PROJECT DELIVERABLE REPORT

D2.3 Gap Analysis of the Existing SDG and EU Framework for Smart Water Management

A holistic water ecosystem for digitisation of urban water sector

SC5-11-2018

Digital solutions for water: linking the physical and digital world for water solutions

Document Information

Grant Agreement Number	820985	Acronym	NAIADES
Full Title	A holistic water ecosystem for digitisation of urban water sector		
Topic	SC5-11-2018: Digital solutions for water: linking the physical and digital world for water solutions		
Funding scheme	IA – Innovation Action		
Start Date	1st JUNE 2019	**Duration**	36 months
Project URL	www.naiades-project.eu		
EU Project Officer	Alexandre VACHER		
Project Coordinator	CENTER FOR RESEARCH AND TECHNOLOGY HELLAS - CERTH		
Deliverable	D2.3 Gap Analysis of the Existing SDG and EU Framework for Smart Water Management		
Work Package	WP2		

Date of Delivery	**Contractual**	M18	**Actual**	M19
			Resubmission date	M26

Nature	R - Report	**Dissemination Level**	PU-PUBLIC
Lead Beneficiary	Mandat International		
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Keywords	SDGs, policy, smart water, methodology, impact assessment		

Revision History

Version	Date	Responsible	Description/Remarks/Reason for changes
0.1	10.04.2020	MI	Table of contents defined
0.2	12.05.2020	MI	State of the art and research
0.3	22.06.2020	MI	Initial draft
0.4	25.09.2020	MI	Final draft
0.5	16.10.2020	GT	Internal Review

1.0	16.10.2020	MI	Review and Release
2.0	08.07.2021	MI	Final Draft
2.1	13.07.2021	IHE, AIMEN, GT	Internal Review
2.2	15.07.2021	MI	Final Submission

Detailed Updates of Revision 2.0

Number of Section	Title	Update	Description/Remarks/Reason for changes
3.4.4	SDG 14: Life Below Water	Deletion of this section	Through solicited inputs from all consortium partners (see detailed description under section 5.1), it was found that NAIADES does not contribute to the achievement of SDG 14. All information related to this goal previously provided was thus deleted.
4.2.4	The EU Framework for Smart Water Management and SDG 14 (Life Below Water) Targets	Deletion of this section	Idem
4.3	Gap Analysis of the EU Framework for Smart Water Management	Brief elaboration on the analysis	A brief conclusion has been added to highlight the main takeaways of the analysis.
5	Deliverable Contribution to the NAIADES Development	Adding of this section	In order to respond to the comments made by the PO, this section was added to explain how the in-depth analysis presented under section 4 will contribute to the development of NAIADES and who the target audience is.
7	Conclusion	Complementing of this section	Following the modifications in the analysis, the conclusion has been updated accordingly.
9	Annexe	Adding of this section	For the analysis presented under section 5, some of the collected data has been put into an annexe due to its volume.

Contents

Abbreviations

BWD	Bathing Water Directive
COP21	2015 United Nations Climate Change Conference
DG DEVCO	Directorate-General for International Cooperation and Development
DG RELEX	Directorate-General for the External Relations
DWD	Drinking Water Directive
EC	European Commission
ECHO	Directorate-General for European Civil Protection and Humanitarian Aid
EFD	EU Flood Directive
EQS	Environmental Quality Standard
EU	European Union
GD	Groundwater Directive
GES	Good Environmental Status

H2020	Horizon 2020
IAM4SDG	Impact Assessment Methodology for SDGs
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
MDGs	Millennium Development Goals
MSF	Marine Strategy Framework
NGD	New Groundwater Directive
PAH	Polyaromatic Hydrocarbons
PBDE	Polybrominated Biphenylethers
SDG	Sustainable Development Goals
SDO	Standards Developing Organisation
UC	Use Case
UCA	Use Case Alicante
UCB	Use Case Brăila
UCC	Use Case Carouge
UN	United Nations
UWWT	Urban Waste Water Treatment
WFD	Water Framework Directive
WP	Work Package

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1   Summary

This report examines the relevance of the Sustainable Development Goals (SDGs) in the existing EU water management regulations, specifically the Drinking Water Directive 98/83/EC on the Quality of Water Intended for Human Consumption, the Water Framework Directive (Directive 2000/60/EC), the Groundwater Directive 80/68/EEC and Groundwater directive 2006/118/EC, the Bathing Water Directive 2006/7/EC Concerning the Management of Bathing Water Quality, the EU Flood Directive 2007/60/EC on the Assessment and Management of Flood Risks, the Urban Waste Water Treatment Directive 91/271/EEC, the Marine Strategy Framework Directive 2008/56/EC, and the Environmental Quality Standards Directive 2008/105/EC. Through the study of the SDG's specific objectives and their respective targets, it seeks to identify the areas of complementarity but also the potential gaps, where future action can be considered. In the context of NAIADES, the focus will be particularly put on SDG 6 "Clean Water and Sanitation", SDG 9 "Industry, Innovation and Infrastructure" and SDG 11 "Sustainable Cities and Communities", although other SDGs will also be examined. In addition, NAIADES contributions to the achievement of the three primary goals and a set of other secondary SDGs will also be analysed.

As a second step, the deliverable introduces the Impact Assessment Methodology for SDG compliance (IAM4SDG) – a practical self-assessment tool that can be used by research projects and evaluators, wishing to analyse their impact on the SDGs. The methodology is based upon the IAM4SDG matrix, which evaluates the likelihood of occurrence of a risk and its impact on the SDGs. The matrix allows to determine the resulting level of priority of each item, and the complementary IAM4SDGs risk management table facilitates the monitoring and activity organisation at the project level to mitigate the risk. The methodology helps guiding the projects to make more focused sustainable management decisions, but also supports the evaluators to better estimate a project's impact on the SDGs.

2   Introduction

To this date, the Sustainable Development Goals (SDGs), set in 2015 by the United Nations, are the leading reference point in the field of sustainability, both for public and private actors. The European Union (EU) is a key actor in the United Nations' (UN) discussions and is committed to be a leader in the implementation of the 2030 Agenda, in close cooperation with its Member States.

In the context of water related SDGs and targets, the EU Water policy, one of the oldest environment policies in the EU, offers the required framework for the protection of the water resources and ecosystems. It tackles various water-related aspects, including groundwater, drinking water, bathing water, urban wastewater management or pollution prevention by different economic sectors (agriculture, industries).

Furthermore, the introduction of Smart Water Management techniques offers new opportunities in the field of sustainability. Indeed, in addition to providing environmental benefits in the improvement of water quality and protection of water-related ecosystems, smart water management delivers many social and economic benefits, such as water leakage reduction, enhanced irrigation efficiency, health progresses, and trust building with local communities.

2.1   Objectives of this Deliverable

This report examines the relevance of the SDGs in the existing EU water management regulations. Through the study of the SDG's specific objectives and their respective targets, it seeks to identify the areas of complementarity but also the potential gaps where future action can be considered. In the context of NAIADES, the focus will be particularly shed on SDG 6 'Clean Water and Sanitation', SDG 9 'Industry, Innovation and Infrastructure' and SDG 11 'Sustainable Cities and Communities', although other SDGs will also be examined. It will also be discussed how NAIADES contributes to the achievement of the three primary goals and a set of other secondary SDGs.

In its second part, the deliverable will introduce the Impact Assessment Methodology for SDG compliance (IAM4SDG) – a practical self-assessment tool that can be used by research projects and evaluators, wishing to analyse their impact on the SDGs. The tool is not only intended for private and public stakeholders involved in smart water management, but can also be extended to other projects, regardless of their area of focus, wishing to evaluate their SDG impact or striving to align their practices with the SDGs. The methodology helps guiding the projects to make more focused sustainable management decisions, but also helps the evaluators to better estimate a project's impact on the SDGs.

2.2   Structure of the Deliverable

The deliverable is structured into seven core sections:

- Section 1 provides a general summary of the deliverable
- Section 2 presents the objectives of the deliverable and the structure applied in the deliverable
- Section 3 'About the Sustainable Development Goals' introduces the topic of the SDGs by recounting their history, process and focus. It also presents the three target SDGs (SDG 6, SDG 9 and SDG 11) directly relevant to the scope of the NAIADES activities and highlights their importance in the context of the EU policy and EU research programmes.
- Section 4 'EU Framework for Smart Water Management' delves into the existing water-related directives at the EU level and strives to identify possible gaps first in respect to the specific targets of the three most relevant SDGs, but also with the general scope of the 17 SDGs as a whole. Through a SWOT analysis, the section summarises the main conclusions of the gap analysis and identifies the opportunities that can be exploited to support the EU Framework for Smart Water Management and the Agenda 2030.
- Section 5 'Deliverable Contribution to the NAIADES Development' focuses on analysing how the project is contributing to the identified EU directives and to relevant SDGs.
- Section 6 'IAM4SDG Methodology for SDG Impact Assessment and Compliance' offers a practical self-assessment tool that can be used by research projects and evaluators, wishing to analyse their impact on the SDGs. The section elaborates in detail on all of the essential steps of the IAM4SDG methodology and provides templates that can be used for its implementation.
- Section 7 concludes with the general findings of the deliverable.

3   About the Sustainable Development Goals

3.1   History of Sustainable Development Goals

The notion of 'development' appeared after the second World War in the context of decolonisation and aimed at rebalancing the 'South' and the 'North'. Yet, the Sustainable Developments Goals, as we know today, stem from decades of international work and dialogue that initiated in the early nineties and that are still leading the global agenda of today.

In June 1992, at the Earth Summit in Rio de Janeiro, Brazil, more than 178 countries adopted the Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development to improve human lives and protect the environment. Water management has been at the forefront of Agenda 21, particularly in chapters 17, 18 and 21 of section II 'Conservation and Management of Resources for Development'. Indeed, Chapter 17 (on the 'Protection of the Oceans, All Kinds of Seas, including Enclosed and Semi-enclosed Seas, and Coastal Areas and the Protection, Rational Use and Development of their Living Resources') outlines the rights and obligations of States and offers the international foundation upon for the protection and sustainable development of the marine and coastal environment and its resources. It presents new management approaches for marine and coastal development. Chapter 18 ('Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources') is intended to support the countries with the application of cohesive criteria regarding the management, development and use of water resources in order to guarantee the quality. This chapter also seeks to reinforce the importance of water in the natural ecosystems by preserving its functions, supply and quality. Another example is chapter 21 (on 'Environmentally sound management of solid wastes and sewage-related issues') which is focuses on programme areas such as waste minimisation; waste reuse and recycling; waste disposal and treatment and the extension of waste service coverage.

In 2000, 189 countries adopted unanimously, at the level of the United Nations, eight millennial goals for development (MDGs) by signing the Millennium Declaration. The objectives were set to be achieved within 15 years, and therefore came to an end in 2015. The MDGs sought to reduce extreme poverty and were composed of eight goals: seven social goals (namely eradicating poverty and hunger, achieving universal primary education, promoting gender equality and empowering women, reducing child mortality, improving maternal health, combating HIV/AIDS, malaria and other diseases, developing a global partnership for development) and one environmental goal (ensuring environmental sustainability).

Figure 1: Millennium Development Goals[1]

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[1]   UN, 'United Nations Millennium Development Goals'. Accessed 11 August 2020. https://www.un.org/millenniumgoals/.

