) to promote certain policies to achieve a predefined set of goals. They are interventions designed by such authorities intending to motivate all stakeholders involved in the issue at stake. This can be a directive, a regulation, a strategy, a plan or a program.

2.4 Engagement

The WACES policy assessment can provide useful input for WACES owners but requires their engagement to share information via a questionnaire, interviews and potentially on-site visits and discuss assessment results.

Objective: The objective is to motivate WACES owners to participate in the in-depth policy assessment process and foster their collaboration to ensure the provision of accurate and detailed data for policy evaluation by offering an insight into:

- **Policies addressed**: An analysis of the specific contributions to the EU policy agenda of the WACES solution.
- **Trade-offs**: An identification of gaps and weaknesses which might be addressed in the further development.
- **Uptake**: An analysis of barriers and recommendations on how to overcome them.
- **Climate resilience**: A climate proofing analysis for one pilot site which could help to access EU funds.

Approach: The willingness to engage and maintain an active dialogue is essential for the assessment success. Motivating WACES owners is therefore a key priority. To encourage their participation, the second questionnaire emphasised the benefits of engaging in the collaboration such as getting feedback, taking advantage of the benefits of the large and diverse stakeholder network for promotion, visibility, wider implementation and roll-out. Throughout the process, it remains critical to continuously highlight the cooperation advantages, ensuring that WACES owners see the value in their investment of time into the project.

2.5 Data collection

The data collection process supports the generation of the analysis framework and includes several steps:

1. Collection from literature and data sources

Objective: Gather basic information such as the OECD framework or climate change related data for the risk assessment from secondary sources providing context and complementing the primary data collection methods. Furthermore, documents are screened which were provided by the WACES owners.

Approach: The data collection includes various sources such as:

- Websites and online databases: Relevant websites and databases providing information on WACES and their implementation.
- WACES Database: Information from the existing WACES database, which includes implementation details, and performance indicators.

This information serves as a baseline for understanding WACES contributions and complements the qualitative insights gathered through interviews and on-site visits.

2. Questionnaires

Objective: The goal of distributing the questionnaires is to collect standardised data from WACES-owners and gather structured, quantifiable information on WACES implementation and performance.

Approach: Three questionnaires with different goals are distributed:

- Questionnaire 1: The goal is to get in touch with different WACES holders via different platforms and to collect as many different projects as possible (conducted during the first project phase; starting Summer 2024).
- Questionnaire 2: The aim is to narrow down and specify different WACES and get their holders on board for cooperation (Start Winter 2024).
- Questionnaire 3: The goal is to gather detailed, work package-specific information which can be used to analyse the assessment criteria (make reference to the section of the report where these are introduced). The questions are directly linked to the assessment criteria respectively and each of them fills a knowledge gap. The questionnaire is sent to the 24+ WACES that are participating in the detailed analysis and can be found in ANNEX I.

3. Interviews

Objective: Capture detailed qualitative insights and experiences directly from key WACES stakeholders such as partners, implementers, and stakeholders, allowing for a deeper understanding of specific challenges and success factors.

Approach: Interviews are conducted with WACES stakeholders, focusing on:

- Real-world experiences and challenges faced during implementation.
- Specific barriers encountered, such as regulatory authorisations or technical limitations.
- Perceived policy impacts and contributions of WACES.

Semi-structured interviews allow flexibility, while ensuring critical topics are covered. The interview structure includes:

- Presentation of participants in the meeting.
- Presentation of the purpose and the potential benefits of the policy assessment exercise, as described in Chapter 2.5. Engagement.
- Answering specific questions to close knowledge gaps.

4. On-site visits

Objective: Obtain first-hand, location-specific data on the implementation of WACES and observe the practical outcomes in real-world settings.

Approach: On-site visits are conducted at selected WACES locations to:

- Validate the data gathered from questionnaires and interviews.
- Assess the operational status and technical functionality of WACES.
- Observe site-specific conditions and contextual factors affecting implementation.

3.0 Policy assessment approach

The following table summarises the overall performance of the different WACES against the six assessment criteria. Table 1 provides an integrated view of how each WACES aligns with EU circular economy policies, identifies trade-offs, and evaluates their effectiveness, efficiency, uptake barriers, and climate resilience. The colour codes used in the table synthesise the findings related to each criterion, offering a clear visual representation of WACES-performance. In the following chapters, the structure of the summary table is explained in more detail, along with a step-by-step breakdown of the methodology used to populate it.

Expected results:

Table 1: Overall expected results: Examples of the assessment results illustrate the colour-coded contributions.

Criteria	**Policies addressed**	**Trade-offs**	**Effectiveness on the ground**	**Efficiency**	**Uptake**	**Climate resilience**
Key questions:	Which EU policies benefit from WACES?	What are the (potential) trade-offs of WACES?	Are WACES significantly contributing to EU policies?	Are WACES an efficient solution?	Which barriers hinder WACES uptake?	How climate-proof are WACES?
WACES 1						
WACES 2						
WACES …						
Explanation: A more throughout explanation of the different colours and their meaning is presented in the following chapters.						

Overall rating: The overall rating allows an assessment of the various categories, indicating how a WACES generally performs in that category. However, it is important to note that due to the substantial differences in content across individual criteria, the colour code provides a highly simplified yet justified overall evaluation.

Table 2: Legend depicting the colour coding for assessing the WACES contributions.

	Highly positive
	Positive (Yes)
	Minor negative
	Significantly negative
	Excluding (No)
	Not applicable

3.1 Policies Addressed

The criterion "Policies Addressed" responds to the question "Which EU policies benefit from the WACES?". It evaluates the alignment between WACES and EU policy objectives. The main objective is to assess which EU policies potentially benefit most from the WACES and how/which WACES contribute to a wide spectrum of achieving those policies.

Data collection: The data for this criterion originates from Questionnaire 3, where the responses were linked to the examined EU policies (see ANNEX II for details).

Table 3: Methodology: Identification of which policies are addressed by the WACES.

Questionnaire 3 (FT selected WACES)		Data collection
Question	Answer	Results
Does your solution… (reduce water consumption or pollution, inputs, recover materials, fertilizer…)?	Neutral/No effect Minor negative effect Significant negative effect	No
	Minor positive effect Significant positive effect	Yes

Explanation: A directive is considered addressed if at least one question linked to a policy instrument receives a response indicating either a significant or minor positive effect; otherwise, it is considered a "No".

Expected result: The table below represents the contribution evaluation of WACES to 12 selected key EU circular economy directives and regulations. The aim is to assess, which of the 24+ selected WACES potentially contribute to the objectives of the relevant policy frameworks. The results gathered from the questionnaires and the interviews are used in a combined way to assess their contributions.

Table 4: Expected results (final): Summary of WACES contributing to EU Circular Economy-related Directives.

WACES / EU CE Directives	WACES 1	WACES …	∑
Nitrates Directive	Yes	No	
Water Framework Directive	Yes	Yes	
…	No	No	
Relevance (∑)			
Explanation: The row relevance is taken to rank the WACES based on the colour code and will be transferred to the overall summary table (see Table 1).			

Colour code:

High coverage: The WACES contributes to five or more policies (out of the 12), showcasing strong alignment with policy objectives and a comprehensive impact across a wide spectrum of policy areas.	
Moderate coverage: The WACES contributes to up to five policies, demonstrating partial alignment with policy objectives and a somewhat still focused impact across multiple policy areas.	
Not applicable: The answer in the questionnaire was left out. Therefore, no information is available.	
Explanation: The colour code was chosen to reflect a positive spectrum as it is expected that all the selected WACES will contribute to some of the selected policies.	

3.2 Trade-offs

This assessment identifies and analyses the potential trade-offs between WACES benefits and their alignment with key EU circular economy policies. While the previous section (policies addressed) highlights where WACES positively contribute to policy goals, this chapter analyses potential conflicts. This chapter refers to the question: "What are the (potential) trade-offs of WACES?"

Data collection: The data for this criterion originates from Questionnaire 3, where the responses were linked to the examined EU policies (see ANNEX II for details).

Table 5: Methodology: Overview trade-offs.

Questionnaire 3 (FT selected WACES)		Data collection
Question	Answer	Results

Does your solution… (reduce water consumption or pollution, inputs, recover materials, fertilizer…)?	Significant negative effect	
	Minor negative effect	
	Neutral/No effect Minor positive effect Significant positive effect	
	Not applicable	
Explanation: A trade-off related to a policy instrument can be identified when a questionnaire response indicates either a minor negative effect or a significant negative effect. In case no effect, minor or significant positive effects are expected, no trade-offs appear. If a question is not answered, the option 'not applicable' is selected.		

Expected results:

Table 6: Expected outcome (final): Summary of trade-off categories WACES fall into.

WACES / EU CE Directives	WACES 1	WACES 2	WACES …	∑
Nitrates Directive				
…				
Relevance				
Explanation: The overall performance of a WACES is presented in the row "Relevance", which is also transferred to the overall summary table (see Table 1). If more than five potential trade-offs occur, the WACES is marked red. Between 1 and 5 trade-offs the WACES is marked yellow and with no trade of green. The results are then transferred to the summary table.				

Colour code:

Yes Trade-off: Indicates that the WACES presents clear trade-offs with the policy objective. These conflicts may undermine the achievement of the directive's goals and would require substantial modifications or strategies to balance the competing interests.	
Potential Trade-off: This represents a situation with a possibility of minor trade-offs. The WACES may align with policy goals but could require adjustments or specific considerations to fully mitigate potential conflicts.	
No Trade-off: Indicates that no significant trade-offs are expected. The WACES aligns well with the policy objective, showing full compatibility with the directive, law or act without compromising other goals.	
Not Applicable: Indicates that the directive does not apply to the specific WACES being evaluated. There is no direct relationship or impact to consider, and therefore no trade-offs are relevant.	

3.3 Effectiveness on the Ground

The "Effectiveness on the ground" criterion responds to the question "Are WACES significantly contributing to EU policies?". It assesses the extent to which WACES are achieving their intended objectives related to EU policy goals. The evaluation helps determine whether WACES are driving meaningful policy impact on the ground across different locations and implementation scales.

The effectiveness assessment builds on the relevance criteria assessment (see chapter 3.1 Policies Addressed), which already identifies the relation between the WACES and the corresponding circular economy EU policies. Given that most of the WACES have only been implemented at a small scale and in a few places, it is hard to judge their (effective or potential) contributions to achieving EU circular economy policies. Particular attention to this factor in the analysis is paid by consider a possible lower weighting of this criterion in the overall assessment.

3.3.1 Phase 1: WACES effectiveness self-assessment

Data collection: The data for this criterion originates from Questionnaire 3, where the responses were linked to the examined EU policies (see ANNEX I for details).

Table 7: Methodology: Self-assessment of WACES holder from Questionnaire 3.

Questionnaire 3		Data collection
Question	Answer	Results
Does your solution… (reduce water consumption or pollution, inputs, recover materials, fertilizer…)?	Significant positive effect	
	Minor positive effect	
	Significant negative effect	
	Minor negative effect	
	Neutral/No effect	
	No answer	
Explanation: If a question is not answered, or if key questions do not apply and therefore the policy instrument is not relevant, the option 'No answer' is selected.		

Expected outcome:

Table 8: Expected outcome (interim): Overview of WACES contribution to policies

WACES / EU CE Directives	WACES 1	WACES 2	WACES …
Nitrates Directive			
…			
Explanation: The table presents an interim step before validating the contribution. The table allows to include additional policies that have not been addressed in the policy assessment.			

Colour code:

Significant contributions: The implemented WACES has made (or is expected to make) significant contributions to achieving the EU circular economy policy objectives in the implementation location.	
Minor contributions: The implemented WACES has made (or is expected to make) minor contributions to achieving the EU circular economy policy objectives in the implementation location.	
No contributions: The implemented WACES has made (or is expected to make) no contributions to achieving the EU circular economy policy objectives in the implementation location.	
Other contributions: The implemented WACES has made (or is expected to make) contributions to achieving other EU, National or local objectives – not related to circular economy - in the implementation location.	

3.3.2 Phase 2: WACES effectiveness evidence gathering

After the WACES owner has completed the classification, the survey or interview conducted within BOOST-IN must gather additional evidence, particularly for the "significant contributions (dark green)" category. This ensures that the self-assessment is supported by concrete data and aligns with the EU circular economy policy objectives. This information the WACES owner can provide or can be gathered via desk research, interviews or site visits, as well as from other WPs. Evidence for the different contributions can be gathered from multiple sources, including monitoring reports.

Expected outcome:

Table 9: Expected outcome (final): Overview of EU policy objectives according to the analysed directives and potential evidence gathering for WACES contribution.

