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EU4GREEN RECOVERY EAST

NATIONAL BASELINE REPORT OF WASTEWATER TREATMENT INFRASTRUCTURE

Armenia

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EU4Green Recovery East – Recovery through a Circular Economy and Pollution Reduction in the Eastern Partnership Countries

(700002623)

Implementing partners:

ENVIRONMENT AGENCY AUSTRIA · EXPERTISE FRANCE GROUPE AFD · OiEau International Office for Water · OECD BETTER POLICIES FOR BETTER LIVES · UNECE · UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION Progress by innovation

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Recovery Through a Circular Economy and Pollution Reduction in the Eastern Partnership Countries

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ABOUT EU4GREEN RECOVERY EAST

The EU4Green Recovery East programme is a regional programme supporting the EU's Eastern Partnership countries on their path towards a greener, more resilient and competitive economy.

With an EU contribution of EUR 21.3 million (2025–2028), it builds on the results of a decade of EU support for better water management and green economy adoption and focuses on five key components: (1) promoting a circular economy, (2) ensuring water is managed as a critical resource, (3) advancing legal approximation with EU environmental legislation, (4) strengthening integration into EU-wide environmental cooperation and data exchange and (5) fostering cross-border environmental cooperation.

The programme is implemented by five partners: Expertise France with the French International Office for Water (OiEau), OECD, UNECE, UNIDO and the Environment Agency Austria (UBA) as the consortium coordinator.

https://www.eu4greenrecoveryeast.eu

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AFD..... Agence Française de Développement (French Development Bank)
BAT..... Best Available Techniques
BOD..... Biochemical Oxygen Demand
CEPA..... Comprehensive and Enhanced Partnership Agreement
COD..... Chemical Oxygen Demand
DoA ..... Description of Action
E&S..... Environmental and Social
EaP.....Eastern Partners
EBRD..... European Bank for Reconstruction and Development
EC.....European Commission
EIB..... European Investment Bank
EPR..... Extended Producer Responsibility
EU ..... European Union
EU4GRE..... EU4Green Recovery East Programme
GIZ..... Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Agency)
IED..... Industrial Emissions Directive
IFI(s)..... International Financial Institution(s)
IWRM..... Integrated Water Resources Management
LSGB..... Local Self-Government Bodies
MATAI..... Ministry of Territorial Administration and Infrastructure
NFP ..... National Focal Point
OECD..... Organization for Economic Cooperation and Development
OiEau..... Office International de l'Eau (International Office for Water)
p.e. ..... Population Equivalent
PFAS..... Per- and Polyfluoroalkyl Substances
PPPs..... Public Private Partnership(s)
PSRC..... Public Services Regulatory Commission
QA/QC..... Quality Assurance/Quality Control
RBMD..... River Basin Management District
RBMP..... River Basin Management Plan
SCADA..... Supervisory Control and Data Acquisition
SDG..... Sustainable Development Goal

TSS..... Total Suspended Solids
UBA ..... Umweltbundesamt GmbH, Environment Agency Austria
UNIDO..... United Nations Industrial Development Organization
UWWTD..... Urban Wastewater Treatment Directive
WC..... Water Committee
WFD..... Water Framework Directive
WISA..... Water and Irrigation Services Enhancement (Project/Program)
WRMA..... Water Resources Management Agency
WSS..... Water Supply and Sanitation
WW..... Wastewater
WWTP..... Wastewater Treatment Plant

1 Executive Summary

This baseline report provides a comprehensive assessment of Armenia's wastewater sector, examining infrastructure capacity, treatment performance and regulatory frameworks. The analysis reveals significant gaps between current practices and EU standards, particularly concerning the Urban Wastewater Treatment Directive (UWWTD) while identifying strategic pathways for sector modernisation under the EU4Green Recovery East Programme.