The MDGs formed a blueprint agreed by world leaders and world's leading development institutions. The strong focus on the social aspects reflected the belief that health and education were the key drivers of development, and therefore that the improvement of individuals' conditions was a prerequisite of sustainability.[2] Amongst the key achievements of the MDGs, we can note[3]:

- More than 1 billion people have been lifted out of extreme poverty (since 1990)
- Child mortality dropped by more than half (since 1990)
- The number of out of school children has dropped by more than half (since 1990)
- HIV/AIDS infections fell by almost 40 percent (since 2000)

Moreover, the MDGs reiterated the importance of water management in the context of goal 7 'ensure environmental sustainability', and more particularly target 7.C 'Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation'. In 2012, target 7.C was the first ever MDG target to be met with over two billion people gaining access to enhanced drinking water sources, such as piped supplies and protected wells between 1990 and 2010.[4]

In 2012, shortly before the expiration of the MDGs, the member-states decided to follow up on the process launched at Rio+20, which set into place the post-2015 development agenda. In the document entitled "The Future We Want", they decided, inter alia, to launch a process to develop a set of SDGs to build upon the MDGs and to establish the UN High-level Political Forum on Sustainable Development. Thus, the Sustainable Development Goals (SDGs), built upon the MDGs, and sought to complete what they did not achieve by 2030.

The UN Sustainable Development Summit in September 2015 culminated in the adoption of the 2030 Agenda for Sustainable Development, with 17 SDGs at its core. The 2030 Agenda consists of 4 sections: (i) A political Declaration (ii) a set of 17 sustainable Development Goals and 169 targets (iii) Means of Implementation (iv) a framework for follow up and review of the Agenda.

Simultaneously, 2015 marked the beginning of a new era with a stronger focus on environmental matters. Indeed, the SDGs coincided with other historic agreements reached in 2015, including the Addis Ababa Action Agenda on Financing for Development, the 2030 Agenda for Sustainable Development, the COP21 Paris Climate Conference, as well as the Sendai Framework for Disaster Risk Reduction.

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[2] Murray, Christopher J.L. 'Shifting to Sustainable Development Goals — Implications for Global Health'. New England Journal of Medicine 373, no. 15 (8 October 2015): 1390–93. https://doi.org/10.1056/NEJMp1510082.
[3] UNDP, 'Background of the Sustainable Development Goals | UNDP'. Accessed 11 August 2020. https://www.undp.org/content/undp/en/home/sustainable-development-goals/background.html.
[4] WHO, 'Millennium Development Goal Drinking Water Target Met'. Accessed 5 October 2020. https://www.who.int/mediacentre/news/releases/2012/drinking_water_20120306/en/.

3.2   The Sustainable Development Goals (SDGs)

The SDGs are distinct from the MDGs in the following four aspects:

- Larger scope: 17 SDGs as opposed to 8 MDGs;
- Multidisciplinary: the SDGs go beyond the social dimension and tackle the sustainability issue through a combination of the three dimensions of sustainable development – economic, social and environmental. As highlighted by the UN, the SDGs "recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests."[5]
- Indivisibility and holistic approach: the goals and targets are closely interlinked and need to be approached as a whole, rather than in a fragmented manner.
- Universality: while the MDGs were implicitly targeting the developing countries, the SDGs concern all countries by taking into account national realities, capacities and levels of development and specific challenges.

Figure 2: Sustainable Development Goals (SDGs)[6]

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[5] UN, 'THE 17 GOALS | Department of Economic and Social Affairs'. Accessed 11 August 2020. https://sdgs.un.org/goals.

[6] UNDP, 'Background of the Sustainable Development Goals | UNDP'. Accessed 11 August 2020. https://www.undp.org/content/undp/en/home/sustainable-development-goals/background.html.

The 17 SDGs are:

1. No poverty: focusing on the eradication of extreme poverty, ensuring equal rights to the poor and vulnerable, and building resilience of the poor.

2. Zero hunger: the scope is ending hunger and malnutrition and ensuring sustainable food production.

3. Good health and well-being: ensuring healthy lives, eradication of AIDS, tuberculosis, malaria and other diseases, reduction of maternal mortality, reduction of premature death.

4. Quality education: ensuring that all boys and girls receive primary and secondary education, increasing the number of young adults with relevant skills.

5. Gender equality: improving women conditions, ending all forms of discrimination and ending all forms of violence against women.

6. Clean water and sanitation: ensuring access to water and sanitation to all.

7. Affordable and clean energy: ensuring universal access to clean, affordable and sustainable energy to all.

8. Decent work and economic growth: sustaining per capita growth, promoting a global strategy to combat youth unemployment, promoting development-oriented policies.

9. Industry innovation and infrastructure: it promotes innovation, the development of resilient infrastructures and sustainable industries.

10. Reduced inequalities: promoting social and political inclusion and reducing the inequalities between countries.

11. Sustainable cities and communities: ensuring access for all to adequate and affordable housing, promoting sustainable cities urbanisation.

12. Responsible consumption and production: achieving sustainable management of natural resources, reducing waste generation.

13. Climate action: including climate change measures in national policies, enhancing education and awareness-raising on climate change issues.

14. Life below water: ensuring a sustainable use of oceans, seas and marine resources.

15. Life on land: halting biodiversity loss, halting desertification, halting land degradation and managing forests in a sustainable way.

16. Peace, justice and strong institutions: developing transparent institutions, developing inclusive societies and communities reducing all forms of violence, ending abuses.

17. Partnership for the goals: reinforcing the global partnership for sustainable development.

In addition to the 17 SDGs, it is important to note that each goal is supported by a set of targets. Overall, there are 169 targets that stimulate international action in critical areas. Each target has between 1 and 3 indicators used to measure progress toward reaching the targets. In total, there are 231 approved unique indicators that will measure compliance.[7]

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[7]   UN, 'SDG   Indicators — SDG   Indicators'.   Accessed   11   August   2020. https://unstats.un.org/sdgs/indicators/indicators-list/.

3.3   Target SDGs for Smart Water Management and NAIADES

Three SDGs – SDG 6, SDG 9 and SDG 11, are directly interwoven into smart water management policies and strategies, and are also at the core of NAIADES activities:

- **SDG 6** on 'Clean Water and Sanitation' is directly related with the project's objective to provide an integrated framework for quality of water assessment and control. Through the diverse range of water management methods developed in the course of the project such as the dynamic water treatment support system, predictive AI analytics of water quality and the Decision Support System (DSS), which guides the water utilities and practitioner at different stages of the process, NAIADES strives to deliver more resource-efficient and real time water management processes, directly contributing to the objectives of SDG6.

- In respect to **SDG 9** 'Innovation, Industry and Infrastructure', NAIADES is actively involved in exploitation activities and ambitions to deliver sustainable solutions in the form of a product/service or a reference architecture/approach. The introduction of NAIADES solutions into traditional water processes will enable the establishment of a new collaborative and more-effective eco-system (digital infrastructure) for all involved stakeholders, while fostering innovation and economic growth.

- Finally, NAIADES is highly focused on urban areas and involves three pilot cities in the development and deployment of its smart solutions, directly in line with the scope of **SDG 11** on 'Sustainable Cities and Communities'. Through the involvement of the pilot cities in addressing challenges related to water domains such as resiliency, efficiency and quality, NAIADES seeks to propose smart and innovative solutions to urban challenges while simultaneously delivering high level impact.

Figure 3: Target SDGs for Smart Water Management and NAIADES

3.4   Overview of the Three Target SDGs and their Relevance to the EU Policy

The European Union expressed strong leadership in the implementation of the Agenda 2030. In 2017, as a response to the 2030 Agenda for Sustainable Development and the SDGs, the European Union adopted the European Consensus on Development, which outlines the common vision and action framework for development cooperation. The EU has committed to implement the SDGs both in its internal and external policies. The European Consensus on Development combines economic, social, and environmental

perspectives and makes the bridge between sustainable development and other European policies. It is organised around the '5 Ps': people, planet, prosperity, peace and partnership[8].

The SDGs were streamlined into existing EU policies, and further action has been initiated by the member-states to ensure the implementation at the national level.

Further information about the three SDGs at the core of this report – SDG 6, SDG 9 and SDG 11 are detailed below.

3.4.1   SDG 6: Clean Water and Sanitation

Goal #6: Ensure availability and sustainable management of water and sanitation for all

Water scarcity affects the lives of more than 40% of the world population and remains an important threat in light of the rising temperatures and the negative effects of climate change. Besides water availability, water quality also remains an important challenge, requiring appropriate infrastructure and quality sanitation services indispensable for safe consumption and good hygiene. Water quality also has a direct impact on the natural ecosystems and on the biodiversity. In order to address these challenges, SDG 6 elaborated water-related targets to support the policy-making and governance practices of the international community.

SDG 6 includes eight global targets that are outlined below[9]:

6.1 Universal and equitable access to safe and affordable drinking water for all.

6.2 Access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

6.3 Improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

6.4 Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

6.5 Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

6.6 Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

6.A Expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.

6.B Support and strengthen the participation of local communities in improving water and sanitation management.

At the European level, the importance of SDG 6 in the context of the EU policy has been reiterated in the European Consensus on Development, aiming at supporting the universal and equitable access to water and encouraging the integrated management of water resources. With regards to the SDG 6, the EU has

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[8] International Cooperation and Development - European Commission. 'European Consensus on Development'. Text. Accessed 12 August 2020. https://ec.europa.eu/international-partnerships/european-consensus-development_en.

[9] UN; 'Water and Sanitation'. United Nations Sustainable Development. Accessed 14 August 2020. https://www.un.org/sustainabledevelopment/water-and-sanitation/.

stated that *"The EU is supporting developing countries in the achievement of this sustainable development goal through bilateral assistance programmes or regional initiatives. Support to the water sector is focusing on access to safe drinking water and sanitation, wastewater and pollution, transboundary water management and cross-sectoral coordination, within an integrated water resources management framework."*[10]

3.4.2   SDG 9: Industry, Innovation and Infrastructure

Goal #9: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

Investments in resilient infrastructure and innovation are drivers of economic growth and development. By welcoming over half of the global population, cities, in particular, offer a fruitful ground for the development and deployment of sustainable technological solutions. Additionally, technological progress is also an essential driver and solution to economic and environmental challenges, which can support sustainable development. In order to tackle and coordinate action, SDG 9 defines relevant targets to support the international community in contributing to its objectives.

SDG 9 includes eight global targets that are outlined below[11]:

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

9.2 Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

9.4 Upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

9.A Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States.

9.B Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.

9.C Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.

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[10] DEVCO. 'The Sustainable Development Goals'. Text. International Cooperation and Development - European Commission, 22 November 2016. https://ec.europa.eu/europeaid/policies/sustainable-development-goals_en.
[11] UN, 'Infrastructure and Industrialisation – United Nations Sustainable Development'. Accessed 14 August 2020. https://www.un.org/sustainabledevelopment/infrastructure-industrialisation/.

The EU has put the SDG 9 at the heart of a large series of policies and actions, including the Europe 2020 Strategy, the Cohesion policy support to industry, innovation and infrastructure, the Trans-European Networks policy or the European Development Policy. Research programmes such as Horizon 2020 and Horizon Europe are financial instruments supporting the research and innovation policies. In respect to SDG 9, the European Commission states that "*Blending, which combines EU grants with loans or other public and private funding, is increasingly supportive of actions on infrastructure which have a multiplier effect on sustainable development in partner countries. EU actions are geared towards inclusive and sustainable growth and economic integration, building on partner countries' comparative advantages in the manufacturing or services sectors. Other targets on access to financial services and technology are consistent with existing EU policy, including its involvement in initiatives such as the Global Partnership for Financial Inclusion.*"[12]

3.4.3   SDG11: Sustainable Cities and Communities

Goal #11: Make cities and human settlements inclusive, safe, resilient and sustainable

With over half of the world population living in cities, it has become apparent that urban spaces need to be part of the solution to achieve sustainable development goals. The sustainable cities of tomorrow not only need to accommodate a growing population, but also offer employment and business opportunities, sustainable and affordable infrastructure and services, while also encouraging participatory governance methods. SDG 11 strives to respond to those challenges through a series of relevant targets.