WACES / EU CE Directives	**Examples of location-specific evidence of significance**	WACES 1	WACES 2	WACES …	Justification
Water Framework Directive	- Improvement of ecological or chemical water status. - Increase in water bodies meeting "good status" targets from X % to Y %. - Reduced number of significant pressures. - Improved status of quality elements in the corresponding water body/ies				
Groundwater Directive	- Reduction of pesticide residues in groundwater to below 0.1 µg/l. - Nitrate concentration in groundwater reduced to below 50 mg/l. - Increased groundwater recharge rates by X m^3/year. - Reduction of saline intrusion in coastal aquifers by X %.				
Drinking Water Directive	- Reduction in nitrate levels in drinking water to below 25 mg/l. - Reduction of heavy metal concentrations. - Reduction in microbial contamination (e.g., E. coli = 0 CFU/100 ml). - Decrease in water treatment costs by X €/m^3. - Increase in the population with access to high-quality drinking water by X %.				
Floods Directive	- Reduction of flood-affected areas by X hectares. - Decrease in flood-related damages by X € per year. - Increased flood retention capacity by X m^3. - Reduction of flood frequency in APSFR (e.g., 1-in-50-year floods to 1-in-100-year events).				

EU Marine Strategy Framework Directive	- Reduction of eutrophication indicators (chlorophyll-a < X µg/l). - Decrease in marine litter density in t/a. - Restoration of marine habitats (e.g., X hectare of seagrass meadows). - Reduction of oxygen-depleted zones in coastal waters by X km².				
Nitrates Directive	- Reduction of nitrate concentration below 50 mg/l in Nitrate Vulnerable Zones. - Reduction in fertiliser use by X kg/ha. - Decrease in phosphorus or nitrate runoff into water bodies by X %.				
Sewage Sludge Directive	- Reduction of heavy metal content in treated sludge to below X mg/kg. - Increase in treated sludge reuse in agriculture by X tonnes/year. - Reduction of soil contamination by X %.				
Industrial Emissions Directive	- Reduction of NOx emissions by X %. - Reduction of SO_2 emissions by X %. - Decrease in particulate matter (e.g. PM2.5) emissions by X %. - Reduction in industrial water consumption by X %.				
Urban Wastewater Treatment Directive	- Increase in the percentage of wastewater treated to tertiary/fourth standards to X %. - Reduction of pollutant loads discharged into water bodies by X %.				
Renewable Energy Directive	- Installation of X MW renewable energy capacity (solar, wind, biomass). - Increase in renewable energy share in the local energy mix by X %. - Reduction in CO_2 emissions by X tonnes/year.				
EU Nature Restoration Law	- Increase in carbon sequestration by X tonnes CO_2/year. - Implementation of afforestation projects covering X hectares. - Reduction in deforestation rates by X %.				
European Climate Law	- Reduction of GHG emissions by X %. - Increase in investments in climate mitigation by X € per year.				
EU Taxonomy Climate and Environment Delegated Acts	- Reduction of GHG emissions by X tonnes CO_2/year in industrial or energy sectors. - Increase in the share of renewable energy in the local energy mix by X %.				

	- Implementation of energy efficiency measures leading to X % reduction in energy consumption.				

Explanation: The researcher seeks evidence by analysing the provided examples within the WACES-specific data. If evidence is identified and aligns with the initially assigned colour, the colour remains unchanged.

If no evidence is found, the colour is displayed as hatched. If the researcher believes the result requires adjustment (upgrading or downgrading), they may do so. However, a brief justification must be recorded in the designated field, explaining the decision and documenting the found evidence.

*Both solid and hatched colours are appropriately included in the overall summary table (see **Table 1**).*

3.4 Efficiency

The criterion "Efficiency" responds to the question "Are WACES an efficient solution?". It evaluates the efficiency of WACES by comparing the costs and benefits through Life Cycle Costing (LCC) and assessing their sustainability over their lifecycle applying a Life Cycle Assessment (LCA).

1) Life Cycle Assessment: The WACES is analysed based on the degree of environmental harm throughout each solution's entire lifecycle. This approach aims to categorise WACES by the extent of negative environmental impacts they cause, focusing on GHG emissions and water pollution.
2) Life Cycle Costing: LCC focuses on the financial implications throughout the lifecycle of each WACES, analysis is based on the extent of cost-effectiveness and financial sustainability. The proposed clustering is reflected in the following colour-coding system:

Data collection: The data for categorising the WACES builds on results of WP1. The WACES are rated according to their percentage of potential environmental damage reduction and cost savings compared to the baseline systems (either existing infrastructure or no infrastructure). An exact description of the form in which the data will be delivered cannot be made at this point as this is a future exercise according to the timeline of the project. If the results are delivered in absolute numbers, the proportion between the baseline scenario and the WACES implementation will be calculated to gather the percentage values.

Expected results:

Table 10: Expected results (final): Overview results of WACES performance regarding environment and costs.

WACES	Water (%)	GHG emissions (%)	LCC (%)	**Overall performance (Ø%)**
WACES 1	…%	…%	…%	…Ø%
WACES …				

*Explanation: The overall performance, based on the average percentage of the three categories is transferred to the overall overview table (see **Table 1**).*

Colour code:

High savings (>50%): The WACES achieves more than 50% GHG emission, water usage or cost savings compared to the baseline scenario.	
Moderate savings (10-50%): The WACES achieves less than 50% GHG emission, water usage, or cost savings compared to the baseline scenario.	
No savings: The WACES does not achieve any significant savings or causes rather negative effects in terms of GHG emissions, water usage, or costs compared to the baseline scenario.	

Not applicable: This category is used when no assessment has been made (e.g. the selected WACES does not deliver enough data or was not selected by WP1).

3.5 Uptake

The "Uptake"-assessment focuses on identifying and evaluating relevant barriers regarding implementation and uptake. The criterion responds to the question: "Which barriers hinder WACES uptake?" The goal is to understand what barriers, such as regulatory, technical, financial, or social, are limiting effective implementation and how significant they are.

Given that most of the assessed WACES are still in the initial implementation stage, a full assessment of potential impacts cannot yet be undertaken with reliable data. Therefore, the broader OECD criterion "impact" is in our analysis narrowed down to "uptake".

The criterion will be assessed with the following stepwise approach: BOOST-IN builds on a pre-existing barrier analysis compiled by the MARCLAIMED and RECREATE projects and develops a coherent assessment methodology. This methodology will also be used for BOOST-IN Task 3.2 and Deliverable 3.2.

In addition, the following structure and list have been adopted for the WACES barrier assessment. This list will be complemented with further aspects and references.

Table 11: Overview table of barriers that potentially can hinder the implementation of WACES (based on a draft by MARCLAIMED and RECREATE projects).

Barrier types	Specific barriers
1. Technology	1.1. **Lack of availability:** No readily accessible technical solutions are available to address specific issues effectively (Sapiano, 2024). 1.2. **Lack of feasibility**: Practical implementation is hindered by constraints like space limitations and structural requirements (e.g., greywater solutions in small flats with no outside area) (Sapiano, 2024). 1.3. **Lack of consistency:** Irregularities in validation processes and performance verification limit the reliability of technologies (Lee & Jepson, 2020). 1.4. **Technical limitations:** Contaminants such as trace chemicals or bacteria may remain in treated water, requiring additional treatment steps to ensure safety (Schmol, & Mecha, 2019). 1.5. **Lack of infrastructure:** Inadequate or missing infrastructure hinders the delivery of treated water to its point of application such as irrigable land (Radini, et al., 2023). 1.6. **Lack of efficiency:** Outputs of technologies may negatively impact subsequent processes or reduce overall water efficiency. 1.7. **Remaining uncertainty:** Ongoing uncertainty exists regarding the environmental impacts of new technologies. 1.8. **Need for training and capacity building:** Insufficient training programmes and capacity-building for workers leading to gaps in technical expertise to manage new technologies, such as greywater systems, hamper effective treatment facility management (Sapiano, 2024; Berbel et al., 2023).
2. Economic/ Financial	2.1. **Need for financial aid**: Financial support, such as subsidies, is essential to offset costs (especially at the beginning) for treatment, transportation, storage, and the development of necessary infrastructure (Hristov et al., 2021). 2.2. **Absence of standardised pricing**: Market development for recycled water is hindered by the lack of a standardised pricing model (Salgado Fagundes and Marques, 2023; Bui et al., 2019).

	2.3. **Lack of research funding:** Financing for research, development, and deployment of new technologies is difficult to access or not existing. 2.4. **Low financial attractiveness:** Extensive payback periods (often decades) (Sapiano, 2024), high upfront costs, and lack of recovery of investment costs (Fidélis, et al, 2020) deter investments. 2.5. **Lack of market demand**: Cheaper alternatives (e.g., boreholes) and sufficient access to traditional water sources reduce demand for reclaimed water (Ramm, 2024). 2.6. **Lack of an intelligent price system:** Current accounting systems fail to capture the true costs concerning production, quality, destination, and availability of the water system, leading to an unfair cost distribution and makes water reuse unattractive (Fidélis, et al, 2020). 2.7. **Economic uncertainty**: The long-term economic viability of innovative water technologies remains uncertain.
3. Social	3.1. **Concerns about potential environmental or social impacts**: Resistance from farmers and the public due to concerns over health risks, costs, maintenance, and consumer acceptance (López Serrano et al., 2022; Sapiano, 2024). 3.2. **Economic concerns:** Concerns that reclaimed water might harm industries like agriculture and tourism (Fidélis, et al, 2020). 3.3. **Lack of available information:** Limited transparency and inaccessible data hinder stakeholder understanding (Fidélis, et al, 2020). 3.4. **Spread of misinformation:** Misconceptions and fears about recycled water (Guerra Rodríguez (2020)) such as microbiology, micropollutants, and microplastics (Ramm, 2024) reduce public acceptance. 3.5. **Exacerbation of Inequalities:** Fears of worsening inequalities in water access or affordability limit public support. 3.6. **Inadequate community engagement:** Lack of community involvement in planning and decision-making fosters resistance (ICRA Costa Brava, 2024).
4. Political	4.1. **Lack of circular economy framework**: The absence of a circular economy framework hinders the integration of water reuse into broader sustainability agendas. Water reuse is not yet mainstreamed in the core water policies and programs in certain regions (Fidélis, et al, 2020). 4.2. **Lack of long-term planning:** Reactive rather than proactive approaches to water challenges undermine long-term water management and sustainability efforts (ICRA Costa Brava, 2024). 4.3. **Rigid political structures**: Hierarchical top-down policy formation and implementation limits adaptability and responsiveness to emerging challenges (Fidélis, et al, 2020). 4.4. **Communication challenges:** Limited information exchange between politicians and the public impedes informed decision-making and reduces public awareness of water reuse initiatives (Fidélis, et al, 2020). 4.5. **Lack of knowledge among politicians:** Politicians often lack a deep understanding of water reuse systems, limiting their ability to support innovative solutions (Fidélis, et al, 2020). 4.6. **Poor understanding of stakeholder needs:** A poor understanding of relevant stakeholders and public attitudes results in ineffective policy design and implementation (Fidélis, et al, 2020).
5. Institutional	5.1. **Lack of coordination/responsibilities**: Poor coordination and overlapping responsibilities among administrative bodies lead to confusion (Exposito et al., 2024) and inconsistent regulatory frameworks (Sapiano, 2024)

	5.2. **Policy capacity gaps:** Limited institutional capacity to develop and enforce comprehensive water and wastewater management policies restricts effective implementation (Fidélis, et al, 2020). 5.3. **Limited support from authorities:** Insufficient backing and arrangements on water management from national, regional, or local authorities hinder implementation (Ramm, 2024). 5.4. **Short-term perspective:** The administration manages public infrastructure through temporary operation contracts, often lasting just 2-3 years. This short time frame makes it challenging to sustain and manage complex on-site knowledge, even when personnel are retained by the succeeding contractor (ICRA Costa Brava, 2024). 5.5. **Lack of institutional knowledge:** Institutions lack the necessary knowledge, resources, and infrastructure, such as training programmes, specialised agencies, or restructuring of water management bodies (Fidélis, et al, 2020).
6. Regulatory & Legal	6.1. **Lack of harmonised standards**: The absence of clear or harmonised standards (e.g. conflicting recommendations and terminology), such as plumbing codes for greywater applications (Sapiano, 2024), creates inefficiencies. One-size-fits-all approaches fail to account for the individual needs of circular economy initiatives and local circumstances, especially in industrial contexts (Ramm, 2024). 6.2. **Lack of regulatory and technical guidance:** Stakeholders face uncertainty due to a lack of regulatory and technical guidance (e.g. inability to fully treat wastewater and sludge, unstable water quality, the low performance of treatment processes, limited technical resources to implement additional treatment technologies) (Fidélis, et al, 2020; e.g. Declercq, 2024 for Southern France; ROp meeting). 6.3. **Lack of regulatory clarity:** Approval processes for reuse schemes suffer from inconsistencies (e.g. Member States will need to modify national legislation to match the EU regulation 2020/741 on water reuse), such as in the regulation of different wastewater products (Water Europe, 2024). 6.4. **Inflexible policy framework**: Inflexible and overly demanding regulations hinder compliance and implementation. 6.5. **Time-consuming and complex monitoring:** Extensive testing, documentation, and monitoring requirements are time-consuming, increase costs and complexity (Fidélis, et al, 2020). 6.6. **Degradation of water and soil quality**: Water reuse can exacerbate the degradation of surface water (e.g., eutrophication), groundwater quality, and soil conditions (Fidélis et al, 2020). 6.7. **Lack of safety for agricultural products**: Concerns over the safety of crops irrigated with treated wastewater reduce adoption and trust (Fidélis, et al, 2020).
7. Permitting procedures	7.1. **Lengthy permitting process:** Obtaining permits often requires extended periods, delaying project timelines (Fidélis, et al, 2020). 7.2. **Complex permitting process:** Bureaucratic hurdles make permitting time-consuming and resource-intensive (Fidélis, et al, 2020). 7.3. **High permitting costs:** Costs incurred during the permitting process, including fees paid to authorities or other related expenses, increase the financial burden (e.g., Simón, 2024). 7.4. **Political influence**: Political influences can delay the permitting process or result in project rejection (Casielles, 2024 in ROp).