SDG 11 includes ten global targets that are outlined below:[13]

11.1 Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

11.2 Provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

11.3 Enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5 Significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6 Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

11.7 Provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

11.A Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

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[12] DEVCO. 'The Sustainable Development Goals'. Text. International Cooperation and Development - European Commission, 22 November 2016. https://ec.europa.eu/europeaid/policies/sustainable-development-goals_en.
[13] UN, 'Cities'. United Nations Sustainable Development. Accessed 14 August 2020. https://www.un.org/sustainabledevelopment/cities/.

11.B Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.

11.C Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilising local materials.

At the EU level, the EU Cohesion policy is the reference document covering the urban dimension. Indeed, over EUR 100 billion are being invested to support urban development. Furthermore, making European cities more sustainable is one of the priorities of the 7th Environment Action Programme. The EU is not only involved at the European level but also globally, including in water-related matters. Indeed, according to the European Commission, *"EU development cooperation policy aid to urban and peri-urban areas focuses in particular on support to access to water and sanitation, urban mobility, energy and affordable housing, as well as energy efficiency and disaster prevention and preparedness. The EU promotes sustainable urbanisation as a basic tool to enhance more effective development at local level."[14]*

3.5 The Interdependencies Between the SDGs 6, 9, 11 and the Other SDGs

The SDGs have an impact on all levels of society, touching upon the concepts of universality, equity and inclusion. Together as a whole, they constitute a dynamic ecosystem, characterised by interdependencies and synergies. The figure below provides a mapping of the existing interdependencies between the three SDGs at the heart of this deliverable – SDGs 6, 9 and 11 and the other SDGs. The multitude of connections between the distinct SDGs reveals which SDGs may directly impact the achievement of the specific targets of another SDG. It also suggests the domains of activity which can be leveraged on in order to support the effort and progress of a specific SDG. The aim of the diagram is to provide an overview of connections on the macroscopic level, secondary contributions to other SDGs might vary on the project level (see section 5 for a detailed analysis of NAIADES contributions to the SDGs).

Figure 4: Interdependencies between SDGs 6, 9 and 11 with other SDGs (compiled by the authors)

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[14] DEVCO. 'The Sustainable Development Goals'. Text. International Cooperation and Development - European Commission, 22 November 2016. https://ec.europa.eu/europeaid/policies/sustainable-development-goals_en.

3.6   Relevance of Sustainable Development Goals in Horizon 2020 and Horizon Europe

As one of the cross-cutting Horizon 2020 priorities, sustainable development is relevant to all areas of the research programme. Indeed, at least 60% of the H2020 budget involves sustainable development, which puts a strong focus on climate action and resource efficiency. In relation to water, the European Commission specifies that resource efficiency can be achieved by "ensuring the provision of clean water in sufficient quantities; promoting efficient & economical water supply & use; helping reduce water shortages, droughts & floods".[15] Horizon2020 strongly encouraged all research and innovation grant applicants to make references to SDGs, as they would be taken into consideration during the evaluation process. As stated by the European Commission:

> *"For many types of action, the proposal template asks applicants to mention any other substantial impacts, including any that would 'address issues related to climate change or the environment, or bring other important benefits for society'. In other words, your proposal must clearly describe any contribution you expect your project to make towards climate action and sustainable development objectives, beyond those mentioned explicitly in the topic description. The experts examining your proposal will assess these aspects along with any other relevant ones."[16]*

The new European research programme, Horizon Europe, puts further stress on sustainability. In the general orientations, the European Commission outlines that investing in research and innovation will help steering the transitions in Europe towards a sustainable, fair and prosperous future. In order to deliver stronger impact, Horizon Europe supports the European Commission's six key policy goals.

Indeed, *"together with the SDGs, these priorities will shape future EU policy responses to the challenges we face and will steer the ongoing transitions in the European economy and society, EU research and innovation has an important role to play, by enabling, steering and supporting each of these priorities."* [17]

Table 1: European Commission Policy Goals and SDGs

Policy goal	Targeted SDGs
A European Green Deal	- SDG 2 – Zero Hunger; - SDG 6 – Clean Water and Sanitation; - SDG 7 – Affordable and Clean Energy; - SDG 8 – Decent Work and Economic Growth; - SDG 9 – Industry, Innovation and Infrastructure; - SDG 11 – Sustainable Cities and Communities; - SDG 12 – Responsible Consumption and Production; - SDG 13 – Climate Action; - SDG 14 – Life below Water; - SDG 15 – Life on Land.
An economy that works for people	- SDG 1 – No Poverty; - SDG 3 – Good Health and Well-being; - SDG 4 – Quality Education; - SDG 5 – Gender Equality;

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[15] European Commission, 'Climate Action and Sustainable Development - H2020 Online Manual'. Accessed 12 August 2020. https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/climate-sustainable-development_en.htm.

[16] Idem

[17] European Commission, 'Orientations towards the first Strategic Plan for Horizon Europe', January 2020, https://ec.europa.eu/info/sites/info/files/research_and_innovation/strategy_on_research_and_innovation/documents/ec_rtd_orientations-he-strategic-plan_122019.pdf

	• SDG 6 – Clean Water and Sanitation; • SDG 7 – Affordable and Clean Energy; • SDG 8 – Decent Work and Economic Growth; • SDG 10 – Reduced Inequalities; • SDG 11 – Sustainable Cities and Communities; • SDG 16 – Peace, Justice and Strong Institutions.
A Europe fit for the Digital Age	• SDG 9 – Industry, Innovation and Infrastructure
Promoting our European way of life	• SDG 16 – Peace, Justice and Strong Institutions
A stronger Europe in the world	• SDG 17 – Partnerships for the Goals
A new push for European democracy	• SDG 17 – Partnerships for the Goals

4   EU Framework for Smart Water Management

The protection of water resources, water ecosystems and consumable water is one of the cornerstones of environmental action in the European Union. Given the global and interconnected nature of the topic, water management at the European level requires the member-states to align their efforts at the regional scale to guarantee successful outcomes. The following section presents the main EU water management policies in place: the Drinking Water Directive 98/83/EC on the Quality of Water Intended for Human Consumption, the Water Framework Directive (Directive 2000/60/EC), the Groundwater Directive 80/68/EEC and Groundwater directive 2006/118/EC, the Bathing Water Directive 2006/7/EC Concerning the Management of Bathing Water Quality, the EU Flood Directive 2007/60/EC on the Assessment and Management of Flood Risks, the Urban Waste Water Treatment Directive 91/271/EEC, the Marine Strategy Framework Directive 2008/56/EC, the Environmental Quality Standards Directive 2008/105/EC. Through the use of a matrix, it then proceeds to analysing their relevance to the SDGs – first at the level of the three SDGs at the heart of this deliverable, namely SDG 6, 9 and 11 and their respective targets. At a later stage, the analysis examines the EU water regulations from a macroscopic perspective and the 17 SDGs as a whole.

It is to be noted that the scope of the targets of SDG 6, 9 and 11 touches upon water-related matters and issues relative to development and cooperation. For the purpose of this report, targets related to development and cooperation will be voluntarily put aside as they fall under the policy work of the Commission's Directorate-General for International Cooperation and Development (DG DEVCO), The Directorate-General for the External Relations (DG RELEX), and DG for European Civil Protection and Humanitarian Aid (ECHO).

4.1   Water-related Directives in the EU

The following section delves into the key water-related directives currently in place in the EU listed above.

4.1.1   The Drinking Water Directive (DWD) 98/83/EC on the Quality of Water Intended for Human Consumption

The EU Drinking Water Directive sets minimum quality standards for water intended for human consumption (drinking, cooking, other domestic purposes), in order to European citizens from contamination. The Drinking Water Directive applies to:

- *"all distribution systems serving more than 50 people or supplying more than 10 cubic meter per day, but also distribution systems serving less than 50 people/ supplying less than 10 cubic meter per day if the water is supplied as part of an economic activity;*
- *drinking water from tankers;*
- *drinking water in bottles or containers;*
- *water used in the food-processing industry, unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form."*[18]

In February 2020, the directive has been updated to further improve the water quality standards. The new legislation also lays out minimum hygiene requirements for materials in contact with drinking water, such as pipes or taps, to avoid contamination. Endocrine disruptors, pharmaceuticals and microplastics shall be monitored via a watch list mechanism allowing the EU to update surveillance in line with the latest scientific developments. Furthermore, member-states are required to enhance the access to clean water for everyone in the EU, particularly for vulnerable groups with no or little access by setting up water fountains in public

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[18] European Commission, 'Drinking Water Legislation - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/water/water-drink/legislation_en.html.

areas. On a voluntary basis, member-states are also encouraged to provision tap water for free or for a low fee in restaurants. Finally, the consolidated directive calls for improved transparency and consumer access to information on the drinking water quality.[19]

4.1.2   The Water Framework Directive (WFD) (Directive 2000/60/EC)

The 'Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy', otherwise known as the EU Water Framework Directive (WFD) is one the oldest environmental policies in the European Union and one of the leading documents regulating the EU water policy. It includes regulations dealing with drinking water, bathing water, urban wastewater management or prevention of pollutions by different economic sectors (agriculture, industries). It provides an overall framework for integrated water management in Europe. Introduced in 2000, the WFD covers the following aspects:

- expanding the scope of water protection to all waters, surface waters and groundwater,

- achieving "good status" for all waters by a set deadline,

- basic measures (directives on urban wastewater, nitrate pollution, industry pollution and others),

- water management based on river basins,

- "combined approach" of emission limit values and quality standards,

- getting the prices right,

- protected areas (directives on bathing water, habitats, drinking water and others),

- getting the citizen involved more closely,

- streamlining legislation.[20]

4.1.3   The Groundwater Directive (GD) 80/68/EEC and Groundwater Directive 2006/118/EC

Groundwater Directive 80/68/EEC requires that Member States take the necessary measures, including a special authorisation system, to prevent "List I" substances from entering groundwater, and to limit the entry of "List II" substances so as to prevent pollution of the groundwater. [21]

This Groundwater directive 2006/118/EC (also known as the New Groundwater Directive, NGD), complements the WFD and defines a regime which sets groundwater quality standards and presents measures to stop or limit inputs of pollutants into groundwater. The Directive outlines chemical status criteria that the member-states need to follow to monitor and assess groundwater quality on the basis of common criteria. Moreover, the member-states need to identify and reverse trends in groundwater pollution, in line with local characteristics, thus enabling further improvements.[22]

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[19] European Commission, 'Drinking Water in the EU: Better Quality and Access | News | European Parliament', 19 October 2018. https://www.europarl.europa.eu/news/en/headlines/society/20181011STO15887/drinking-water-in-the-eu-better-quality-and-access.

[20] European Commission, 'Introduction to the EU Water Framework Directive - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/water/water-framework/info/intro_en.htm.

[21] European Commission, 'Groundwater Policy - River Basin - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/water/water-framework/groundwater/framework.htm.

[22] European Commission, 'Law - EU Coastal and Marine Policy - Environment - European Commission'. Accessed 20 May 2020. https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm.

4.1.4 The Bathing Water Directive (BWD) 2006/7/EC Concerning the Management of Bathing Water Quality

The first European bathing water legislation, the 'Bathing Water Directive' came into force in 1975. Its main objectives are to safeguard public health and protect the aquatic environment in coastal and inland areas from pollution.[23] The 'Revised Bathing Water Directive' from 2006 updates the measures of the 1975 legislation and simplifies its management and surveillance methods. It requires members states to monitor and assess the bathing water for at least two parameters of (faecal) bacteria.[24] Moreover, it also offers a more proactive approach to informing the public about water quality using four quality categories for bathing waters — 'poor', 'sufficient', 'good' and 'excellent'. Amongst other things, these profiles include information regarding the kind of pollution and sources that affect the quality of the bathing water and are a risk to bathers' health. The Bathing Water Directive also supports other environmental policies such as the Water Framework Directive, under which bathing waters are one of the Protected Areas and the Marine Strategy Framework (MSF) Directive, in contributing to reaching "good environmental status" by 2020.[25]

4.1.5 The EU Flood Directive (EFD) 2007/60/EC on the Assessment and Management of Flood Risks

The Directive 2007/60/EC on the assessment and management of flood risks was adopted on 26 November 2007. This Directive now requires member-states to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. Furthermore, this Directive also strengthens the rights of the public to access this information and to participate in the planning process.

The EU Flood Directive 2007/60/EC supports the Water Framework Directive, particularly by guaranteeing that the flood risk management plans and river basin management plans are harmonised, and by the inclusion and administration of public participatory mechanisms in the development of these plans. All assessments, maps and plans prepared shall be shared with the public.

Additionally, in the context of the directive, the member-states shall coordinate their flood risk management practices in common river basins, including with third countries, and shall in solidarity not undertake measures that would put the neighbouring countries at risk of flooding. Member-states shall be mindful of long-term developments such climate change and sustainable land use practices in the flood risk management cycle covered by this Directive.[26]

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[23] European Commission, 'Bathing Water Directives — European Environment Agency'. Accessed 14 August 2020. https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/bathing-water-directives.

[24] European Commission, 'Bathing Water - Environment - European Commission'. Accessed 14 August 2020. https://ec.europa.eu/environment/water/water-bathing/index_en.html.

[25] European Commission, 'Bathing Water - Environment - European Commission'. Accessed 14 August 2020. https://ec.europa.eu/environment/water/water-bathing/index_en.html.

[26] EUR-Lex, 'EUR-Lex - 32007L0060 - EN - EUR-Lex'. Accessed 13 August 2020. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007L0060.

4.1.6   The Marine Strategy Framework (MSF) Directive 2008/56/EC

The Marine Strategy Framework Directive was adopted by the EU in 2008 in order to improve the protection of the marine environment. Concretely, the Marine Strategy Framework Directive strives for the EU's marine waters to reach a 'Good Environmental Status' (GES) by 2020. The Directive addresses the topic through a multidisciplinary approach, encompassing notions of environmental protection and sustainability. Key points of the Marine Strategy include:

- The establishment of environmental targets and associated indicators to achieve GES by 2020.
- The establishment of a monitoring programme for the ongoing assessment and the regular update of targets.
- The development of a programme of measures designed to achieve or maintain GES by 2020.[27]

4.1.7   The Urban Waste Water Treatment (UWWT) Directive 91/271/EEC

Council Directive 91/271/EEC concerning urban waste water treatment was adopted by the EU in 1991 to protect the water ecosystems from the negative effects of discharges of urban waste water and from certain industrial discharges. The Directive is guided by four principles of: planning, regulation, monitoring and information and reporting.

More concretely, the Council Directive requires:

- The collection and treatment of waste water in all agglomerations of >2000 population equivalents (p.e.);
- Secondary treatment of all discharges from agglomerations of > 2000 p.e., and more advanced treatment for agglomerations >10 000 population equivalents in designated sensitive areas and their catchments;
- A requirement for pre-authorisation of all discharges of urban wastewater, of discharges from the food-processing industry and of industrial discharges into urban wastewater collection systems;
- Monitoring of the performance of treatment plants and receiving waters; and
- Controls of sewage sludge disposal and re-use, and treated wastewater re-use whenever it is appropriate.[28]

4.1.8   The Environmental Quality Standards (EQS) Directive 2008/105/EC

Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 outlines environmental quality standards in the field of water policy. The Directive specifies 33 substances or groups of substances for which environmental quality standards were set in 2008, including selected existing chemicals, plant protection products, biocides, metals and other groups like Polyaromatic Hydrocarbons (PAH) that are mainly incineration by-products and Polybrominated Biphenylethers (PBDE) that are used as flame retardants.[29]

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[27] European Commission, 'Law - EU Coastal and Marine Policy - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm.

[28] European Commission, 'Water Pollution - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/water/water-urbanwaste/index_en.html.

[29] European Commission, 'Priority Substances and Certain Other Pollutants According to Annex II of Directive 2008/105/EC - Environment - European Commission'. Accessed 13 August 2020. https://ec.europa.eu/environment/water/water-framework/priority_substances.htm.

4.2   The EU Framework for Smart Water Management and SDGs

The following section analyses the aforementioned EU directives in the smart water management sector in respect to the three SDGs at the heart of this deliverable, namely SDG 6, 9 and 11. Through the use of a matrix, it seeks to analyse which of the respective targets of the SDGs are covered by the EU Framework for Smart Water Management, thus allowing to identify possible gaps between the EU water policy and the global SDGs. The cells of the matrix have been coloured in green, yellow or red to highlight which targets are more and less covered by the EU Framework for Smart Water Management. Striped cells refer to the targets that are outside of the scope of the smart water management domain.

4.2.1   The EU Framework for Smart Water Management and SDG 6 (Clean Water and Sanitation) Targets

Table 2 below provides an overview of the coverage of the SDG 6 targets by each of the EU water-related directives. It can be noted that the EU Framework for Water Management covers all of the SDG 6 targets. Indeed, targets 6.3, 6.5, 6.6, and 6.B (green) are the most addressed by the EU Framework for Smart Water Management. Targets 6.1, 6.2, and 6.4 (yellow) are moderately covered, whereas target 6.A (red) is only covered under the UWWT directive. This can be justified by the fact that 6.A seeks to expand water and sanitation support to developing countries – a target that also falls within the scope of the EU development policy, rather than EU-centric water policies.

Table 2: Matrix on the EU Framework for Smart Water Management and SDG 6

	6.1	6.2	6.3	6.4	6.5	6.6	6.A	6.B
DWD	X	X	X	X				X
WFD	X		X	X	X	X		X
GD			X		X	X		
BWD						X		X
EFD					X			X
MSF			X		X	X		
UWWT		X	X				X	
EQS	X	X	X					

4.2.2   The EU Framework for Smart Water Management and SDG 9 (Industry Innovation and Infrastructure) Targets

Table 3 provides an overview of the SDG 9 targets covered by each of the EU water-related directives. It can be noted that the EU Framework for Smart Water Management only covers two of the SDG 9 targets: 9.1 and 9.4. This is also explained by the fact that not all EU water policies touch upon the industry (9.2 and 9.5) or financial (9.3) matters. Furthermore, development policies in developing countries (targets 9.A, 9.B, 9.C) are out of the scope of the EU Framework for Smart Water Management and covered under the EU development policy. Although addressed by the Drinking Water Directive, target 9.4, focused on upgrading all industries and infrastructures for sustainability, is poorly covered under the remaining policies of the EU Framework for Smart Water Management. Increased focus on resource-use efficiency combined with a greater adoption of clean and environmentally sound technologies and industrial processes would reinforce the existing EU policies for water management while supporting the achievement of the SDG 9 targets.

Table 3: Matrix on the EU Framework for Smart Water Management and SDG 9

	9.1	9.2	9.3	9.4	9.5	9.A	9.B	9.C
DWD	X			X				
WFD	X							
GD	X							
BWD								
EFD	X							
MSF	X							
UWWT								
EQS								

4.2.3 The EU Framework for Smart Water Management and SDG 11 (Sustainable Cities and Communities) Targets

Table 4 provides an overview of the SDG 11 targets covered by each of the EU water-related directives. It can be noted that the EU Framework for Smart Water Management covers 7 SDG 11 targets out of 10. Indeed, targets 11.2 (transport), 11.7 (green spaces) and 11.C (developing countries) are out of the scope of the EU Framework for Water Management and covered under other relevant EU policies. Multiple directives are connected to target 11.6 on reducing the environmental impact of cities. Targets 11.3 (inclusive and sustainable urbanisation), 11.A (strong national and regional development planning) and 11.B (implement policies for inclusion, resource efficiency and disaster risk reduction) are narrowly addressed by the EU Framework for Smart Water Management and could benefit from a stronger focus to support the SDGs.

Table 4: Matrix on the EU Framework for Smart Water Management and SDG 11

	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.A	11.B	11.C
DWD	X					X				
WFD	X		X	X	X	X		X		
GD										
BWD					X					
EFD					X				X	
MSF				X						
UWWT						X				
EQS						X				

4.2.4　The EU Framework for Smart Water Management and the SDGs

The following Table 5 examines all the relevant directives from the EU Framework for Smart Water Management and identifies the SDGs they correspond to, based on the targets of each of the SDGs. The matrix below presents the results of the analysis. As it can be seen from the matrix, the EU water directives are strongly connected to all SDGs, with a strong focus on SDG 3 'good health and well-being', SDG 6 'clean water and sanitation', SDG 9 'industry, innovation and infrastructure', SDG 11 'sustainable cities and communities' and SDG 12 'responsible consumption and production'. The directives have shown no impact at the level of SDG 4 'quality education' and SDG 5 'gender equality' and limited impact at the level of SDG 1 'no poverty', SDG 7 'affordable and clean energy', SDG 10 'reduced inequalities' and SDG 17 'partnerships for the goals'.

Table 5: Matrix on the EU Framework for Smart Water Management and the SDGs

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DWD	X	X	X			X			X	X	X	X					
WFD			X			X	X	X	X		X	X	X	X	X	X	
GD		X	X			X			X			X		X	X		
BWD			X			X					X	X					
EFD			X			X			X		X		X		X	X	
MSF						X		X	X		X	X	X	X			X
UWWT			X			X					X	X					
EQS		X	X			X					X	X					

4.3   Gap Analysis of the EU Framework for Smart Water Management

Based on the results of the analysis in the previous section, a SWOT analysis has been performed in order to capture the strengths, weaknesses, opportunities and threats for the EU Framework for Smart Water Management. The SWOT analysis is a strategic planning tool aimed at identifying both strengths and weaknesses of an individual or an organisation while also determining possible opportunities and threats. It is commonly considered as a practical instrument to asses a specific activity, helping to evaluate what can be achieved and what can should obtain some more focus. Although, the Framework gives a robust foundation for the smart water sector, a number of opportunities can be exploited to strengthen the EU water policy and help deliver the Agenda 2030 objectives.