Data collection: The data collection includes four steps.

1. Step 1 - Identify barriers

Table 12: Methodology (1/4): Identification of the barriers faced by the WACES holders.

Questionnaire 1			Questionnaire 2		
Question	Answer options	R	Question	Answer options	Results
If your solution has been implemented, or is in the process of being implemented, in the field, to what extent have you encountered regulatory authorisation difficulties?	Many difficulties		Have you faced any difficulties out of the following categories: Technological Economical/Financial Social Political Institutional Regulatory & legal Permitting procedures	Yes	
	More than some, fewer than many difficulties				
	Some difficulties				
	No difficulties			No	
	Not applicable				
Explanation: Questionnaires 1 and 2 are designed to identify barriers and potentially categorise the types of barriers that may appear. If no barriers are identified, WACES will be marked green. *If barriers have been identified, they will be analysed in the interviews in more detail.*					

2. Step 2 - Detailed barrier analysis:

Table 13: Methodology (2/4): Detailed analysis of barriers including the subcategories within the main categories.

Interview (1/2) - Detailed barrier			
Question	Answer options		Results
Can you describe the difficulties you have faced in detail?	**Technological:** Lack of availability …. **Economical/Financial** **Social** **Political** **Institutional** **Regulatory & legal** **Permitting procedures**	Significant challenges appeared	
		Minor challenges appear	
Explanation: The interviewer does not inquire about all potential barriers. Instead, based on the responses provided in the second questionnaire, they focus on the barriers which were selected. For each identified barrier (e.g., lack of availability), the severity is assessed.			

3. Step 3 - Analysis of how to overcome barriers:

Table 14: Methodology (3/4): Recognition and connection of barriers and solutions to overcome them.

Interview (2/2) - Overcome barrier			
Question	Complementary questions	Answer options	Results

Which modifications did you undertake to execute the solution?	- Which specific barrier did you face? - How did you manage to overcome the barrier? - Which of the barriers have been faced in other (non-implemented) WACES cases with similar technologies or in the same/other regions? - Is the barrier more related to the technology or the geographic region where the solution has been implemented?	Major adjustments are required, such as substantial reductions in size, capacity, or financial investment.	
		Adjustments that require some changes to processes or technologies, but do not significantly impact overall costs or design. These could include updates to systems, moderate reorganisation of project workflows, or small-scale upgrades.	
		Small, incremental changes to improve efficiency or adapt to specific project needs. These might include slight process tweaks, integrating minor technological improvements, or optimising workflows without substantial changes or cost.	
Explanation: After analysing the barriers in detail, the interviewer asks questions about how to overcome the barriers. Based on the answers the interviewer selects one of the three answer options. The decision is validated by notes from the interviews. The category not feasible (red) does not apply to the category as there is still the option that a solution exists to overcome the barrier.			

4. Step 4 - Overall evaluation:

Table 15: Methodology (4/4): Connection of the identified barriers with the solutions to generate an overall performance.

Overall judgement	
Answer options	Results
Significant barriers exist that cannot be addressed through modifications, rendering the solution unfeasible.	
Significant barriers are present but can be overcome with substantial modifications regarding the design, processes, or resources.	
Barriers are manageable and can be addressed with minor adjustments, requiring relatively low effort and cost.	
Explanation: In the case a barrier results in both questions in yellow, it stays yellow. Yellow and orange, allow the assessor what to pick the colour. Orange and orange stay orange. Orange and red are up to the assessor to decide. This is done separately for each barrier category.	

Expected results:

Table 16: Expected outcome (final): Summary of WACES barriers according to different categories

WACES / Barriers	Technological	Economical/ Financial	Social	Political	Institutional	Regulatory & Legal	Permitting procedures
WACES 1							
WACES …							

Explanation: The colours are based on the results from Table 15 in case barriers have been identified. If no barriers have been identified, the results (colour green) are transferred from Table 12. For the overall assessment (see Table 1) of each WACES's "impact" criterion, the highest class of barriers in any category is reflected. In case a barrier category has not been examined, the category is marked as not applicable (grey).

Colour code:

Not Feasible: Major barriers exist that cannot be resolved through modifications, rendering the solution impractical. In such cases, the WACES is deemed unfeasible and is (or has been) abandoned.	
Significant Modification: The WACES faces considerable barriers but remains feasible with substantial modifications. These may include changes to design, scale, or processes, as well as increased investments or adjustments to comply with financing or legislative requirements. Overcoming these challenges requires significant effort and resources.	
Minor Modification: The WACES is generally feasible with no barriers, or manageable barriers. These can be addressed through minor adjustments, such as refining technologies or tweaking project processes. The modifications required involve relatively low effort and cost.	
No barriers: No barriers have been faced	
Not applicable:	
Explanation: The colour code with the description refers to the expected outcomes and not to the steps taken before in the methodology which can have a slightly different meaning.	

Additional information:

Based on the description of the barriers faced in this deliverable. The information is complemented in T3.2 and D3.2 with adding:

- An analysis evaluating the WACES barrier types and providing specific examples categorised by WACES types and regions; especially analysing the location-specific barriers.
- Information on actions taken to overcome the barriers
- Further literature review
- Expert judgment, including stakeholder workshops in the ROps.

3.6 Climate resilience

Climate resilience addresses the question, "How climate-proof are WACES?" by assessing their long-term ability to withstand climate-related risks and continue delivering benefits under changing environmental conditions. This involves evaluating vulnerabilities to extreme weather events, floods, sea level rise, droughts, and other hazards to ensure their functionality and sustainability. Furthermore, this criterion reflects the extent to which the net benefits of the WACES intervention continue or are likely to continue, within the financial, economic, social, environmental and institutional capacities of the systems needed to sustain the net benefits over time.

Given the early implementation stage of many WACES, this criterion focuses on WACES resilience against different natural hazards. Therefore, a climate resilience assessment is carried out for the

specific WACES implementation site, based on the EU climate proofing guidance, analysing questions such as:

- Will processes remain functional under extreme temperatures?
- Could floods affect the implementation site?
- Might sea level rise pose a risk?

As climate-proofing is particularly relevant for securing infrastructure funding from EU sources, the idea is for WACES owners to gain dual benefits by cooperating with BOOST-IN:

1. Gaining insights into risks and mitigation strategies for their projects.
2. Receiving a climate-proofing assessment that can serve as a blueprint for future implementations.

The EC Technical Guidance on Climate Proofing of Infrastructure[3] covering the planning period 2021-2027[4] is the reference document for this assessment, focusing on Climate resilience/Adaptation to climate change. The guidance approach follows two phases. A third phase was added to transfer the results into this guiding policy framework:

- Phase 1 – **Screening**: Carry out a (1) climate sensitivity, (2) exposure and (3) vulnerability analysis in line with this guidance. If there are significant climate risks warranting further analysis, proceed to phase 2.
- Phase 2 – **Detailed analysis**: Assess the (4) likelihood and severity of climate hazards, their (5) impacts on project performance across various dimensions, and the significance of (6) risks, identifying critical vulnerabilities and necessary adaptation measures.
- Phase 3 – **Overall judgement**: Integrate the risk assessment (analysis) results into the WACES framework, reflecting the highest risk classification or adjusting the risk level based on credible mitigation evidence.

3.6.1 Phase 1: Screening analysis

The screening analysis addresses the vulnerability of WACES implementation sites to specific climate hazards. This considers two factors: The hazard sensitivity of project components and the likelihood of these hazards occurring now and in the future.

1. Sensitivity analysis

The sensitivity analysis identifies relevant climate hazards for a certain project type, focusing on components like on-site assets, inputs, outputs, and transport links, regardless of the location. It assigns sensitivity levels (high, medium, low) based on the potential hazard impact.

Data collection:

Table 17: Methodology: Identification of climate hazards by the WACES holders.

Questionnaire 2		
Question	Answer options	Results

[3] Infrastructure includes, in addition to traditional 'grey' infrastructure, 'green' infrastructure and mixed forms of 'grey/green infrastructure', which often correspond to WACES. The Commission Communication COM/2013/249 defines green infrastructure as 'a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, green infrastructure is present in rural and urban settings.'

[4] https://ec.europa.eu/newsroom/cipr/items/722278/

To what extent do the following climate hazards affect your solution, including on-site assets and processes, inputs such as water and energy, outputs such as products and services, or access and transport links? • Extreme temperatures • Flooding • Droughts and water scarcity • Ice and snow • Storms (as matrix)	High sensitivity	
	Medium sensitivity	
	Low sensitivity	

Expected outcome: Table 18 reflects a summary regarding the output of the sensitivity screening analysis including a sensitivity ranking (high, medium, low) of the relevant climate variables and hazards[5].

Table 18: Expected outcome (interim): Overview of the hazards faced by the different WACES.

WACES/Hazards	Extreme temperatures	Flooding	Droughts and water scarcity	Ice and snow	Storms
WACES 1					
WACES 2					
…					

Colour code:

High sensitivity: The climate hazard significantly impacts assets, processes, inputs, outputs, and/or transport links.	
Medium sensitivity: The climate hazard moderately impacts assets, processes, inputs, outputs, and/or transport links, potentially causing minor disruptions.	
Low sensitivity: The climate hazard has a minimal or no impact on assets, processes, inputs, outputs, and/or transport links.	

2. Exposure analysis

The **exposure** analysis aims to identify hazards relevant to the case study/project location, irrespective of the project type. For example, flooding could be a significant climate hazard for WACES located at a river in a floodplain. Therefore, the exposure analysis focuses on the location (exposure to the current and future climate), whereas the sensitivity analysis focuses on the project type.

Data collection:

Table 19: Methodology overview (1/2) of the assumed lifetime by the WACES holder to find the fitting climate scenario.

Questionnaire 2	
Question	Answer options
What is the estimated lifetime of your solution?	until 2100

[5] Climate ADAPT impact categories: https://climate-adapt.eea.europa.eu/en/knowledge/adaptation-information/adaptation-options

	until 2070
	until 2040
Explanation: To ensure the comparability of the different WACES, the exposure analysis period is always set from 2071–2100 and Representative Concentration Pathway (RCP) 8.5. However, if a WACES holder provides a shorter lifetime period, the assessor may conduct an additional analysis based on the reduced timeframe. If no other information is available, assessments will use climate projection data for 2071–2100. • For initial screening analyses, climate projections based on RCP 6.0 or RCP 8.5 are recommended. • For detailed analyses: RCP 4.5 may be used for lifespans up to 2060. RCP 6.0 and RCP 8.5 are more relevant for projections up to 2100, particularly for projects that can increase resilience during their lifetime.	

Table 20: Methodology (2/2): Identification of the WACES exposure rate against different hazards.

Data collection		
Question	Answer options	Results
Is the location where the solution has been implemented exposed to: • Extreme temperatures • Flooding • Droughts and water scarcity • Ice and Snow • Storms today in the current climate or under an RCP8.5 scenario by 2071-2100?	High or very high exposure	
	Medium exposure	
	Low exposure	
Explanation: This will be separately done for each WACES. Once for the current climate and once for the future climate. To identify the exposure, rates for each hazard presented in the literature box below are used.		

Literature to analyse exposure:

ESPON[6], utilising the information displayed for absolute exposure, baseline (current climate) and very high emissions scenarios (future climate):

- **Extreme temperatures**: Risk scenarios of heat stress on the population
- **Droughts and water scarcity**: The highest exposure resulting from different risks: (1) Risk on the environment from wildfires, and (2) Risk of droughts in the primary sector
- **Storms:** Identifying areas with exposure to maximum wind speed for three-second gusts for winter storms.

EU Flood Risk Area Viewer[7]:

[6] Report: https://archive.espon.eu/sites/default/files/attachments/ESPON_CLIMATE_update_Final_Report_0.pdf; maps: https://archive.espon.eu/sites/default/files/attachments/ESPON_CLIMATE_maps_update.pdf; webmaps: https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/pages/web-maps

[7] https://discomap.eea.europa.eu/floodsviewer/

- **Flooding**: Identifying the proximity to Areas of Potentially Significant Flood Risk (APSFRs) of the site location (for some cases, further detailed analysis with the information included in national flood risk map viewers, published by the European Commission can be undertaken.

EEA - Snow and ice - snow, glaciers and ice sheets[8]:

- **Ice and Snow**: Identifying the historical and projected days with medium natural snow cover.

Expected outcome:

Table 21: Expected outcome (interim): Overview of the WACES risk exposure in the current and future climate.

Name: WACES 1						
Climates/ Hazards	Extreme Temperatures	Flooding	Droughts and water scarcity	Ice and Snow	Storms	Others
Current climate						
Future climate						
Highest score						

Explanation:

Extreme temperatures:

- **Current climate**: Risk of heat stress on population[9].
- **Future climate**: Risk of heat stress on population**:** Very high emissions scenario (1970—2100) with absolute exposure[10].
- **Scoreboard**: Very low (green), low-medium (yellow), high-very high (red)

Flooding:

- **Flood area:**
- **Current climate:** Flood Risk Area Viewer[11]
- **Future climate:** No data
- **Scoreboard:** Flood area Yes (continue)/No (green)
- **-> Yes:** Check severity:
  - **High exposure**: Close to flood source (e.g. river)/middle of flooded area (red)
  - **Medium exposure**: Close to the border within the flood area (yellow)

Droughts and water scarcity:

1. **Drought on primary sector:**
- **Current climate:** Risk of drought on primary sector: Baseline climate (1981—2010) with absolute exposure.[12]

[8] https://www.eea.europa.eu/publications/europes-changing-climate-hazards-1/snow-and-ice/snow-and-ice-snow

[9] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/d06826c6354c4f649e2447804ebec2ca/explore

[10] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/dc9fecc992494159be7670d2ee84d594/explore

[11] https://discomap.eea.europa.eu/floodsviewer/?page=Page

[12] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/b13a705ef1b84bac82837a2c873cb609/explore

- **Future climate:** Risk of drought on primary sector: Very high emissions scenario (1970—2100) with relative exposure.[13]
- **Scoreboard:** Very low (green), low-medium (yellow), high-very high (red)

2. **Wildfire:**

- **Current climate:** Risk of wildfire on environment: Baseline climate (1981—2010) with absolute exposure[14]
- **Future climate:** Risk of wildfire on environment: Very high emissions scenario (1970—2100) with relative exposure[15]
- **Scoreboard:** Very low (green), low-medium (yellow), high-very high (red).

Ice and snow[16]:

- **Current climate:** Historical days with medium natural snow cover (1986-2005)
- **Future climate:** Projected days with medium natural snow cover (2081-2100)
- **Scoreboard (d/y):** <25 (green), 25-50 (yellow), >50 (red)

Storms:

- **Current climate:** Maximum wind speed for three-second gusts for winter storms, 1981—2010[17]
- **Future climate:** No data
- **Scoreboard (m/s):** 19.9-28.3 (green), >28.3-38 (yellow), >38-72 (red)

3. Vulnerability analysis

The **vulnerability** analysis combines the outcome of the sensitivity analysis and the exposure analysis. It is summarised in a table for the WACES selected at a chosen location. The most relevant climate variables and hazards are those with a high (red) or medium (yellow) vulnerability level, which are then taken forward to the detailed assessment. The vulnerability levels should be carefully defined and explained, and the scores justified.

Table 22: Expected outcome (interim): WACES vulnerability assessment categories classified according to sensitivity and exposure to climate threats.

Name: WACES 1			
Vulnerability	High exposure	Medium exposure	Low exposure
High sensitivity	Floods		
Medium sensitivity		Storms	
Low sensitivity			Extreme Temperatures
Explanation: The vulnerability assessment revealed high vulnerability to floods, medium vulnerability to storms and low vulnerability to extreme temperatures. As a result, the detailed assessment will specifically focus on floods and storms, as these hazards represent the most significant risks to the system.			

3.6.2 Phase 2: Detailed analysis

The risk assessment is a structured method for analysing climate hazards and their impacts to enable informed decision-making. This process assesses the likelihood and severity of the hazard impacts identified in the screening phase, as well as the significance of the risk to the project's success.

[13] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/da33c6742a5a4850ba087db53a60f1d9/explore
[14] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/57fdaeb3c67b4288bcf992ba44ef0845/explore
[15] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/6c5eafa3fbc841f99e3c8c3270ff1dcb/explore
[16] https://www.eea.europa.eu/publications/europes-changing-climate-hazards-1/snow-and-ice/snow-and-ice-snow
[17] https://gis-portal.espon.eu/arcgis/apps/sites/#/espon-hub/maps/8223766d04f04ffebb6f54f63ae36868/explore

Compared to the vulnerability analysis, the risk assessment more effectively identifies longer cause-effect chains that link climate hazards to project performance across multiple dimensions, such as technical, environmental, social/inclusion/accessibility, and financial. It also highlights the interactions between these factors. Hence, a risk assessment may identify issues not revealed by the vulnerability assessment.

4. Likelihood

This step assesses how likely the identified climate hazards are to occur within a given timescale, e.g. the lifetime of the WACES. For some climate risks, considerable uncertainty about their occurrence can emerge. It may require expert judgement, based on currently best available information and data from registers, statistics, simulations, and current/past knowledge drawn from stakeholder consultations. This should also include references to national, regional and/or local climate data and projections.

The assessment is conducted for each high- or medium-level climate impact vulnerability, depicted in Table 22 above.

Data collection: The likelihood analysis of a hazard occurring, is based on the same literature as for the exposure analysis. Furthermore, information provided by the WACES holders is considered.

Expected outcome:

Table 23: Expected outcome (interim): Summary of likelihood occurrence regarding various climate threats.

Name: WACES 1								
Classification (Term)	**Qualitative description**	**Quantitative occurrence during WACES lifetime**	Extreme Temperatures; Flooding; Droughts and Water Scarcity; Ice and Snow; Storms; Others					
Rare	Highly unlikely to occur	5%						
Unlikely	Unlikely to occur	20%						
Moderate	As likely to occur as not	50%						
Likely	Likely to occur	80%						
Almost certain	Very likely to occur	95%						

5. Impact

This step examines the consequences if the climate hazard identified occurs at the WACES implementation site. This should be assessed on an impact scale per hazard, also referred to as severity or magnitude. The consequences generally relate to physical assets and operations, health and safety, environmental impacts, social impacts, impact on accessibility for persons with disabilities, financial implications, and reputational risk. The assessment may need to consider the adaptive capacity of the system in which the project operates, including any existing risk mitigation measures. It may also be relevant to consider how fundamental this infrastructure is to the wider network or system (i.e. criticality) and whether it may lead to additional impacts and cascading effects.

Data collection:

BOOST-IN collaborates with the WACES owner to prepare an expert judgment draft. This draft incorporates a variety of information sources, including literature reviews, relevant case studies, and interviews with stakeholders involved in the WACES implementation. The findings are consolidated in a structured framework, exemplified by Table 24, which provides a clear and systematic evaluation of potential impacts.

Table 24: Methodology: Magnitude of consequence across various risk areas.[18]

Risk Areas	Magnitude of consequence				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Asset Damage / Engineering / Operational	The impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary/emergency business continuity actions	Disaster with the potential to lead to shutdowns, collapse, or loss of the asset/network
Safety and Health	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury or disability	Single or multiple fatalities
Environment	No impact on the baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effects. Recovery is longer than one year. Failure to comply with environmental regulations/consent	Significant harm with widespread effects. Recovery is longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups. National, long-term social impacts	Loss of social licence to operate. Community protests
Financial (for a single extreme event or annual average impact) (**)	x % IRR (***) < 2% of turnover	x % IRR 2-10% of turnover	x % IRR 10-25% of turnover	x % IRR 25-50% of turnover	x % IRR > 50% of turnover
Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion; negative national media coverage	National, long-term impact with the potential to affect the stability of the government
Cultural Heritage and Cultural Premises	Insignificant impact	Short-term impact. Possible recovery or repair.	Serious damage with a wider impact on the tourism industry	Significant damage with national and international impact	Permanent loss with a resulting impact on society

(*): The ratings and values suggested here are illustrative. The project promoter and climate-proofing manager may choose to modify them.

(**): Example indicators – other indicators that may be used including costs for: immediate / long-term emergency measures; restoration of assets; environmental restoration; indirect costs on the economy,

indirect social costs.

(***): Internal Rate of Return (IRR)

Expected outcome:

Table 25: Expected outcome (interim): Impact classification of different climate hazards and associated categories.

Name: WACES 1					
Risk areas - Impacts	**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**

[18] https://climate.ec.europa.eu/document/download/abd8d140-1808-4bc5-86ed-4cbb9352fd5c_en

Asset damage, engineering, operational		Ice and snow			
Safety and health					
Environment				Storm	
Social					
Financial					
Reputation		Flood			
Cultural Heritage and Cultural Premises					
Other					

6. Risk:

Having assessed each hazard's likelihood and impact, the significance level of each potential risk can be estimated by combining the two factors. The risks can be plotted on a risk matrix (as part of the overall risk assessment, with the categories extreme (red), high (orange), medium (yellow) and low (green)) to identify the most significant potential risks and those requiring adaptation measures.

Table 26: Expected outcome (final): Risk Matrix estimating the significance level of each potential risk and associated outcomes.

Name: WACES 1					
Likelihood/impact	Insignificant	Minor	Moderate	Major	Catastrophic
Rare					
Unlikely	Ice and snow				Flood
Moderate					
Likely			Drought		
Almost certain					

3.6.3 Phase 3: Overall judgement

The results of this risk assessment are integrated into the overall WACES policy assessment framework (see Table 1) under the "sustainability" criterion, reflecting the highest classification derived from the evaluation. The WACES holders are consulted to gather additional insights on the risk assessment to validate the information.

Data collection:

The risk assessment is supplemented by interviews with the WACES holder in the following step. The WACES holder is first informed about the preliminary results and can respond with personal comments. This allows additional input and clarifies whether measures have been taken or are planned to mitigate potential risks. If the WACES holder provides credible evidence that risk reduction measures have been or will be implemented, the assessor can adjust the risk classification accordingly.

Table 27: Methodology: Assessment check with WACES holder and preparation for a general overview.

Interview/Data collection			
Question	Answer options	Result	Complementary question

Do you agree with this assessment? Have you undertaken any risk mitigation measures which shall be considered (impacts)? Do you have any different/additional information (exposure, likelihood, impact) to consider?	Extreme risk		Which measures could you implement to reduce climate risks?
	High risk		
	Medium risk		
	Low risk		

Expected outcome:

Table 28: Expected outcome (final): Summary of the WACES vulnerability.

WACES	**Vulnerability**
WACES 1	
WACES 2	
WACES 3	
…	
Explanation: The table is transferred to the overall overview *(see **Table 1**)*.	

Colour code:

Extreme risk: The WACES is exposed to severe natural disasters at its location, leading to potentially significant disruptions. Limited adaptation measures are in place, and limited adaptation can be done, raising concerns about economic viability and long-term sustainability.	
High risk: The WACES faces considerable risks from natural hazards, which could result in notable challenges. While some adaptation measures exist, their effectiveness may be limited, and further adaptation options are constrained, potentially affecting functionality and performance.	
Medium risk: The WACES is moderately affected by natural hazards. Existing adaptation measures can manage these risks to a degree, but the scope for further adaptation may be limited, making additional measures necessary to ensure resilience and optimal operation.	
Low risk: The WACES is minimally affected by natural hazards. Existing adaptation measures are adequate, with limited need or scope for additional adaptation, ensuring no significant risk to functionality, economic viability, or long-term sustainability.	

4.0 Conclusion

This assessment framework establishes a structured methodology for analysing the alignment of WACES with EU policy objectives. By integrating the OECD-DAC evaluation criteria, a systematic data collection approach, and a colour-coded classification system, the framework represents an essential first step towards a transparent and replicable assessment tool for evaluating selected WACES. While this document does not present results, it lays the groundwork for future assessments and documents

the initial steps undertaken within the project. Designed to be adaptive, the framework will evolve based on insights gathered in subsequent analysis phases.

The next phase of the project will see the application of this framework in Deliverable 3.2, which is divided into two key components. The first part focuses on assessing the 24+ selected WACES, identifying their strengths and weaknesses to understand their potential contributions and limitations. The second part examines the regional policy context for circular economy implementation across the six ROp, with a focus on policy needs, enabling factors, and barriers to WACES adoption in specific regional settings.

By bridging the findings from the policy assessment framework with regional case studies, Deliverable 3.2 aims to refine the understanding of context-specific challenges and opportunities. This, in turn, will provide valuable insights for decision-makers, helping them develop targeted and adaptive policy strategies that promote sustainable water and circular economy innovations. Ultimately, these efforts will set the stage for Deliverable 3.3, which will translate the findings into policy recommendations to further enhance the uptake and implementation of WACES across the EU.

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ANNEX I: Assessment of the Environmental, Energy, and Resource impacts of your WACES

This questionnaire is designed to evaluate your solution's potential impacts on water quantity and quality, surrounding environments, energy consumption, agricultural practices, wastewater management, and climate change resilience. Your input will help identify significant effects, opportunities for improvement, and areas where the solution supports policy goals.