STRENGTHS	WEAKNESSES
• Large coverage of the 17 SDGs in the EU Framework for Smart Water Management. • All SDG 6 targets covered in the EU Framework for Smart Water Management. • Important contribution of the EU Framework for Smart Water Management to SDG 3, 9, 11, 12. • Moderate contribution of the EU Framework for Smart Water Management to SDG 2, 8, 13, 14, 15, 16.	• No or limited contribution of the EU Framework for Smart Water Management to SDG 1, 4, 5, 7, 10, 17. • Limited focus on SDG 14 'Life below water' related aspects in the EU Framework for Smart Water Management. • The role of education and gender equality is missing from the EU Framework for Smart Water Management. • Limited references to topics related to SDG 7 'affordable and clean energy' in the EU Framework for Smart Water Management. • Limited synergies with SDGs 7, 11, 12 around resource efficiency.
OPPORTUNITIES	**THREATS**
• Developing new policy models to bridge the existing gaps between the SDGs and the EU Framework for Smart Water Management. • Leveraging technological solutions and digital innovations to support the achievement of the SDGs and their targets. • Involving the education sector to raise awareness around water-related challenges, stimulate behavioural change and stimulate research and knowledge-sharing (SDG 4). • Strengthening the focus on SDG 14 in the EU Framework for Smart Water Management to support biodiversity conservation and prevent species extinction. • Considering standardisation as an instrument to facilitate the deployment of solutions for Smart Water Management. • Broadening the scope of the EU Framework for Smart Water Management to include energy and hydroelectric power to support the achievement of SDG 7. • Building tighter synergies with SDG 7, 11 and 12 to stimulate resource efficiency and responsible consumption and production. • Digital infrastructure allows more balanced ratio of women and men working in the area.	• No or limited reference to SDGs 1, 4, 5, 7, 10, 17 in the EU Framework for Smart Water Management may delay the implementation of the said goals and targets and hinder the timely achievement of Agenda 2030. • Disconnection between SDGs and EU Framework for Smart Water Management masks potential loss in long-term sustainability. • Limited focus on SDG 14 in the EU Framework for Smart Water Management may contribute to aquatic biodiversity loss. • The non-inclusion of the education sector in the EU Framework for Smart Water Management may prevent the change in consumer behaviour and awareness about the water-related challenges and affect the achievement of the directives and of SDG 6. • The limited references to energy and hydroelectric power in the EU Framework for Smart Water Management could affect the successful achievement of the targets of SDG 7. • Resource efficiency is narrowly addressed by the EU Framework for Smart Water Management and may hinder the accomplishment of SDG 7, 11, 12.

The SWOT analysis showed that the strengths of the current EU Water Management Framework lie in the wide coverage of the SDGs and the important and moderate contributions to ten SDGs. Also, numerous opportunities notably regarding developing new policy models to bridging existing gaps, leveraging technological solutions and innovations as well as considering standardisation as a tool to facilitate the adoption of smart water solutions, to name a few, are present. Identified weaknesses principally relate to the weak coverage of seven SDGs and the limited importance accorded to education and gender equality, among others. Last, the analysis also found a set of some important threats. These concern for instance the limited references to energy and hydroelectric power in the EU directives, resource efficiency being narrowly addressed and the non-inclusion of the education sector which all might hinder the timely achievement of the SDGs.

Nonetheless, numerous synergies have been identified between the SDGs calling for the development of a more systematic methodology accounting for the interdependencies and allowing for a more comprehensive and holistic approach (see section 6).

5   Deliverable Contribution to the NAIADES Development

After having presented an in-depth analysis of both the SDG and the EU Water Management framework and their resulting gaps, this section will focus on illustrating how this study links and contributes to the development of the NAIADES project. What is more, it will be shown how NAIADES supports and complements the EU directives in terms of achieving the SDGs. After presenting the methodology, this section will thus draw upon (1) the connection between the NAIADES use cases and the EU directives, (2) the relation between the NAIADES tasks under each WP and the EU directives and, last, (3) the contribution of the NAIADES project to the achievement of the SDGs.

5.1   Approach

Following the identification of applicable SDGs and EU directives related to NAIADES and the analysis of resulting gaps between both frameworks, it is pertinent to consider how NAIADES is contributing to these frameworks. To do so, all consortium partners were asked to provide relevant information in an Excel sheet. This sheet included the following sub-tables:

1. Table 1 consisted of a list of all 17 SDGs and the respective targets, with the primary SDGs identified for this project (namely, SDG 6, 9 and 11) at the top. The aim of this activity was to understand how NAIADES precisely contributes to these primary SDGs while also identifying secondary SDGs that were not considered as relevant to the project before. When a NAIADES solution contributed to a specific goal, partners were asked to indicate the WP number as well as additional information in terms of activity, target audience and other specificities (i.e., related task and deliverable) of the solution. For the primary SDGs, it was requested to specify, which solution applied to which target in particular, given that these SDGs have been analysed on the target-level above. Following the chosen approach above (see section 4), the focus for the remaining 14 goals was kept on the goal-level, as the precise targets were considered of smaller importance. Partners, nonetheless, decided to provide this supplementary information, with the target-level thus known for the entirety of the concerned SDGs.
2. To fill in Table 2, it was requested to provide information about the various NAIADES solutions and use cases, by indicating name, objectives, direct expected results, potential impacts, linked EU directives, potential benefits (based on IWA Digital Water Transformation Journey (see D2.5)) and identified gaps regarding concerned EU directives. The sheet was principally filled in by the WP2 leader and MI, and was completed by other consortium members.
3. For Table 3, the consortium partners were asked to indicate with a simple cross "X" which WP task touched upon which EU directive(s).

The thus obtained data was then analysed and is being discussed in the following sections.

5.2   Use Cases and EU Directives

This section will draw upon the use cases connected to the three pilots Carouge, Brăila and Alicante as well as the 'Global Observatory' solution and analyse how they relate to specific EU water directives. The aim of this analysis is to understand the importance of the EU Water Management Framework as an essential support for NAIADES activities, while also grasping how the project aligns with and supports these EU directives.

5.2.1 Use Cases and Solutions

The following list presents the considered use cases (UC) and provides an overview of their objectives as indicated by the consortium partners:

- Carouge
  - UCC1: focuses on watering plant boxes and aims at finding the best schedule for doing so
  - UCC2: deals with the water quality for fountains and seeks to optimise the water quality monitoring
- Brăila
  - UCB1: addresses water demand and consumption and intends to obtain short-term water demand forecasts, automatically associate water consumption with defined events and thus increase energy efficiency
  - UCB2: puts its focus and objective on detecting water leakages in the network
  - UCB3 (Is-dWTP): works on dynamical water treatment suggestions and aims at finding the optimal amount of chemicals required to guarantee drinking water quality levels for any water quality at the inlet of the dWTP
- Alicante
  - UCA1: focuses on water demand and seeks to obtain short-term water demand forecasts
  - UCA2: works on detecting and monitoring saline intrusions in the sewer network
  - UCA3: addresses general awareness and provides the information required for the city managers to become aware of the public water consumption patterns and to act accordingly, while also offering the means to run ICT-supported behavioural change and consumption awareness programs to engage consumers in water conservation
- Global Observatory
  - The aim of the Global Observatory is to offer users the possibility to (1) get information about water topics related to a specific area and the urban water cycle in general on the internet and (2) extract insightful information from news and social media on use case priorities and to interact with collected indicators data (including SDG) and published knowledge on success stories (e.g., regarding natural disasters or water contamination) and localised weather characteristics

5.2.2 Relation to EU Directives

Table 6: EU Directives Applying to the Use Cases/Solutions

Solution/Use Case	Relevant EU Directives
UCC1	Water Framework Directive (WFD) 2000/60/EC
UCC2	Water Framework Directive (WFD) 2000/60/EC Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption Bathing Water Directive (BWD) 2006/7/EC Concerning the Management of Bathing Water Quality
UCB1	Water Framework Directive (WFD) 2000/60/EC Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption
UCB2	idem
UCB3	idem

UCA1	idem
UCA2	Marine Strategy Framework (MSF) Directive 2008/56/EC (TBC) Urban Waste Water Treatment (UWWT) Directive 91/271/EEC
UCA3	Water Framework Directive (WFD) 2000/60/EC Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption
Global Observatory	idem

Table 6 shows which EU directives apply to the specific use cases and solutions and shows how the latter are nestled within the legal setting offered by the directives. The complete table with details regarding expected results, potential impacts and benefits can be found in the annexe. Identified gaps will be addressed in D9.12.

The most relevant directive is the Water Framework Directive (WFD) 2000/60/EC which relates to all use cases except UCA2. The second most important regulation is the Drinking Water Directive (DWD) 2020/2184 which serves as a legal basis for all solutions except UCC1 and UCA2. This is little surprising, given that the overarching focus of the project is put on general smart water management, with resulting objectives such as water consumption and efficiency, confidence of water consumers or water safety and reliability. Furthermore, it was found that the Bathing Water Directive (BWD) 2006/7/EC applies to UCC2, given that it seeks to maintain a high water quality for fountains that are commonly used as a bathing spot by children during the summer months.

However, it can be noted that UCA2, with its focus on saline intrusions, seems to stand out from the other use cases, being the only one that is covered by the Marine Strategy Framework (MSF) Directive 2008/56/EC (TBC) and Urban Waste Water Treatment (UWWT) Directive 91/271/EEC).

5.2.3 Tasks & EU Directives

Similarly to the use cases and solutions, it was considered pertinent to analyse which NAIADES tasks under each WP fall within the scope of specific directives. As above, this is relevant in order to understand how the tasks can be contextualised in the legal setting offered by the directives. Table 7 shows that tasks in all WPs except WP1 and WP8 are concerned. As the crosses "X" indicate, only the directives in green are relevant for the NAIADES project. Indeed, none of the NAIADES use cases or solutions works directly on groundwater or flood management, and it is thus logical that these directives are not considered by the project.

In line with what has been found for the use cases, the WFD and the DWD are the most prominent directives, building the legal framework for tasks in all concerned WPs. The three additional directives, namely BWD, MSF and UWWT, are slightly less relevant, applying only to tasks in WP 2, 3, 5, 7 and 9.

Table 7: WP Tasks concerned by the EU Directives

Water-related Directives in the EU	T2.1	T2.2	T2.3	T2.4	T2.5	T2.6	T3.1	T3.2	T3.3	T3.4	T3.5	T4.1	T4.2	T4.3	T4.4	T4.5	T5.1	T5.2	T5.3	T5.4	T5.5	T6.1	T6.2	T6.3	T6.4	T6.5	T7.1	T7.2	T7.3	T7.4	T9.1	T9.2	T9.3	T9.4	T9.5	T9.6
DWD						X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X					X	
WFD						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X					X	
GD																																				
BWD						X	X	X	X	X	X							X		X							X	X		X					X	
EFD																																				
MSF						X	X	X	X	X	X						X	X									X	X		X						
UWWT						X	X	X	X	X	X						X	X									X	X		X					X	
EQS																																				

5.3   SDGs and NAIADES

After having identified the relevant primary SDGs above, it is pertinent to discuss how NAIADES is contributing to the achievement of these goals by 2030. For this, as mentioned in the methodology, the consortium members were asked to indicate which WP tasks support specific targets while also determining whether their activities contribute to other, secondary SDGs. This section will discuss the results while also drawing upon the gaps within the EU Framework for Water Management identified under section 4. For visual support, each table is coloured in the official colour of the specific SDG. In addition, the colours employed for the targets (green, yellow and red) indicates the degree of coverage by the EU directives determined previously.

5.3.1   Primary SDGs

SDG 6 Clean Water and Sanitation

Given that the scope of NAIADES is related to smart water management, the prevailing correspondence/overlapping between activities of the consortium and targets concerns SDG 6. Indeed, NAIADES significantly contributes to the three targets listed in the Table 8, focusing on improved water quality (target 6.3), increased water-use efficiency (target 6.4) and strengthened participation of local communities (target 6.B).

In the analysis above, it was found that the EU Framework for Water Management covers the entirety of the targets listed under SDG 6. However, it was also stated that targets 6.3 and 6.B are among the most covered targets, whereas target 6.4 is only moderately considered by the EU directives. Given the significant contribution to target 6.4 by NAIADES, it can be noted that the project responds to areas that are less covered by the directives and thus fills in a certain gap.