Please respond to each question by selecting the most appropriate answer. For questions marked with "If Yes," further details will be required. This assessment aims to ensure a comprehensive understanding of the solution's environmental, economic, and social implications.

Water					
1. **Does the solution (in the implementation site) affect the water quantity?**				Yes	No
If Yes, does it…	Significant positive effect	Minor positive effect	Neutral/ No effect	Minor negative effect	Significant negative effect
1.1. …influence groundwater abstraction or aquifer recharge?					
1.2. …influence surface water (rivers, lakes, wetlands) abstraction?					
1.3. …affect water storage infrastructure?					
1.4. …affect overall water flow or quantity?					
1.5. …impact water leakage?					
1.6. …other:					
2. **Does the solution affect the water quality in groundwater, surface water, marine waters and/or drinking water?** If Yes, does it…				Yes	No
2.1. …affect nitrate levels?					
2.2. …affect phosphor levels?					
2.3. …affect levels of heavy metals?					
2.4. …affect levels of pesticides or herbicides?					
2.5. …affect levels of microplastics?					
2.6. …influence microorganisms (e.g., bacteria) in drinking water?					
2.7. …other?					

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3. **Does the solution affect the environment?** If Yes, does it…				Yes	No
3.1. …influence water-related parameters in the soil?					
3.2. …contribute to ecosystem restoration?					
3.3. …influence the protection of human health?					
3.4. …impact air pollution?					
3.5. …affect water filtration and purification?					
3.6. …impact greenhouse gas emissions?					
3.7. …influence climate change adaptation or improve resilience?					
3.8. …affect flood risk mitigation and the effects of floods?					
3.9. …influence risks from hazardous events?					
3.10. …other?					
Energy					
4. **Does the solution affect energy production or consumption?** If Yes, does it…				Yes	No
4.1. …influence the implementation of renewable energies?					
4.2. …affect the use of energy-efficient technologies?					
4.3. …other					
Resources/Nutrients					
5. **Does the solution (on the implementation site) affect wastewater treatment, preventing harmful effects?** If Yes, does it…				Yes	No
5.1. …influence the use of sludge to recover resources?					
5.2. …impact the reuse of wastewater for agricultural purposes?					
5.3. …influence the reuse of wastewater in industrial processes?					
5.4. …affect urban non-potable uses (e.g. toilet flushing)?					
5.5. …other?					

ANNEX II: Assessment of WACES Contribution to EU Directives

WACES / EU CE Directives	**Question** (Does the WACES contribute…)
Water Framework Directive	**Key Question:** …to achieving good quantitative and qualitative status of groundwater and surface water? **Questionnaire:** 1,2,3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 3.9
Groundwater Directive	**Key Question:** …to achieving good chemical status of groundwater? **Questionnaire:** 1.1, 2
Drinking Water Directive	**Key Question:** …to improving drinking water quality and reducing risks from hazardous events? **Questionnaire:** 1.1,1.2, 1.3, 1.5, 2.6, 5.4
Floods Directive	**Key Question:** …to mitigating the negative effects and risks of floods? **Questionnaire:** 3.8
EU Marine Strategy Framework Directive	**Key Question:** …to achieving good environmental status of marine waters? **Questionnaire:** 2.1, 2.2, 2.3, 2.4, 2.5, 2.6
Nitrates Directive	**Key Question:** … to reducing nitrate and phosphorus water pollution from agricultural activities? **Questionnaire:** 2.1, 2.2, 5.1, 5.2
Sewage Sludge Directive	**Key Question:** …to reducing harmful effects from sewage sludge and its reuse in agriculture?

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	Questionnaire: 2.3, 5.1, 5.2
Industrial Emissions Directive	**Key Question:** …to reducing industrial pollution and its effects on soil, water, and air? **Questionnaire:** 2.3, 3.1, 3.3, 3.4, 3.6
Urban Wastewater Treatment Directive	**Key Question:** …to improving the reuse of treated wastewater or preventing pollution from wastewater? **Questionnaire:** 5.1, 5.2, 5.3, 5.4
Renewable Energy Directive	**Key Question:** …to promoting renewable energy production or energy efficiency? **Questionnaire:** 4.1, 4.2
EU Nature Restoration Law	**Key Question:** …to restoring ecosystems such as wetlands, forests, or other habitats? **Questionnaire:** 3.2
European Climate Law	**Key Question:** …to reducing greenhouse gas emissions and achieving climate neutrality? **Questionnaire:** 3.6, 3.7
EU Taxonomy Climate and Environment Delegated Acts	**Key Question:** …to aligning with sustainable activities defined in the EU Taxonomy? **Questionnaire:** 4.1, 4.2

ANNEX III: EU circular-economy policies and relevant SDGs

The following table outlines the Directives, Strategies and SDGs analysed during the initial stage. The snowball methodology supported the process, leading from one directive and strategy to the next.

	Level	Instrument
Legally binding	**EU**	Nitrates Directive
		Water Framework Directive
		Floods Directive
		Drinking Water Directive
		EU Marine Strategy Framework Directive
		Groundwater Directive
		Sewage Sludge Directive
		Industrial Emissions Directive
		Urban Wastewater Treatment Directive
		Renewable Energy Directive
		EU Restoration Law
		EU Climate Law
		EU Taxonomy Climate and Environment Delegated Acts
	National	Spain: Royal Decree 1620/2007
		Italy: Legislative Decree 152/2006 on agricultural water reuse
		Greece: Law 3199/2003 on industrial water use and wastewater discharge
		France: Decree No. 2022-336 of March 10, 2022, relating to the uses and conditions of reuse of treated wastewater
		Bulgaria: The Water Act on water management also for the mining sector
		Germany: Fertilizer Ordinance and Sewage sludge directive on nutrient recycling to agriculture
non-binding	**EU**	The European Green Deal
		Blueprint for Safeguarding European Waters
		Action Plan "Towards zero pollution for air, water, and soil
		Climate Change Adaptation EU Strategy
		EU Biodiversity Strategy 2030
		EU Farm to Fork Strategy
		Circular Economy Action Plan
		A framework of the setting of ecodesign requirements for energy-related products (recast)
		EU Strategy for Sustainable Circular Textiles
		ecological criteria for the award of the EU Ecolable for textile products
		Revision of the Green Public Procurement Criteria for Textile Products and Services
		REPowerEU
	Global	SDG 2 "Zero Hunger"
		SDG 6 "Clean water and sanitation"
		SDG 12 "Responsible consumption and production"
		SDG 13 "Climate Action"

ANNEX VI: Descriptions of regulations and guidelines

¡Error! No se encuentra el origen de la referencia. provides an overview of the regulations, i.e., directives and the strategies analysed for the policy assessment regarding the WACES addressed within the BOOST-IN project.

Directive/Strategy	Short description
Nitrates Directive	The Nitrates Directive addresses water pollution caused by nitrates from agricultural sources. Adopted in 1991 and amended in 2018, the directive aims to protect water quality by preventing nitrates from agricultural sources from polluting surface waters and groundwater. It plays a crucial role in protecting water resources from nitrate pollution and promoting sustainable agriculture practices in the European Union. By implementing the measures outlined in the directive, member states can minimize the environmental impact of agricultural activities and safeguard water quality for current and future generations.
Water Framework Directive	The Water Framework Directive (WFD) is a key piece of European Union (EU) legislation aimed at protecting and improving the quality of water resources across Europe. Adopted in 2000, the directive establishes a framework for the management of surface waters, transitional waters, coastal waters, and groundwater within EU member states. It seeks to ensure the sustainable and integrated management of water resources, protect aquatic ecosystems, and safeguard water quality for current and future generations in the European Union.
Floods Directive	The EU Floods Directive is a legal framework that aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage, and economic activities. It is part of a broader approach to water management in the EU, aiming to harmonize efforts across member states to effectively mitigate and manage flood risks, thereby enhancing resilience to flooding events.
Drinking Water Directive	The Drinking Water Directive is a piece of legislation to ensure the quality and safety of drinking water for the citizens of the European Union. Its primary aim is to protect human health by setting standards for the quality of drinking water across the EU Member States.
EU Marine Strategy Framework Directive	The EU Marine Strategy Framework Directive (MSFD) aims at protecting and conserving the marine environment across the European Union. Adopted in 2008, the directive provides a framework for achieving and maintaining Good Environmental Status (GES) in EU marine waters by 2020 and beyond. It is a comprehensive framework for the sustainable management of marine waters, aiming to protect marine biodiversity, promote sustainable use of marine resources, and mitigate human impacts on marine ecosystems.
Groundwater Directive	The EU Groundwater Directive seeks to protect groundwater resources as vital sources of drinking water and support for ecosystems, as well as to ensure their sustainable use. Adopted in 2006, the directive aims to prevent and control groundwater pollution and degradation across EU Member States.
Sewage Sludge Directive	The EU Sewage Sludge Directive aims to regulate the use and disposal of sewage sludge, a byproduct of wastewater treatment. Adopted in 1986 and revised in 1991, the directive aims to protect human health and the environment from the potential risks associated with the application of sewage sludge to land. The objective is to to ensure the safe and environmentally sound management of sewage sludge, minimize risks to human health and the environment, and to promote sustainable practices for wastewater treatment and sludge disposal.
Industrial Emissions Directive [19]	The Industrial Emissions Directive (IED) regulates the environmental impact of industrial activities. Adopted in 2010, the directive aims to prevent and control pollution from industrial installations across the EU Member States. To protect human health and the environment from pollution it promotes the use of best available techniques and technologies to achieve sustainable industrial development.

[19] Annex I (p. 65ff) Provides threshold values to categories of activities referred to in Article 10;
Annex II (p. 71ff) provides a list of polluting substances; Annex V (p. 75ff) lists technical provisions for combustion plants including emission limit values;
Annex VI (p. 84ff) lists technical provisions relating to waste incineration plants and waste co-incineration plants;
Annex VII (p. 97ff) lists technical provisions relating to installations and activities using organic solvents;
Annex VIII (p. 111ff) lists technical provisions relating to installations producing titanium dioxide

Urban Waste Water Treatment Directive (and revision thereof (draft))[20]	The Urban Waste Water Treatment Directive (UWWTD) seeks to protect the environment and public health by regulating the collection, treatment, and disposal of urban wastewater. Adopted in 1991, the directive aims to ensure that urban wastewater is adequately treated before discharge into water bodies, preventing water pollution, protecting aquatic ecosystems, public health and promoting the sustainable management of urban wastewater across the EU.
The National Emission Reduction Commitments Directive (NEC Directive)	The NEC Directive addresses air pollution from certain pollutants, such as sulfur dioxide (SO2), nitrogen oxides (NOx), ammonia (NH3), volatile organic compounds (VOCs), and fine particulate matter (PM2.5). Adopted in 2001, the directive aims to reduce emissions of these pollutants to protect human health and the environment as well as improve air quality across the EU.
Renewable Energy Directive	The Renewable Energy Directive (RED) aims to promote the use of energy from renewable sources and to reduce greenhouse gas emissions. Adopted in 2009 and revised in 2018, the directive sets targets for the share of renewable energy in the EU's overall energy consumption and establishes sustainability criteria for biofuels and bioliquids. Its objective is to accelerate the transition to a low-carbon economy by increasing the use of renewable energy sources, promoting energy efficiency, and reducing greenhouse gas emissions in the European Union.
EU Restoration Law	The EU Nature Restoration Law aims at restoring degraded ecosystems across Europe. Its primary objectives are to reverse biodiversity loss, enhance ecosystem resilience, and contribute to climate change mitigation and adaptation. The law sets legally binding targets for the restoration of a variety of ecosystems, including forests, wetlands, peatlands, grasslands, and marine environments. Key measures include restoring pollinator habitats, improving soil health, increasing green urban areas, and rewilding degraded natural spaces. This law is part of the European Green Deal and supports the EU's commitment to becoming the first climate-neutral continent by 2050 (MDPI) (Ecosystem Marketplace).
EU Climate Law	The EU Climate Law, Regulation (EU) 2021/1119, establishes a legally binding framework for achieving climate neutrality in the European Union by 2050. It enshrines into law the objectives of the European Green Deal and sets the stage for the EU's climate policy and legislative actions. It should ensure that all member states contribute to and benefit from the transition to a climate-neutral economy. It is a cornerstone of the EU's efforts to combat climate change and promote sustainable development.
Regulation on land use, land use change and forestry (LULUCF)	The legislative framework established by the EU addresses greenhouse gas emissions and removals associated with land use, land use change, and forestry activities. Adopted in 2018, the regulation sets out rules for accounting and reporting emissions and removals from these activities to ensure their inclusion in the EU's efforts to mitigate climate change. The LULUCF Regulation plays a crucial role in ensuring the inclusion of land use, land use change, and forestry activities in the EU's climate policy framework.
EU Restoration Law	The EU Nature Restoration Law aims at addressing biodiversity loss and ecosystem degradation within the European Union. The primary objectives of the law are to restore damaged ecosystems, improve biodiversity, and enhance the resilience of natural habitats. Key components of the law include Binding Restoration Targets, National Restoration Plans, Monitoring and Reporting, Funding and Support, and Public Participation.
EU Soil Monitoring Law (upcoming)	
EU Regulation 2020/741 on minimum requirements for water reuse[21]	EU Regulation 2020/741 establishes minimum requirements for water reuse, aiming to promote the safe and efficient use of reclaimed water for agricultural irrigation and aquifer recharge. The regulation sets out quality standards and monitoring requirements to ensure that reclaimed water meets specified health and environmental criteria before its use. By establishing clear guidelines for water reuse, the regulation aims to enhance water resource management, improve water efficiency, and contribute to sustainable agricultural practices and ecosystem health within the EU.
EU Taxonomy Climate and Environment Delegated Acts	The EU Taxonomy Climate and Environment Delegated Acts are part of the EU Taxonomy Regulation (Regulation (EU) 2020/852), which establishes a classification system for sustainable economic activities. These acts provide