Table 8: NAIADES Contributions to SDG 6

Number	Target	WP	Activity	Target Group	Task and Deliverable
6.3	Improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	WP4	Dynamical water treatment suggestions (optimized use of chemicals)	Drinking water treatment plant's manager	T4.2 and T4.5 (D4.3 and D4.9)
		WP5	Water quality prediction	Water quality control and infrastructure maintenance	T5.5 (D5.9)
			Saline intrusion detection	Waste water processing plants	T5.1 (D5.1)
6.4	Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and	WP5	Minimizing water losses by increasing water demand prediction accuracy	Water utility companies	T5.3 (D5.5)

			Optimizing public gardens watering	Municipality administrations	T5.1 (D5.1)
	substantially reduce the number of people suffering from water scarcity		Water information for evidence-based decision making, and education of public against misinformation	Water utility companies, municipality administrations and citizens	T5.4 (D5.7)
			Identification leakage position within the water distribution network.	Water utility companies	T4.1 (D4.1) T5.1 (D5.1)
6.B	Support and strengthen the participation of local communities in improving water and sanitation management	WP5	Feedback information ingesting from Twitter and news (open data), and providing insightful information that can serve for citizen education	Citizens	T5.4 (D5.7)

SDG 9 Industry, Innovation and Infrastructure

The second primary SDG covered by NAIADES is goal 9. Based on the inputs from the consortium partners, it has been found that all contributions are made to target 9.1 which puts its focus on sustainable and resilient infrastructure to reinforce economic growth and human welfare (see Table 9). This target disposes of a strong coverage by the EU directives, meaning that NAIADES is in line with the EU Water Management Framework.

Table 9: NAIADES Contributions to SDG 9

Number	Target	WP	Activity	Target Group	Task and Deliverable
9.1	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being,	WP5	Saline intrusion detection	Waste water processing plants	T5.1 (D5.1)
			Identification leakage position within the water distribution network	Water utility companies	

| | | Optimizing public gardens watering | Municipality administrations | |
| | | Increasing water demand prediction accuracy | Water utility companies | T5.3 (D5.5) |

SDG 11 Sustainable Cities and Communities

SDG 11 represents the third primary SDG identified in the analysis above. All NAIADES activities related to this goal refer to target 11.B which focuses on cities and other settlements adopting and implementing policies towards, among others, resource efficiency and resilience to disasters. Table 10 summarises which precise NAIADES solutions contribute to target 11.B.

In the previous framework analysis, it was found that this target is only weakly covered by the EU Water Management Framework. It can thus be stated that NAIADES supports and complements the EU directives by responding to areas that are not vastly covered.

Table 10: NAIADES Contributions to SDG 11

Number	Target	WP	Activity	Target Group	Task and Deliverable
11.B	Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels	WP4	Urban water models	Water utility companies	T4.1 (D4.1)
			Dynamical water treatment suggestions (including critical weather events circumstances)	Management of drinking water treatment plant	T4.2 (D4.3) and T4.5 (D4.9)
		WP5	Water quality prediction	Water quality control and infrastructure maintenance	T5.5 (D5.9)
			Increasing water demand prediction accuracy	Water utility companies	T5.3 (D5.5)
			Optimizing public gardens watering	Municipality administrations	T5.1 (D5.1)

5.3.2   Secondary SDGs

After having presented NAIADES influence on the three primary SDGs previously identified, this section is now focusing on the eight secondary SDGs, namely SDG 1, 2, 3, 4, 7, 12, 13 and 17, which NAIADES is partly contributing to. As earlier stated, the degree of coverage by the EU Water Management Framework has been determined on the goal level and not the target level for the secondary SDGs (see section 4 above). It is, thus, possible that the EU directives deal with a specific target in a more extensive or limited manner than assumed here.

SDG 1 No Poverty

The NAIADES project supports SDG 1 by contributing to target 1.5 which focuses on building resilience notably regarding climate-related extreme events and disasters (see Table 11). The NAIADES weather forecasting toolkit is precisely aiming at strengthening resilience, thus opening an opportunity to be, amongst others, be employed in the global South. The EU directives only weakly cover SDG 1, with NAIADES thus supporting the EU framework by filling certain gaps and partly curbing the identified threat related to SDG 1.

Table 11: NAIADES Contributions to SDG 1

Number	Target	WP	Activity	Target Group	Task and Deliverable
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	WP5	NAIADES weather forecasting toolkit	Weather forecasting services/entities	T5.2 (D5.3)

SDG 2 Zero Hunger

The target 2.4 of SDG 2 puts its focus on building sustainable food production systems, amongst others by enhancing resilience to climate change-induced extreme weather phenomena. As for SDG 1, NAIADES is contributing to this goal through its developed weather forecasting toolkit (see Table 12). In terms of alignment with the EU directives, it can be stated that the SDG is moderately covered by the framework, meaning that the NAIADES project supports the directives by working on areas that are not extensively covered by these.

Table 12: NAIADES Contributions to SDG 2

Number	Target	WP	Activity	Target Group	Task and Deliverable
2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	WP5	NAIADES weather forecasting toolkit	Water utility services and municipalities	T5.2 (D5.3)

SDG 3 Good Health and Well-Being

SDG 3 focuses on with NAIADES contributing to target 3.9 that aims at decreasing the number of deaths and illnesses from, among others, water pollution (see Table 13). This goal is extensively covered by the EU directives. It follows that the NAIADES project aligns with the framework in this regard and additionally supports it.

Table 13: NAIADES Contributions to SDG 3

Number	Target	WP	Activity	Target Group	Task and Deliverable
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	WP4	Dynamical water treatment suggestions (optimized use of chemicals)	Drinking water treatment plant's manager	T4.2 and T4.5 (D4.3 and D4.9)
		WP5	Water quality prediction	Water quality control and infrastructure maintenance	T5.5 (D5.9)
			Saline intrusion detection	Waste water processing plants	T5.1 (D5.1)

SDG 4 Quality Education

NAIADES contributes to target 4.7 of SDG 4 through its public awareness and behavioural change interventions (see Table 14). This target aims at enabling and guaranteeing that all learners gain the knowledge and skills necessary to bring forward sustainable development.

The coverage of this SDG by the EU directives is only weak. The NAIADES project thus complements the directives by contributing to domains that are less touched upon by the EU framework.

Table 14: NAIADES Contributions to SDG 4

Number	Target	WP	Activity	Target Group	Task and Deliverable
4.7	By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	WP5	Non-ICT public awareness and behavioural change interventions	Water utilities, municipalities and schools	T6.5

SDG 7 Affordable and Clean Energy

The target 7.3 of SDG 7 puts its focus on significantly increasing energy efficiency. As for this SDG, NAIADES is contributing to it through its optimised operation and planning system thanks to which electricity consumption is reduced (see Table 15). In terms of alignment with the EU directives, it can be stated that the SDG is weakly covered by the framework, meaning that the NAIADES project supports and complements the directives by working on areas that are not extensively covered by these.

Table 15: NAIADES Contributions to SDG 7

Number	Target	WP	Activity	Target Group	Task and Deliverable
7.3	By 2030, double the global rate of improvement in energy efficiency	WP5	Reduced electricity consumption through the anticipation of production, storage and delivery of the expected water volume (Optimised operation and planning)	Water utility managers	T4.1 (D4.1) T5.3 (D5.5)

SDG 12 Responsible Consumption & Production

The NAIADES project supports SDG 12 by contributing to target 12.2 which focuses on the sustainable management and use of natural resources. All the contributions are made by WP 5 which works on increasing water use efficiency and reduce losses through saltwater intrusions and leakages (see Table 16). NAIADES is aligned with the EU Water Management Framework which extensively covers this goal and contributes to its achievement.

Table 16: NAIADES Contributions to SDG 12

Number	Target	WP	Activity	Target Group	Task and Deliverable
12.2	By 2030, achieve the sustainable management and efficient use of natural resources	WP5	Saline intrusion detection	Waste water processing plants	T5.1 (D5.1)
			Identification leakage position within the water distribution network	Water utility companies	
			Optimizing public gardens watering	Municipality administrations	
			Minimizing water losses by increasing water demand prediction accuracy	Water utility companies	T5.3 (D5.5)

SDG 13 Climate Action

SDG 13 is the secondary SDG that is the second most covered by NAIADES after SDG 17. Indeed, three WPs contribute to two targets, namely 13.1 and 13.3 (see Table 17). Whereas target 13.1 aims at building resilience and adaptive capacity regarding climate change-related weather events and natural disasters, target 13.3 focuses on education and awareness-raising concerning climate change solution paths such as mitigation, adaptation, impact reduction and early warning systems.

As found in the framework analysis, the coverage of the EU directives regarding SDG 13 is only moderate. NAIADES supports the framework and helps contribute to the goal in the following manner.

Table 17: NAIADES Contributions to SDG 13

Number	Target	WP	Activity	Target Group	Task and Deliverable
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	WP4	Dynamical water treatment suggestions (including critical weather events circumstances)	Management of drinking water treatment plant	T4.2 (D4.3) and T4.5 (D4.9)
		WP5	NAIADES weather forecasting toolkit	Weather forecasting services	T5.2 (D5.3)
			Water information for evidence-based decision making, and education of public against misinformation to enhance action for climate crisis	Water utility companies, local governments, municipality administrations and citizens	T5.4 (D5.7)
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	WP6	Water awareness dashboard for water consumers	Water consumers	D6.1 and D6.2

SDG 17 Partnership for the Goals

SDG 17 is the most relevant secondary goal, given that a total of three targets, i.e., 17.14, 17.16 and 17.17 are addressed by two WPs. Target 17.14 aims at strengthening policy coherence to bring forward sustainable development and is being supported by the IAM4SDG methodology developed within the scope of WP2 of NAIADES and presented in this deliverable. Furthermore, WP9 contributes to both target 17.16 focusing on building multi-stakeholder partnerships for sustainable development and target 17.17 seeking to encourage and promote effective public, public-private and civil society partnerships (see Table 18).

Regarding the alignment with the EU directives, it can be stated that SDG 17 is weakly covered by the framework, meaning that the NAIADES project supports and complements the directives by significantly working on areas that are not extensively covered by these.

Table 18: NAIADES Contributions to SDG 17

Number	Target	WP	Activity	Target Group	Task and Deliverable
17.14	Enhance policy coherence for sustainable development	WP2	IAM4SDG methodology	NAIADES consortium, researchers, project evaluators, EU regulators, international community, policy makers	T2.2 (D2.3)
		WP9	Recommendations	Researchers, EU regulators, international community, policy makers	T9.5 (D9.12)
17.16	Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries	WP9	DigitalWater2020 Cluster activities, Standardisation (Y.Sup63 at ITU-T), Recommendations	Researchers, EU regulators, policy makers	T9.1 (D9.14, D9.15), T9.4 (D9.10 and D9.11), T9.5 (D9.12),
17.17	Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships Data, monitoring and accountability	WP9	Standardisation activities	Water utilities, municipalities, policy makers, water technological companies, standard development organisations	T9.4 (D9.10 and D9.11) and intermediary reports

5.4   Discussion and Key Takeaways

This chapter aimed at illustrating how the two frameworks proposed by the SDGs and the EU directives relate to the NAIADES project. In addition, this study enabled the identification of SDGs and respective targets that 'go beyond the eye', which first seemed to not be directly related to the project. This analysis will help partners to connect their activities to the targets, know which areas are more or less covered by the project, and understand where opportunities for improvement can be found. The results proved that NAIADES strongly contributes to the primary SDGs addressed by the project, namely SDG 6, 9 and 11, as well as to the secondary SDGs 13 and 17. In addition, moderate contributions are also made to SDG 1, 2, 3, 4, 7 and 12.