[20] Annex I (p. 12ff) Requirements for urban waste water
[21] Annex I (p. 16) Uses and minimum requirements

	detailed criteria for determining which activities can be considered environmentally sustainable, guiding investments towards achieving the EU's climate and environmental goals. They are essential tools in the EU's strategy to achieve climate neutrality by 2050, guiding sustainable investments and ensuring that economic activities align with the EU's environmental objectives.
EU Strategies	
EU Action Plan "Towards zero pollution for air, water, and soil" (as part of the EU Green Deal)	Adopted in May 2021, the action plan sets out a series of measures and initiatives aimed at reducing pollution levels and achieving clean air, water, and soil across the EU. It represents a comprehensive and ambitious strategy to tackle pollution and protect the environment as well as public health. By implementing the measures outlined in the action plan, the EU aims to achieve cleaner air, water, and soil for current and future generations.
Blueprint for Safeguarding European Waters	The "Blueprint to Safeguard Europe's Water Resources" outlines a strategic framework to address challenges related to water scarcity and pollution, ensuring sustainable water management across the EU. It is a comprehensive strategy to guide the EU towards sustainable water management, addressing both current challenges and future pressures on water resources.
Climate Change Adaptation EU Strategy	The Climate Change Adaptation EU Strategy provides a framework for coordinated action to adapt to the impacts of climate change and build resilience across various sectors and regions in the EU. It outlines a coordinated approach to adapt to the changing climate and minimize vulnerabilities to climate-related risks. By integrating adaptation considerations into policies and practices, the aim is also to safeguard the well-being of its citizens and ecosystems.
EU Biodiversity Strategy for 2030	Adopted in May 2020, the strategy sets ambitious targets and actions to protect biodiversity, promote sustainable land and ocean management, and address the drivers of biodiversity loss. It represents a commitment of the EU to address the biodiversity crisis and promote the conservation and restoration of ecosystems by 2030. By implementing the measures outlined in the strategy, the aims are to protect biodiversity, support sustainable development, and build a resilient and nature-positive future.
EU Farm to Fork Strategy	The initiative was developed to promote sustainable food systems and enhance the environmental and social sustainability of food production and consumption. Adopted in May 2020, the strategy outlines a range of actions to promote healthy diets, reduce the environmental footprint of food production, and ensure the resilience of food supply chains. The EU Farm to Fork Strategy represents a holistic approach to support human health, environmental sustainability, and social equity.
EU Circular Economy Action Plan (CEAP)	The EU Circular Economy Action Plan (CEAP) is a comprehensive strategy to promote the transition to a circular economy, where resources are used more efficiently, waste is minimized, and the value of products and materials is maximized throughout their lifecycle. Adopted in March 2020, the action plan outlines a range of measures and initiatives to promote sustainable production and consumption, reduce resource use and waste generation, and foster innovation and investment in circular economy solutions. It represents a holistic and ambitious approach to promoting a more sustainable, resource-efficient, and circular economy in the European Union. By implementing the measures outlined in the action plan, the EU aims to achieve its environmental, economic, and social objectives while reducing its environmental footprint and contributing to global efforts to address climate change and biodiversity loss.
EU Soil Strategy for 2030	The EU Soil Strategy for 2030 aims to address soil degradation, promote sustainable soil management, and protect soil functions and biodiversity. Adopted in May 2022, the strategy outlines a range of actions and initiatives to improve soil health, prevent soil erosion, and enhance the resilience of soils to climate change and other pressures. By implementing the measures outlined in the strategy, the EU aims to protect soil resources, enhance ecosystem resilience, and support sustainable land use and agriculture for current and future generations.
The European Green Deal	The European Green Deal was launched to transform Europe into a more sustainable, climate-neutral, and environmentally friendly continent. Introduced in December 2019, the European Green Deal encompasses a wide range of policies and measures aimed at tackling climate change, promoting clean energy, protecting biodiversity, and fostering sustainable economic growth. It addresses the climate crisis, environmental protection, and promotes sustainable development. By implementing the measures outlined in the European Green Deal, the EU aims to lead the global transition to a more sustainable and resilient future.

REPowerEU	REPowerEU is a strategic plan initiated by the European Commission in response to the energy crisis exacerbated by Russia's invasion of Ukraine. It aims to reduce the EU's dependence on Russian fossil fuels and accelerate the transition to renewable energy sources. The plan should make the EU more energy-resilient, sustainable, and independent, while also contributing to the broader goals of the European Green Deal, such as reducing greenhouse gas emissions and achieving climate neutrality by 2050.
A framework for the setting of ecodesign requirements for energy-related products (recast)	The framework for the setting of ecodesign requirements for energy-related products, commonly known as the Ecodesign Directive, provides a legislative framework within the EU to establish minimum environmental performance standards for energy-related products. The directive aims to promote the development of more environmentally friendly products by setting requirements related to energy efficiency, resource use, emissions, and other environmental aspects. By establishing ecodesign requirements, the objective is to reduce the environmental impact of products throughout their lifecycle, from production to use and disposal, towards a transition to a more sustainable and circular economy.
EU Strategy for Sustainable and Circular Textiles	Introduced in 2021, the strategy outlines a range of initiatives and measures to address environmental and social challenges associated with textile production and consumption. It represents a comprehensive and ambitious approach to promoting sustainability and circularity in the textile industry. By implementing the measures outlined in the strategy, the EU aims to drive positive change towards a more sustainable and ethical textile sector that benefits both people and the planet.
Ecological criteria for the award of the EU Ecolabel for textile products	The ecological criteria for the award of the EU Ecolabel for textile products establish standards and requirements that textile products must meet to qualify for the EU Ecolabel certification. These criteria are designed to promote sustainability and environmental responsibility throughout the lifecycle of textile products, from raw material sourcing to manufacturing, use, and disposal. By textiles meeting these criteria, consumers are assured that they are making environmentally conscious choices when purchasing textiles.
Revision of the EU Green Public Procurement (GPP) Criteria for Textile Products and Services	The revision of the EU Green Public Procurement (GPP) criteria for textile products and services involves updating the standards and requirements that public authorities must consider when procuring textiles. These criteria are designed to promote environmentally friendly and socially responsible practices in the textile industry and to encourage the adoption of sustainable textile products and services by public authorities. The revision of the GPP criteria for textile products and services aims to promote sustainable and responsible procurement practices among public authorities, driving positive change in the textile industry towards a more sustainable and ethical future.
Sustainable Development Goals (SDGs)	
SDG #2 "Zero hunger"	SDG 2 aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture by ensuring sustainable food systems, addressing malnutrition and supporting small-scale farmers. SDG 2 seeks to ensure that everyone has access to sufficient, safe, and nutritious food, and that food production systems are sustainable, resilient, and equitable. Achieving SDG 2 is essential for reducing poverty, improving health outcomes, promoting economic growth, and advancing sustainable development worldwide.
SDG #6 "Clean water and sanitation"	SDG 6 aims to ensure availability and sustainable management of water and sanitation for all. 1. Universal Access to Safe and Affordable Drinking Water 2. Universal Access to Sanitation and Hygiene 3. Improvement of Water Quality 4. Efficient Water Use and Water Resource Management 5. Resilience to Water-Related Disasters 6. Inclusive and Sustainable Water Governance Achieving SDG 6 is critical for improving public health, reducing poverty, and advancing sustainable development globally.
SDG #12 "Responsible consumption and production"	SDG 12 aims to ensure sustainable consumption and production patterns that minimize waste, reduce environmental impact, and promote resource efficiency and social equity as well as economic prosperity. 1. Sustainable Consumption 2. Sustainable Production 3. Resource Efficiency 4. Waste Reduction and Recycling

	5. Product Lifecycle Management 6. Consumer Awareness and Education 7. Corporate Sustainability Reporting Achieving SDG 12 is essential for advancing sustainable development and ensuring a more equitable and resilient future for all.
SDG #13 "Climate action"	SDG 13 aims to take urgent action to combat climate change and its impacts by implementing measures to mitigate greenhouse gas emissions, adapt to climate change, and build resilience to its adverse effects. 1. Reducing Greenhouse Gas Emissions 2. Renewable Energy Adoption 3. Climate Resilience and Adaptation 4. Climate Finance and Investment 5. Climate Education and Awareness 6. International Cooperation and Partnerships SDG 13 seeks to galvanize global efforts to address the climate crisis, mitigate greenhouse gas emissions, and build climate resilience to protect vulnerable communities and ecosystems. Achieving SDG 13 is critical for safeguarding the planet, promoting sustainable development, and ensuring a livable and prosperous future for all.

ANNEX V: EU circular-economy policy assessment

Based on the analysis conducted in this assessment, the questionnaire outlined in Annex I was developed as one of the initial steps in the overall methodology. It serves as a foundational tool for gathering structured data and aligning the evaluation process with the policy framework.

Does the selected WACES contribute to…

EU policies	
Nitrates Directive	• the ND objectives by reducing Nitrate water pollution coming from agricultural sources (Article 1) • reducing the Nitrate level in SW and/or GW bodies • improving the eutrophic state of fresh surface waters, estuarial water and/or coastal waters (Article 6 1. C) • reducing the nitrate concentration to below 25mg/l in vulnerable zones • (Article 6) • reducing the nitrate concentration to below 50mg/l in groundwaters (Annex I A 1.) • keeping the amount of manure per hectare (and year) at below 170kg N • (Annex III 2.) • contribute to good agricultural practice (ANNEX II) • monitoring the nitrate content of waters (Article 5)
Water Framework Directive	• achieving GWB good quantitative status (20) • achieving GWB/SWB good chemical status (22) • contributing to marine water (27) • contributing to GW (Article 4 (1) a) • contributing to SW (Article 4 (1) a) • reducing rate of incidents regarding water pollution (39) (Article 16) • mitigating to the effects of floods and/or droughts (Article 1 e) • achieving SWB good ecological status [22](Article 4) • contributing to aquatic, terrestrial ecosystems or/and wetlands? (Article 1 a) • improving cost efficiency (ANNEX III) • supporting or ease the monitoring of water status (Article 8)

[22] Adding more detailed the contributions to the ecological status (ANNEX V 1.2): Phytoplankton, Macrophytes etc.

Funded by the European Union

Floods Directive	• Reducing the risk of adverse consequences, […] for human health, the environment, cultural heritage, economic activity and infrastructure associated with floods • (3) p. 1 • Achieving good ecological and chemical status, and […] to mitigating the effects of floods (4) p. 1 • Managing flood risks at the community level […] concerted and coordinated action […] to improve the overall level of flood protection (5) p. 1 • […] tailored solutions according to the needs and priorities of those areas […] (13) p. 2 • Prevention, protection and preparedness. […] maintenance and/or restoration of floodplains (14) p. 2 • To the solidarity principle […] in the context of flood risk management (15) p. 2 • "best practice" and "best available technologies" (18) p.2 • Achieving the appropriate objectives for the management of flood risks (Article 7, 2. p. 5) • Implementing measures for achieving the objectives (Article 7, 3. p. 5)
Drinking Water Directive	• protecting human health from contaminated water intended for human consumption (2) • ensuring the water is wholesome and clean (2) • improving access to wholesome and clean water (2) (Article 16) • ensuring this water is free of micro-organisms like parasites (2) • reducing water leakages (4) • reducing the input of substances to reach the thresholds[23] (ANNEX I A,B,C,D) • reducing the level of treatment required to produce water for human consumption (17) • reducing the risk of hazardous events at water abstraction points (17) • reducing migration of potentially harmful substances (21) • providing up-to-date information on water consumption of the consumer (37) • improving water safety and reduce risks (include. abstraction, treatment, storage and • distribution of water) (Article 7) • improving/supporting of monitoring (Article 13)
EU Marine Strategy Framework Directive	• achieving or maintaining good environmental status in the marine environment (Article 1 (1)) • protecting and preserving the marine environment and preventing its deterioration (Article 1 (2) a) • preventing and reducing inputs (pollution) in the marine environment (Article 1 (2) b) • applying an ecosystem-based approach (Article 1 (3)) • Maintaining biological diversity (Article 1 (1); Annex I) • using existing regional institutional cooperation structures (Article 6 (1))

[23] A more detailed contribution to each of the thresholds based on the ANNEX I can be made.