When considering the results obtained through the SWOT analysis above, it can be mentioned that NAIADES covers certain points that were identified as weaknesses and threats. Indeed, the project involves the education sector through its awareness-raising campaigns at schools and other institutions to change consumer behaviour related to water use. Furthermore, NAIADES contributes to SDG 7 through its efforts to increase energy efficiency and makes strong contributions to SDG 17 and moderate ones to SDG 1 and 4, which are only addressed in a limited manner by the EU directives.

6 IAM4SDG Methodology for SDG Impact Assessment and Compliance

6.1 IAM4SDG Concept

SDGs have been adopted and endorsed by the EU and all its Members States. As such, NAIADES shall comply with these commitments, particularly when designing and implementing pilots with effective impact on water management.

In order to support this process and to avoid gaps between NAIADES activities and the SDGs, Mandat International researched and designed an innovative "**Impact Assessment Methodology for SDGs**" (hereafter referred to "IAM4SDG") applicable to smart water management projects such as NAIADES pilots. The methodology has been designed to be tested in NAIADES and, if successful, to be applicable to other research and pilot projects, including in other application domains.

The IAM4SDG aims at providing a user-friendly and easily implementable methodology and tool to align smart water management projects and pilots with the SDGs. The objective of this methodology is twofold:

1. **To identify and address potential risks and negative impact** of the assessed project on the 17 SDGs;

2. **To identify and leverage potential positive impact** of the assessed project to implement and achieve the SDGs.

While environmental impact assessment studies focus on analysing the risks for the environment, IAM4SDG enlarges the perspectives in two directions: it considers the whole set of SDGs, and not only environmental aspects. It also identifies and considers potential positive impacts of the project for SDGs achievement, instead of focussing only on the risks.

IAM4SDG provides a formal and well-structured methodology enabling stakeholders to systematically assess the potential negative and positive impacts of a project on the SDGs, and to translate the results into a practical action plan to better align their action with the SDGs.

As it has been designed to be easily applicable by non-specialists, the results may be subject to cognitive biases by the implementer, but the methodology enables to replace a subjective evaluation by a methodology forcing the user to apply a systematic assessment of the potential impact on SDGs.

Beyond its formal results, IAM4SDG can also contribute to raising awareness on the SDG requirements in a project. It seeks to encourage the user to familiarise themselves better with the various aspects of sustainable development, while also inviting them to think 'outside of the box' by making them consider possible connections between their project and the impact on sustainable development. As a consequence, IAM4SDG allows the user to be better equipped to prioritise future actions. The SDG impact assessment allows to learn more about Agenda 2030 and the opportunities and difficulties of implementing the SDGs.

6.2   Intended Applications of the IAM4SDG Methodology

The IAM4SDG methodology has been designed to serve several purpose and potential applications.

First, the methodology enables to identify SDG-related hazards and to evaluate the risks and opportunities attached to a project.

Where applied *ex antes*, the IAM4SDG methodology can be used to assess and take a decision on the financing and implementation of a project. It may lead to recommending or rejecting a new project.

At the start of a project, the methodology can help in guiding and optimising sustainable management decisions. It enables the project consortium in identifying issues to be addressed for maximising the positive impact of the project on the SDGs. It can lead to project adaptation and more specifically to fine tuning the resource allocation and work plan of the project to address to better address the sustainable development requirements.

An important output of the methodology is a clear action plan whose implementation can be monitored during the life of the project. It can be used to monitor the sustainable development performance of the project. At the end of the project, the methodology can serve as a basis to deliver an impact assessment of the project on terms of sustainable development and SDGs achievement.

6.3   IAM4SDG Process

The IAM4SDG requires to clearly determine the scope of the project to be analysed. The process should be led by a clearly identified manager who will serve as Sustainable Development Officer (SDO) or SDG Officer for the project to be assessed.

The overall process is structured in a sequence of 6 phases:

1. Identification of risks and opportunities
2. Qualification of risks and opportunities
3. Determination of priority levels
4. Identification of Actions
5. Formalising the Action Plan
6. Monitoring and reporting

These six phases are further described in the following sections.

6.3.1   Identification of Risks and Opportunities

The risk identification process consists in identifying any potential hazards and opportunities within a project that may have an impact on each of the 17 SDGs. The evaluators are expected to consider all possible impacts (positive and negative) arising from their activities in the project with respect to each one of the SDGs.

In order to perform a systematic evaluation, the project must be systematically analysed against each one of the 17 SDGs. For each SDG, the SDO should identify what are the potential risks or negative impact on the related SDG objectives, as well as how could the project contribute to support the objectives associated to the same goal.

The following template table will be used to identify these risks and opportunities:

Table 19: Identification of Risks and Opportunities

SDG	Identified Risks	Identified Opportunities
1 No poverty Eradication of extreme poverty, ensuring equal rights to the poor and vulnerable, and building resilience of the poor.		
2 Zero hunger Ending hunger and malnutrition and ensuring sustainable food production		
3 Good health and well-being Ensuring healthy lives, eradication of AIDS, tuberculosis, malaria and other diseases, reduction of maternal mortality, reduction of premature death		
4 Quality education Ensuring that all boys and girls receive primary and secondary education, increasing the number of young adults with relevant skills		
5 Gender equality Improving women conditions, ending all forms of discrimination and violence against women		
6 Clean water and sanitation Ensuring access to water and sanitation to all		
7 Affordable and clean energy Ensuring universal access to clean, affordable and sustainable energy to all		
8 Decent work and economic growth Sustaining per capita growth, combat youth unemployment, development-oriented policies.		
9 Industry innovation and infrastructure Promoting innovation, the development of resilient infrastructures and sustainable industries.		
10 Reduced inequalities Promoting social and political inclusion and reducing the inequalities between countries		
11 Sustainable cities and communities Ensuring access for all to adequate and affordable housing, promoting sustainable cities urbanisation.		
12 Responsible consumption and production Achieving sustainable management of natural resources, reducing waste generation		
13 Climate action Measures to mitigate climate change. Enhancing education and awareness on climate change issues.		
14 Life below water ensuring a sustainable use of oceans, seas and marine resources		
15 Life on land Halting biodiversity loss, desertification, and land degradation. Managing forests in a sustainable way		
16 Peace, justice and strong institutions Transparent institutions and inclusive societies and communities, reducing all forms of violence, ending abuses		
17 Partnership for the goals Reinforcing the global partnership for sustainable development		

Where applied ex antes, the identification will be mainly based on the project's description. However, beyond the documentation review, the identification phase can be enriched and enhanced by leveraging on diverse methods, such as:

- Observation, by observing the location and context of the project. On-site visits and inspection can be used to better grasp the potential impact of the project.
- Internal consultation, by interviewing and interacting with the project partners to identify the risks in their specific tasks and project-related activities.
- Stakeholders' consultation, by interviewing and interacting with the stakeholders impacted by the project to identify potential risks and opportunities in terms of sustainable development.
- Comparison, by looking into similar projects and learning from their experience regarding the risks they faced.

6.3.2   Qualification of Risks and Opportunities

Once the risks and opportunities have been identified and listed for each SDG, it is important to determine their importance. In order to adopt a clear and easily understandable methodology, IAM4SDG proposes to assess the following parameters:

For the Risks:
- Impact
- Likelihood

For the Opportunities:
- Impact
- Effort required

The following subsections describe how each one of these parameters shall be evaluated.

Qualification of Impact

The impact refers to effect that the project may have on a given SDG. The impact can be negative and/or positive. In the context of the IAM4SDG methodology, the impact scale can vary, but the recommended scale is a three-level scale. Hence, the impacts can be described with the following options: 'small', 'medium' or 'large' (see Table 20).

Table 20: Level of Impact on SDGs

Impact	Description
Small	Small impact on the SDGs
Medium	Medium impact on the SDGs
Large	High impact on the SDGs

Qualification of Likelihood

In ISO/IEC 31000, the likelihood is defined as *"the chance of something happening."* The impact likelihood can be defined as the chance of the identified impact to occur. In IAM4SDG, the likelihood of occurrence is expressed in a qualitative way, through the use of a three-level scale with the following options: 'small', 'medium', or 'large' (see Table 21).

Table 21: Likelihood of Occurrence Estimation

Likelihood	Description
Small	Will most likely not occur
Medium	Possible to occur
Large	Likely to occur

Qualification of Effort Required

The required effort can be defined as the required amount of effort and/or financial resources needed to implement the opportunity. In IAM4SDG, the required effort is expressed in a qualitative way, through the use of a three-level scale with the following options: 'small', 'medium', or 'large'.

Table 22: Required Effort Estimation

Likelihood	Description
Small	Minor effort and cost
Medium	Substantial effort or cost
Large	Major effort or cost

6.3.3   Determination of Priority Levels

Priority Levels Definition

In order to differentiate and focus on priority risk and opportunities, the methodology leverages the previous stage to determine the level of priority. The priority level is determined as the result of:

1. Impact level and Likelihood for the negative impact priority level determination.
2. Impact level and Required effort for the opportunity priority level determination.

The priority level is classified on a scale from 1 to 3, where 1 is 'high priority', 2 is 'medium priority' and 3 is 'low priority'. The classification by levels of priority allows to differentiate and prioritize the negative impacts and the opportunities in terms of actions and resource allocations.

1	high priority
2	medium priority
3	low priority

IAM4SDG Priority Matrix

IAM4SDG methodology leverages on a matrix to categorize the priority levels of identified risks and opportunities. For determining the priority level of identified risks, the matrix considers the impact level and likelihood level, in line with the risk analysis model specified in ISO/IEC 31000. For determining the priority level of identified opportunities, the matrix considers the impact and effort required. In both cases, priority levels are determined.

For each of the 17 SDGs, the user is requested to place each potential risk identified by their project into the matrix, according to its estimated likelihood of occurrence and the determined level of impact (see Table 23). Once done, they should examine the resulting level of priority and assess whether it is acceptable.

Table 23: IAM4SDG Matrix

		Likelihood / Effort required		
		Small	Medium	Large
Impact	Small	3	3	2
	Medium	3	2	1
	Large	2	1	1

6.3.4   Identification of Actions

For each negative impact and opportunity identified that has been qualified as medium or high, a set of practical actions should be identified:

1. Mitigate the identified negative
2. Implement the identified opportunity.

The risk mitigation step involves development of mitigation plans designed to manage, eliminate, or reduce risk to an acceptable level. This process implies to identify adequate and efficient actions by taking into account factors like:

- Effectivity of the proposed action
- Feasibility in terms of required resources (cost and effort)

The table below (see Table 24) offers an overview of the possible risk mitigation options to consider.

Table 24: Measures for Risk Mitigation

Mitigation option	Description	Remarks
Eliminate	Taking concrete and proactive measures to eliminate the risk and its possible side-effects.	A clear plan detailing the measures to eliminate the risk is required.
Prevent	Adjusting the project objectives or work plan to eliminate or reduce the risk.	This mitigation option could be accommodated by a change in funding, schedule, requirements.
Control	Enforcing actions to reduce the impact or likelihood of the risk.	
Transfer	Reassigning the organisational accountability and responsibility to another qualified stakeholder willing to accept to handle the risk.	
Accept	Recognising the existence of a risk and making a deliberate decision to assume it without taking special measures to control it.	The consent of all project partners is necessary.
Monitor	Monitoring the environment for changes that affect the nature and/or the impact of the risk.	

The following table (see Table 25) provides a synthetic table summarising the results of the identification of risks and opportunities, qualification of risks and opportunities, determination of priority levels, and identification of Actions.