	• or extending cooperation between Member States in a catchment area (Article 6 (2)) • enabling the sustainable use of marine goods and services by present and future generations • keeping marine food webs at abundances to ensure long-term abundance • keeping no-indigenous species at levels that do not harm the ecosystem • minimising human-induced eutrophication • safeguarding the structure and functions of ecosystems
Groundwater Directive	• contributing to good GW chemical status (Article 1) • contributing to reversal a trend in GW status (Article 5) • contributing to reduce the amount of substance input (Article 3 and 6) – see list for substances in ANNEX 2 B
Sewage Sludge Directive	• preventing harmful effects on soil to prevent • harmful effects on soil, vegetation , animals and man (Article 1) • supporting the treatment of sewage sludge before agricultural use (Article 6) • supporting to limit the amount of heavy metals in the soil in **mg/kg** of (Article 4; ANNEX I A)[24] • supporting to limit the amount of heavy metals in sludge for use in agriculture in **mg/kg of dry matter** of (Article 4; ANNEX I B) • supporting to limit the amount of heavy metals which may be added annually to agricultural land based on a 10-year average in **kg/ha/yr** (Article 4; ANNEX I C)
Industrial Emissions Directive [25]	• preventing, reducing and as far as possible eliminating pollution from industrial activities (2) p. 2; • giving priority to intervention at source, ensuring prudent management of natural resources (2) p. 3 • an integrated approach to prevention and control of emissions (into air, water and soil, to waste management, to energy efficiency and to accident prevention (3) p. 3 • preventing deterioration of the quality of soil and groundwater (23) p. 6 • keeping emissions below limit values set out in Annex V (30) p. 8 • applying minimum desulphurisation rates (31) p. 8 • ensuring a high level of environmental and human health protection and avoiding transboundary movements of waste (34) p. 8 • reducing photochemical oxidants (35) p. 8 • reducing titanium dioxide (36) p. 9 • integrated prevention and control of pollution arising from industrial activities (Article, 1 p. 11)

[24] The list of heavy metals can be found in the ANNEX I A, B, C

[25] Annex I (p. 65ff) Provides threshold values to categories of activities referred to in Article 10;
Annex II (p. 71ff) provides a list of polluting substances; Annex V (p. 75ff) lists technical provisions for combustion plants including emission limit values;
Annex VI (p. 84ff) lists technical provisions relating to waste incineration plants and waste co-incineration plants;
Annex VII (p. 97ff) lists technical provisions relating to installations and activities using organic solvents;
Annex VIII (p. 111ff) lists technical provisions relating to installations producing titanium dioxide

	• preventing / reducing emissions into air, water and land, and to preventing generation of waste (Article, 1 p. 11)
Urban Waste Water Treatment Directive (and revision thereof (draft))[26]	• protecting the environment from the adverse effect of waste water discharges (Article 1, p. 3) • secondary treatment or an equivalent treatment (Article 4, 1. p. 5) • reusing treated waste water (Article 12, p. 8) • reusing sludge from waste water treatment (Article 14, 1., p. 9) • reducing the amount of toxic, persistent or bioaccumulable materials in sludge disposed of to surface waters (Article 14, 4., p. 9) • monitoring discharges from urban waste water treatment plants as well as amounts and composition of sludges disposed of to surface waters (Article 15, 1., p. 10)
The National Emission Reduction Commitments Directive (NEC Directive)	• reducing national emissions of certain atmospheric pollutants • achieving levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment (2), p. 1 & 2 • reducing mercury emissions (4), p. 2 • reducing emissions of: sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and fine particulate matter, black carbon (6), p. 2[27] • achieving the national emission reduction commitments (7), p. 2[28]; Article 4, p. 7 • achieving the Union's long-term objective on air quality (8), p. 2 • achieving the air quality objectives and to mitigating climate change impacts (9), p. 2 • reducing health-related costs; improving citizens' well-being & contributing to the transition to a green economy (10), p. 2 • identifying indicative emission levels (13), p. 2 • addressing the most harmful pollutants (20), p. 3 • reducing atmospheric ammonia from agriculture (21), p. 3 • monitoring the impacts of air pollution on terrestrial and aquatic ecosystems (30), p. 4 • achieving the Union's biodiversity and ecosystem objectives in line with the 7th Environment Action Programme (Article 1, 2. (b))
Renewable Energy Directive	• promoting renewable froms of energy to reduce GHG-emissions and to comply with the Paris Agreement and the climate framework with the target to cut emissions by at least 40% below 1990 levels by 2030 (2) p. 1 • the security of energy supply, sustainable energy at affordable prices, technological development and innovation […] (3), p. 3 • reducing energy consumption […], using energy efficiency technologies and promoting the use of renewable energy in different sectors[29] (4), p. 2

[26] Annex I (p. 12ff) Requirements for urban waste water
[27] And pollutants referred to in Annex I (Article, 1, p. 5)
[28] Annex II (p. 19ff)
[29] Electricity, heating and cooling, […]

	• establishing small-scale installations accorinding to state aid rules (17), p. 3 • deploying electricity from renewable sources to the lowest possible price for the consumer (19), p. 3 • meeting environmental and climate change objectives (44), p. 7 • meets the criteria[30] for protecting land with high biodiversity value and land with high carbon stock (81), p. 13 • achieving at least 32% of energy from renewable sources in the EU by 2030 (128), p. 20, (Article 3, p. 24) • the respective national overall targets for the share of energy from renewable sources (Annex I, p. 60) • applying the waste hierarchy adequately (21) • the infrastructure/implementation of energy cummunities
European Climate Law	• tackling climate change and delivering on the implementation of the Paris Agreement (1), p. 1 • decoupling greenhouse gas emissions from economic growth (7), p. 2 • adapting to the adverse consequences of climate change (8), p. 2 • reducing greenhouse gas emissions in a cost-effective way (13), p. 3 • establishing carbon sinks (carbon removal) (22), p. 4/5 • restoring ecosystems (23), p. 5 • reducing GHG emissions by 55% by 2030 compared to 1990 levels (26), p. 5 • achieving a net carbon sink of 225 million tonnes of CO_2 equivalent in 2030 (in the EU) (27), p. 6 • achieving climate neutrality by 2050 (29), p. 6 • enhancing the adaptive capacity, strengthen resilience and reduce vulnerability to climate change (31), p. 6 • considering the SDGs (32), p. 6 • the irreversible and gradual reduction of anthropogenic greenhouse gas emissions by source and enhancement of removals by sinks (Article 1, p. 8) • achieving the temperature goal set out by the Paris Agreement (Article 1, p. 8) • achieving negative emissions after 2050 (Article 2, p. 9)
EU Taxonomy Climate and Environment Delegated Acts	• substantially to the sustainable use and protection of water and marine resources, to the transition to a circular economy, to pollution prevention and control, or the protection and restoration of biodiversity and ecosystems […] (heading) • economic activities that contribute to] one or more of the six objectives[31] set out in Article 9 […] in accordance with Articles 10 to 16 […] (1.1. (i), p. 2) • doing no significant harm to an of the other environmental objectives in accordance with Article 17 (1.1. (ii), p. 2) • minimum (social) safeguards set out in Article 18 (1.1. (iii), p. 2) • technical screening criteria […] in accordance with Articles 10(3), 11(3), 12(2), 13(2), 14(2) & 15(2) (1.1. (iv), p. 2)

[30] Article 29(2)-(7) and (10)
[31] The six environmental objectives as defined in the Taxonomy Regulation are as follows: (a) climate change mitigation; (b) climate change adaptation; (c) the sustainable use and protection of water and marine resources; (d) the transition to a circular economy; (e) pollution prevention and control; and (f) the protection and restoration of biodiversity and ecosystem.

EU Action Plan "Towards zero pollution for air, water, and soil" (as part of the EU Green Deal)	• reducing air, water and soil pollution to levels no longer considered harmful to health and natural ecosystems and that respect boundaries our planet can cope with, thus creating a toxic-free environment (2.1., p. 3) • reducing by more than 55% health impacts of air pollution • reducing by 30% the share of people chronically disturbed by transport noise • reducing by 25% the (EU) ecosystems where air pollution threatens biodiversity • reducing by 50% nutrient losses, the use and risk of chemical pesticides, the use of the more hazardous • ones, and the sale of antimicrobials for farmed animals and in aquaculture • reducing by 50% plastic litter at sea and by 30% microplastics released into the environment • reducing significantly total waste generation and by 50% residual municipal waste (2.1., p. 3) • sustaining prosperity and transforming production [of what?] towards zero pollution and directing investments towards zero pollution (2.1., p. 4) • preventing pollution at source, or minimising or remediating pollution (2.1., p. 4) • capping ambient (outdoor) air pollution (2.2., p. 5) • aligning air the EU's air quality standards with the (upcoming) WHO recommendations (2.2., p. 5) • reducing ammonia emissions from agriculture (2.2., p. 5) • reducing health inequalities through zero pollution (2.2, FS 1, p. 7) • supporting urban zero pollution action (2.2., FS 2, p. 7)
Blueprint for Safeguarding European Water	• achieving good water status (2., p. 4) • better implementation and increased integration • of water policy objectives into other policy areas (2., p.4) • reducing pressure on the ecological status from changes in water bodies (2.1. , p. 4) • progressively retrofitting (existing) structures in order to improve water status (2.1., p. 5)[32] • preventing the degradation of headwaters (2.1., p. 5) • reducing over-abstraction […] & over-allocation of water (2.1., p. 6) • fulfilling monitoring obligations under the WFD (2.2., p. 7) • reducing diffuse and point-source pollution, eutrophication (2.2., p. 8) • implementing water efficiency measures (2.3., p. 10) • improving irrigation efficiency (2.3., p. 12) • reducing leakage from water distribution networks (2.3., p. 12) • water re-use for irrigation and industrial purposes (2.4., p. 14) • achieving the specific Blueprint objectives outlined in Table 7, p. 22

[32] Such measures include fish passes and fish lifts, buffer strips, green infrastructure (such as the restoration of riparian areas etc. (2.1., p. 5), restoring flood plains & wetlands, reducing soil sealing (2.4., p. 14)

Climate Change Adaptation EU Strategy	• becoming a climate-resilient society, fully adapted to the unavoidable impacts of climate change (p. 3) • reaching climate neutrality (by 2050); reinforcing adaptive capacity and minimising vulnerability to climate impacts (p. 3) • transferability and applicability on a regional, national or transnational scale (p. 4) • improving knowledge and managing uncertainty (2.1., p. 4) • the digital transformation (2.1.1., p. 5) • to better understand the interdependencies between climate change, ecosystems and the services they deliver (2.1.1., p. 5) • availability of more and better (higher quality) climate-related risk and loss(es) data (2.1.2., p. 6) • fostering local, individual, and just resilience (2.2.2., p. 9) • promoting Nature-based Solutions for Adaptation (2.2.4., p. 11) • implementing physical climate change adaptation solutions (2.3, p. 12) • establishing resilient, climate-proof infrastructure (2.3.2., p. 14) • ensuring the availability and sustainability of freshwater (2.3.4., p. 16) • sharply reducing water use (2.3.4., p. 17) • ensuring water quality (2.3.4., p. 17)
EU Biodiversity Strategy for 2030	• protecting and restoring wet-, peatlands and coastal ecosystems (1., p. 2) • emission reduction and climate adaptation (1., p. 2) • reversing biodiversity loss (2.2., p. 6) • reducing pressures on habitats and species (2.2, p. 6) • bringing back high-diversity landscape features (such as ponds) enhancing carbon sequestration, previnging soil erosion and depletion, filter air and water and supporting climate change adaptation (2.2.2., p. 7) • increasing soil fertility and biodiversity (2.2.2., p. 8) • decarbonising the energy system; renewable engergy (2.2.5., p. 10) • restoring the good environmental status of marine ecosystems (2.2.6., p. 11) • restoring freshwater ecosystms (2.2.7., p. 12) • reducing pollution (2.2.9., p. 13) • reducing the use of fertilisers (2.2.9., p. 13)
REPowerEU	• rapidly reducing [the] dependence on Russian fossil fuels (Intro, p. 1) • saving energy (1., p. 3) • diversifying energy imports (2., p. 4) • quickly substituting fossil fuels by accelerating […] clean energy transition (3., p. 6) • smartly combining investments and reforms (4., p. 12) • reinforcing preparedness (5., p. 19)