Table 25: IAM4SDG Synthetic Table

SDG #	Risk / Opportunity	Impact	Likelihood / Effort	Priority Level	Identified Action	Leader	Deadline	Status	Remarks

6.3.5   Formalising the Action Plan

IAM4SDG Risk and Opportunity Management Table

Once the level of priority has been identified through the matrix, the IAM4SDG methodology recommends filling in the IAM4SDG Action Plan table (see template Table 26).

Table 26: IAM4SDG Risk and Opportunity Management Table

Priority Level	SDG #	Risk / Opportunity	Identified Action	Leader	Deadline	Status	Remarks
HIGH							
MEDIUM							
LOW							

The table summarises the previously identified risks into the 3 priority levels, ranked from highest priority to the lowest priority. High priority items require actions from the project. For medium priority items, action is strongly recommended to mitigate the risks, while for low priority actions, action is encouraged.

6.3.6   Monitoring and Reporting

As previously mentioned, the methodology requires to designate a Sustainable Development Officer (SDO) or SDG Officer in charge of applying the IAM4SDG process.

This officer shall monitor the implementation of the Action Plan. Whenever a project if substantially refocused with impact on its work plan, the SDO shall review and update the IAM4SDG analysis.

The SDG Officer shall provide a report at the end of the project (or on a yearly basis) to present the actions achieved by the project and its effective impact with regards to the SDGs.

7   Conclusion

The EU water policy and related policies, such as the Water Framework Directive, the Urban Waste Water Treatment Directive, and Drinking Water Directive, are among the most ambitious pieces of water legislation in the world. They deliver exemplary regulatory foundations to support the SDGs at the EU and global levels.

Through this deliverable, it was sought to analyse the current EU water policy frameworks to assess their interconnectedness to the SDGs. The analysis has revealed that the EU water directives are interwoven with the SDG framework, with a strong focus on SDG 3 'Good Health and Well-Being', SDG 6 'Clean Water and Sanitation', SDG 9 'Industry, Innovation and Infrastructure', SDG11 'Sustainable Cities and Communities' and SDG 12 'Responsible Consumption and Production'. However, the directives have shown no direct impact at the level of SDG 4 'Quality Education' and SDG 5 'Gender Equality' and limited impact at the level of SDG 1 'No Poverty', SDG 7 'Affordable and Clean Energy', SDG 10 'Reduced Inequalities' and SDG 17 'Partnerships for the Goals'. Through the SWOT analysis, the existing gaps in the EU policy were demonstrated and the SDGs that could be consider in future policy-making were identified. An example is SDG 14 'Life below water', that is not fully addressed in the EU Framework for Smart Water Management. The achievement of the SDGs and of the Agenda 2030 objectives will not only depend on sector-specific policies but also through cross-sectorial integration and cooperation. In this regard, the integration and recognition of the importance of water across sectors and policies will support the achievement of the SDGs, including by streamlining it into the EU Common Agricultural Policy, the EU Regional and Urban Policy, EU gender equality strategy, the LIFE Programme, the EU Neighbourhood Policy, the EU Enlargement Policy, the EU Development Cooperation Programmes, and Horizon Europe. Deliverable 9.12 will continue the analysis presented here, by looking into the perceived impacts of the project on the SDGs and by leveraging on the partner's experience and collaborative efforts to make progress on the SDGs. D9.12 will also put emphasis on international cooperation and provide recommendations that can then be communicated to relevant actors.

Furthermore, a supplementary analysis illustrated how NAIADES contributes to a total of three primary and eight secondary SDGs, fills certain gaps identified through the SWOT analysis and supports the EU directives in areas that are less covered by them. The study showed that NAIADES principally contributes to the primary SDGs 6, 9 and 11, while also making strong contributions to SDG 13 'Climate Action' and SDG 17. Besides, through the project's contributions to SDG 1, 4, 7 and 17, NAIADES acts on important weaknesses and threats identified for the EU directives in the SWOT analysis.

Additionally, the deliverable sought to present the Impact Assessment Methodology for SDGs (IAM4SDG) – a self-assessment tool allowing to evaluate how a project as a whole (or an activity undertaken in the context of a project) impacts the SDGs. IAM4SDGs is intended to familiarise partners of research projects with the various aspects of sustainable development, while also inviting them to think 'outside of the box' by making them consider possible connections between their project and the impact on sustainable development. Consequently, IAM4SDG allows the user to be better equipped to prioritize future actions. The methodology is based upon the IAM4SDG matrix, which evaluates the likelihood of occurrence of a risk and its impact on the SDGs. The matrix allows to determine the resulting level of priority of each item, and the complementary IAM4SDGs risk management table facilitates the monitoring and activity organisation at the project level to mitigate the risk. The methodology helps guiding the projects to make more targeted sustainable management decisions, but also helps the evaluators to better estimate a project's impact on the SDGs.

The IAM4SDG methodology will be tested and validated with the three pilots of NAIADES. The results will be presented in the deliverable D9.12 'SDG Impact Assessment'.

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9 Annexe

ID	Name	Objectives	Expected results (direct)	Potential Impact	EU Directives	Potential benefits (based on IWA digital water)
UCC1	Watering	■ Find the best schedule for watering plants' boxes based on the estimation of the plant's needs	■ Watering Dates (timetable) associated to each plants' box ■ Amount of water to spend on each plant box ■ Optimized itinerary and selection of which	■ Increase water efficiency ■ Reduce workload of municipality staff ■ Reduce energy consumption of the vehicles used for watering	Water Framework Directive (WFD) (Directive 2000/60/EC)	Environmental protection - improved conservation and management of critical water resources. Process excellence - speed in decision-making due to efficient data analysis and processing
UCC2	Fountains Quality	■ Optimise water quality monitoring and management	■ Real-time Water Quality monitoring (at least every 15 mins) of pH, Chlorine, Chlorates,Turbidity and Temperature. ■ Water Quality Forecast (2 days in advance - 4 values per day). ■ Visualisation of the short term and long term evolutions and trends. ■ Alerts based on data from sensor and external sources.	■ Guarantee water quality standards in the fountains at all times ■ Optimise maintenance planning, and act with anticipation using water quality forecasts, leading to: - Saving water, by reducing the need of injecting fresh water in the fountains when quality is too low - Preventing suspension of service due to excessive contamination - Preventing episodes when all the water has to be replaced ■ Reduce staff workload ■ Step towards the application of modern digital technologies that can reduce the costs of water quality status reporting for public authorities. ■ Reduce risks for the health of the public	Water Framework Directive (WFD) (Directive 2000/60/EC, Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption ; Bathing Water Directive (BWD) 2006/7/EC Concerning the Management of Bathing Water Quality	Process excellence - speed in decision-making due to efficient data analysis and processing. Regulatory compliance - reduced risk of non-compliance reporting from water quality issues
UCB1	Water Demand & Water Consumption	■ Obtain short term water Demand forecasts ■ Automatically associate water consumption with defined events @CUP_Braila: Increase energy efficiency, network operation efficiency, water quality improvement (lower water age), balancing pressure change from	■ Water demand Forecast (7 days in advance - 4 values per day) ■ Graphic information that links the real-time consumption data with events	■ Save natural sources water (by optimising the distribution of water) ■ Better understanding of consumption states ■ Reduced electricity consumption through the anticipation of production, storage and delivery of the expected water volume (Optimized operation and planning) @CUP_Braila: Decreasing the time that water spends in the system, thereby	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Environmental protection - improved conservation and management of critical water resources. Reduced operational expenditure - optimised operation that reduce energy and maintenance costs
UCB2	Water Leakages	■ Detect leakages in the network	■ Rapid Detection and location of leakages in the district network @CUP_Braila: Using the hydraulic model to create a daily comparisson with the real world	■ Reduce water loss (saving water from natural sources) @CUP_Braila: Detect potential problem areas that require maintenance, reducing operating costs in the long term. Reducing energy usage by eliminating waste.	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Environmental protection - improved conservation and management of critical water resources. Increased capital efficiency - improved cash flow as a result of targeted rehabilitation of faulty infrastructure
UCB3 (Is-dWTP)	Dynamical Water Treatment Suggestions	■ Find the optimal amount of chemical required to guarantee drinking water quality levels for any water quality at the inlet of the dWTP	■ Provide dosage of coagulant and chlorine for any water quality at the inlet	■ Optimised use of chemicals **Adaptation to any inlet water quality derived from climate events (including extreme events). (TBD)** ■ drinking water quality guaranteed to be always on the legal quality levels.	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Process excellence - speed in decision-making due to efficient data analysis and processing. Regulatory compliance - reduced risk of non-compliance reporting from water quality issues
UCA1	Water Demand	■ Obtain short term water Demand forecasts	■ Water demand Forecast (7 days in advance - 4 values per day)	■ Prevent water shortages ■ Optimize drinking water management planning ■ Save natural sources water (by optimising the distribution of water) ■ (IC) Detect abnormal water demand events (e.g. leaks) through the comparison of forecast vs. real demand ■ (IC) Securization of the supply through the optimization of the water tank storage ■ (IC) Reduced electricity consumption through the anticipation of production	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Environmental protection - improved conservation and management of critical water resources. Reduced operational expenditure - optimised operation that reduce energy and maintenance costs
UCA2	Saline intrusion	■ Detect and monitor saline intrusions in the sewer network	■ Rapid Detection and location of saline intrusions in the sewer network	■ Reduce costly and CO2 negative treatment of salinity on WWTP (by reducing salinity in waste water) ■ Increasing production and availability of reused water for irrigation (currently limited by salinity)	Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment, **Marine Strategy Framework (MSF) Directive 2008/56/EC (TBC)**, Urban Waste Water Treatment (UWWT) Directive 91/271/EEC	Reduced operational expenditure - optimised operation that reduce energy and maintenance costs
UCA3	Awareness - City Dashboards	■ Provide the information required for the city managers to become aware of the public water consumption patterns and act accordingly ■ Provide the means to run ICT-supported behavioural change support and consumption awareness programs to engage consumers in water conservation	■ Dashboards with meaningful, detailed information on public water consumption enabling evolution analysis and comparison of consumption points ■ Web-based behavioural change support dashboard for younger users at public schools	■ Detection of excess consumption ■ Improved understanding of water consumption for city managers ■ Identification of problems (e.g. internal leaks in buildings or gardens) ■ Water savings ■ Follow-up of water saving actions ■ Support for User awareness and behavioural change campaigns (e.g. shools)	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Increased resilience - increased safety through rapid customer engagement on public safety concerns. Customer experience - Increased customer engagement and responsiveness to customer inquiries
Global Observatory	Global Observatory	■ Get information about water topics on the Internet related to my area (as hints about consumer confidence) and to the urban water cycle in general ■ Extract insightful information from news and social media on Use Case priorities, interacting with collected idicators data (including SDG), published knowledge on success stories (in natural disasters or water contamination), and with localised weather characteristics	■ Dashboard for water related news customised to pilot's needs. ■ Dashboard for water related social media topics customised to pilot's needs. ■ Climate change related dashboard. ■ Dashboard for various water related datasources indicators.	■ Improved decision-making and efficiency in dealing with water-related events / Better understanding of the consumer confidence and general opinion on water management and climate crisis action from social media and news / Avaiability of exploration tools to improve knowledge on water topics	Water Framework Directive (WFD) (Directive 2000/60/EC), Drinking Water Directive (DWD) 2020/2184 on the Quality of Water Intended for Human Consumption	Customer experience - Increased customer engagement and responsiveness to customer inquiries / Better decision making based on collected evidence and exploration of historical knowledge data