EU Farm to Fork Strategy	• restoring freshwater and sea-based resources on which the food system depends (2., p. 4) • ensuring sustainable food production (2.1., p. 5) • carbon sequestration (2.1., p. 5) • producing biogas from sewage and wastewater (2.1., p. 6) • reducing excess nutrients in the environment (2.1., p.6) • establishing circular business models (2.3., p. 12) • improving water quality (3.1., p. 15)
The European Green Deal	• achieving a resource-efficient economy with no net GHG-emissions (by 2050) (1., p. 2) • zero pollution for a toxic-free environment (1., p. 3) • preserving and restoring ecosystems and biodiversity (1., p. 3) • supplying clean, affordable, and secure energy (1., p. 3) • reducing the risk of carbon leakage (2.1.1., p. 4) • decarbonising the energy system (2.1.2., p. 6) • reducing water and soil pollution (from excess nutrients) (2.1.6., p. 11) • restoring the natural functions of ground and surface water (2.1.8., p. 14) • preserving and restoring biodiversity in lakes, rivers, wetlands and estuaries and preventing and limiting damage from floods (2.1.8., p. 14) • addressing pollution from urban runoff (2.1.8., p. 14)
Regulation on land use, land use change and forestry (LULUCF)	• achieving the objectives of the Paris Agreement and […] the GHG-emission reduction target […] for 2021 to 2025 regarding te land use, land use change (and forestry) sector (Article 1, p. 2)
EU Restoration Law	• ensuring the recovery of biodiverse and resilient nature (across the Union territory) and achieving the Union's climate change mitigation and adaptation objectives (1), p. 2 • a fair and prosperous society, with a modern, resource-efficient and competitive economy (2), p. 3 • integrated and biodiversity-inclusive spatial planning and/or effective management (processes) (4), p. 3 • ensuring that by 2030 at least 30% of degraded (terrestrial), inland water and marine and coastal ecosystems are under effective restoration (4), p. 3 • restoring, maintaining and enhancing nature's contribution to people (ecosystem functions and services)[33] (4), p. 4 • achieving the UN SDGs, in particular 14.2, 15.1, 15.2 and 15.3, referring to the need to ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services[34] (5), p. 3

[33] […] Such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk as well as the protection from natural hazards and disasters, through NbS and/or ecosystem-based approaches for the benefit of people and nature.
[34] […] in particular forests, wetlands, mountains and drylands

	• creating high-quality jobs and sustainable growth (14), p. 8 • establishing nature and nature-based solutions, including natural carbon stocks and sinks (16), p. 9 • protecting and restoring wetlands and peatlands as well as coastal and marine ecosystems […] (18), p. 11 • reducing greenhouse gas emissions by at least 55% compared to 1990 levels by 2030 (19), p. 12 • restoring degraded soils and enhancing soil biodiversity (23), p. 13 • urban ecosystem services, including natural disaster risk reduction and control such as for floods and heat island effects […] (47), p. 27 • restoring freshwater ecosystems; by 2030 at least 25.000 km of free-flowing rivers compared to 2020 (50), p. 29 • rewetting organic soils of drained peatlands) (59), p. 34
EU Circular Economy Action Plan (CEAP)	• a regenerative growth model that gives back the planet more than it takes (Introduction, p. 2) • doubling its circular material use rate in the coming decade (Introduction, p. 2) • reducing carbon and environmental footprints (2.1., p. 4) • bringing back nature into agricultural land (2.2.2., p. 8)
EU Soil Strategy for 2030	• healthy soil ecosystems that are more resilient (2., p. 2)[35] • soil restoration and better management for carbon removal (3.1., p. 5) • higher water retention capacity in soil (3.1., p. 5) • limiting the drainage of wetlands and organic soils; restoring managed & drained peatlands (3.1., p. 6) • enhancing biodiversity in agricultural land, contributing to conserving and increasing soil organic carbon (SOC) (3.1., p. 7) • reusing excavated soil (safely, sustainably and circularly) (3.2.1., p. 7) • reducing net land take and soil sealing (3.2.2., p. 8) • closing the nutrient and carbon cycle – recycling organic matter (3.2.3., p. 10) • soil biodiversity for human, animal and plant health (3.3., p. 10) • soil for healthy water resources – allowing floodwaters to infiltrate oils to reduce disasters and pollution (3.4., p. 12) • preventing soil and land degradation and restoring healthy soils (4., p. 12) – contributing to sustainable soil management (SSM) (4.1., p.12) • preventing desertification (4.2., p. 15) • preventing soil pollution (at source) – clean industry, sustainable product design, improved recycling, waste management, nutrient recovery; more efficient fertiliser application, reduced pesticide use (4.3., p. 16) • restoring degraded soils and remediating contaminated sites (4.4., p. 17)
EU Regulation 2020/741 on minimum	• wider reuse of treated waste water, limiting extraction from surface water bodies and groundwater bodies, reducing impact of discharge of treated waste water into water bodies, promoting water savings (2), p. 1

[35] See Medium-term and long-term objectives on p. 3

requirements for water reuse[36]	• promoting water-efficient technologies (in industry) and water-saving irrigation techniques (2), p. 1 • achieving good qualitative and quantitative water status for surface water bodies and groundwater bodies (2), p. 1 • treated wastewater reuse (2), p. 1 • reducing water scarcity and lessening the vulnerability of supply systems (3), p. 1 • optimising existing resources within the water cycle and creating new resources, integrating environmental, social and economic considerations (5), p. 2 • meeting minimum requirements for water reuse (6), p. 2 • minimum parameters for reclaimed water (10), p. 2 • recovering nutrients from the reclaimed water (11), p. 2 • restoring nutrients such as nitrogen, phosphorus and potassium to natural biogeochemical cycles (12), p. 2 • preventing deterioration in the quality of water intended for human consumption (17), p. 3 • monitoring the quality of reclaimed water (19), p. 3 • protecting the environment and human and animal health (39), p. 7 • undertaking Union programmes, including the LIFE programme, to support local initiatives (44), p. 7
A framework for the setting of ecodesign requirements for energy-related products (recast)	• achieving ecodesign requirements for energy-related products (1), p. 2
EU Strategy for Sustainable and Circular Textiles	• reducing the environmental footprint of textiles along their life cycle (p. 2) • reducing microplastics pollution (2.3, p. 6)
ecological criteria for the award of the EU Ecolabel for textile products	• treating air and wastewater emissions of substances, production recipes and technologies used to manufacture and impart specific qualities and functions to the product (chemicals and processes) (Annex, 16. And Table 1 (b), p. 5) • treating wastewater from retting[37] ponds to reduce COD[38] or TOC[39] by at least 75% for hemp fibres and by at least 95% for flax and other bast fibres. (Criterion 2. 2(b), p. 4) • compliance of wool scouring [washing] with COD values for final discharge of effluent (Criterion 3. Table 3, p. 10) • keeping chlorine in the finished fibres at levels below 150 ppm and in the wastewater from pulp manufacturing below 0,170 kg/ADt[40] pulp (Criterion 9. 9(c), p. 12

[36] Annex I (p. 16) Uses and minimum requirements
[37] https://www.britannica.com/technology/retting#ref36456
[38] Chemical Oxygen Demand (COD)
[39] Total Organic Carbon (TOC)
[40] Air Dry Tonne (ADt)

	• colour removal to treat wastewater in compliance with criterion 16(a)[41] (Criterion 14. Table 6, (i), p. 17) • wastewater charges not exceeding 20g COD/kg textiles processed (Criterion 16. 16(a), p. 20) • degrading 90% of the component substances in wastewater treatment plants (Appendix 1, (a) (ii), p. 27) • eliminating all surfactants, fabric softeners and complexing agents in wastewater treatment plants (Appendix 1, (f) (ii), p. 31) • water and liquor re-use/recycling in batch[42] processes (Appendix 3, 1. 1.6, p. 39) • using "smart" rinsing technologies with water flow controls and counter currents (Appendix 3, 2. 2.3, p. 39)
Revision of the EU Green Public Procurement (GPP) Criteria for Textile Products and Services	• reducing the environmental impacts of cotton production (2.1.2.1, p. 21) • reducing water use in cotton production (2.1.2.1, p. 30) • reducing water pollution in wool fibre production (2.1.2.2, p. 31) • reducing energy consumption in wool production (2.1.2.2, p. 31) • lowering discharge COD limits to 25g/kg for coarse and lamb's wool and 45g/kg for fine wool (2.1.2.2, p. 32) • keeping Best Available Technique (BAT) limit values for sulphur emissions below integrated washing 70 -220kg/tonne fibre, batch washing 40-60 kg/tonne fibre (filament fibres) and 12.5-30 kg/tonne fibre (staple fibres) (2.1.2.3, p. 34) • reducing the formation of dioxins and halogenated compounds (2.1.2.3, p. 34) • keeping chlorine in wastewater from pulp manufacturing below 0.170kg/tonne air-dried pulp (2.1.2.3, p. 39) • keeping concentrations of certain substances on the finished product below limit values outlined in Table 6, p. 48

SDGs

SDG #2 "Zero hunger"	• end hunger, achieve food security and improved nutrition and promote sustainable agriculture
SDG #6 "Clean water and sanitation"	• ensuring availability and sustainable management of water and sanitation for all • safe drinking water • safe sanitation and hygiene
SDG #12 "Responsible consumption and production"	• reducing domestic material consumption • removing fossil fuel subsidies
SDG #13 "Climate action"	• taking urgent action to combat climate change and its impacts • reducing greenhouse gas emissions

[41] Wastewater discharges from wet processing
[42] preparation, dyeing, printing, and finishing of textiles

Regional policy reforms in 6 ROp

Spain - Royal Decree 1620/2007[43]	• the reuse of treated wastewater[44] • using reclaimed water for the purposes listed in Appendix I.A. (p.10) • meeting the quality criteria set out in Article 5, p. 4 (Appendix I.A.) • meeting the terms and conditions for the use of reclaimed water (Article 8 (6), p. 7) • meeting the rules to water reuse concession sand permits (Article 11, p. 8)
Italy - Legislative Decree 152/2006 on agricultural water reuse[45]	• the protection of surface, marine and underground waters (Article 1 (1) (a)-(d), p. 1) • preventing and reducing pollution and implementing the remediation of polluted water bodies (Article 1 (1) (a)) • achieving an improvement of the state of waters and adequate protection of those intended for particular uses (Article 1 (1) (b)) • pursuing sustainable and durable uses of water resources, with priority for drinking water resources (Article 1 (1) (c)) • maintaining the natural self-purification capacity of water bodies, as well as the ability to support large and well-diversified animal and plant communities (Article 1 (1) (d)) • achieving the objectives outlined in paragraph 1 by applying the tools outlined in paragraph 2 (a)-(f), p. 1 • identifying environmental quality objectives and specific destinations of water bodies(2) (a) • the integrated protection of qualitative and quantitative aspects within each river basin and an adequate control system (2) (b) • compliance with the discharge limit values set by the state […] (2) (c) • the adaptation of the sewerage, collection and purification systems of water discharge as part of the intergrade water service (2) (d) • (the identification of measures for) the prevention and reduction of pollution in vulnerable zones and sensitive areas (2) (e) • (the identification of measures aimed at) the conservation, saving, reuse and recycling of water resources (2) (f) • meeting the minimum environmental quality objectives outlined in (Articles 4-6, p. 8) • meeting the requirement for waters for specific “destination” (Articles 7-17, p. 9 ff)
Greece - Law 3199/2003 on industrial water use and wastewater discharge[46]	• water protection and management • implementing specific measures against pollution (Article 9, p. 7) • complying with general rules on water use (Article 10, p. 7)
France - Decree No. 2022-336 of March 10, 2022	• the protection of human health and the environment (Article 2. I., p. 1)

[43] English version: https://www.asersagua.es/Asersa/Documentos/Spanish%20Regulations%20for%20Water%20Reuse%20EN.pdf (referring to this version regarding page numbers)
[44] Appendix I (p. 10ff.) sets out the quality criteria for the reuse of water according to its intended use
[45] Translated with Google Translator (referring to this version regarding page numbers)
[46] Translated with the EU eTranslation tool (referring to this version regarding page numbers)

relating to the uses and conditions of reuse of treated wastewater	• making sludge comly with all limit values in tables I a and I b of Annex I in article R. 214-1 Environmental Code, Title II (Article 2, p. 2)
Bulgaria - The Water Act on water management also for mining sector	• ensuring integrates water management in the interest of society and for the protection of the population (Article 2, p. 1) • suffient quantity and good quality of surface and groudwater (Article 2 (1), p. 1f) • the reduction of water pollution (Artilce 2 (2), p. 2) • protecting surface, groundwaters and waters of the Black Sea (Article 2 (3), p. 2) • ending pollution of the marine environment with natural or synthetic substances (Article 2 (4), p. 2) • reducing the effects of floods and droughts (Artlice 2 (6), p. 2) • preventing or reducing harmful effects of water as well as recovery of damages (Article 2a (7), p. 3) • the maintenance and restoration of plant and soil cover related with the reproduction of waters (Artlicle 2a. (9), p. 3)
Germany - Fertilizer Ordinance and Sewage sludge directive on nutrient recycling to agriculture	• regulating the application or introduction of swage sludge, sewage sludge mixture and sewage sludge compost (Part 1 §1 (1) 1., p. 2) • recycling sewage sludge. Recovering phosporus and returing phosphorus obtained (Part 1 §3 (1), p. 3) • keeping pollutants in sewage sludge below limit values outlined in Appendix I, p. 19



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