Armenia generates approximately 721.9 million m³ of wastewater annually, yet only 8% receives any form of treatment. The country operates six centralised municipal wastewater treatment plants with a combined nominal capacity of 666,528 m³/day, but actual throughput reaches only 196,024 m³/day—less than 30% of design capacity. All six facilities provide mechanical pretreatment only through coarse screening and, in five cases, fine screening with grit and grease removal. The Aeratsia WWTP in Yerevan pretreats 92% of all treated wastewater in the country, creating a critical single point of vulnerability in the system. In addition, there is a community-level facility with a lagoon system that provides treatment for 0.13% of the total treated wastewater.

The absence of biological treatment results in minimal pollutant removal, with BOD and TSS reduction averaging only 10%. Nutrient removal is non-existent, with total nitrogen and phosphorus reductions of approximately 1–2% at Aeratsia. Consequently, 154.3 million m³ (21%) of wastewater is discharged without any treatment, while 505.3 million m³ (70%) is classified as clean according to national standards despite receiving no treatment. This performance falls substantially short of EU requirements for secondary and tertiary treatment.

Infrastructure deterioration compounds operational challenges. Approximately 50% of Armenia's 4,174.3 km sewerage network requires complete replacement, with over 80% of systems in Yerevan and Shirak considered obsolete. Decades of insufficient maintenance have led to severe infiltration and inflow problems, groundwater contamination through leakage and frequent overflows during rainfall or snowmelt periods. The widespread interconnection of stormwater and municipal sewer systems, often without proper planning, exacerbates hydraulic overloading.

Industrial wastewater management presents a critical regulatory gap. Without quantitative or qualitative monitoring systems for industrial discharges, enterprises release effluents directly into municipal networks, surface waters or groundwater without oversight. This unregulated discharge impairs WWTP performance, contaminates water resources and poses public health risks, particularly where groundwater serves drinking or irrigation purposes.

The regulatory framework demonstrates partial alignment with EU directives through the 2002 Water Code and subsequent amendments, yet significant transposition gaps remain. Armenia lacks binding implementation timelines, comprehensive sensitive area designations and enforceable compliance mechanisms comparable to EU standards. The institutional landscape is fragmented across multiple ministries and agencies, with unclear coordination mechanisms and limited enforcement capacity. Veolia Djur CJSC serves 73% of the population across 373 settlements but operates wastewater systems in only 74 of 80 settlements with infrastructure, while many local self-government bodies lack technical and financial capacity for effective service delivery. The six RBMPs all identify urban wastewater as the key priority and delineate large agglomerations requiring rehabilitation and extension of sewer networks as well as enhancement of existing treatment plants or building of new treatment plants to reach secondary or even tertiary treatment. Finally, the RBMPs recommend launching feasibility studies for all

agglomerations greater than 500 population equivalents (p.e.), leaving the clear needs of smaller settlements largely unaddressed.

According to the lease agreement between the Water Committee, Veolia Générale des Eaux and Veolia Djur CJSC, signed on 21 November 2016 and entering into force on 1 January 2017, the Public Services Regulatory Commission of Armenia issued a licence to Veolia to serve 380 settlements, including the capital Yerevan, 45 other cities and 334 villages, representing approximately 80% of the population.

Sanitation coverage varies dramatically between urban and rural areas. While 96% of urban residents access improved sanitation, 51% of the rural population relies on unimproved facilities. Of 930 territorial units, approximately 830 lack sewerage services entirely. Many on-site systems discharge directly to surface or groundwater bodies without treatment, creating environmental and health hazards.

Given these conditions, meaningful opportunities for energy efficiency improvements, sludge valorisation or biogas production under Output 2.3.3 are currently unavailable. The specific energy consumption of existing WWTPs (all below 0.1 kWh/m³) reflects the simplicity of mechanical pretreatment rather than optimisation potential. Priority interventions must focus on rehabilitating collection networks and introducing biological treatment processes before advanced resource recovery becomes feasible.

The report recommends redirecting EU4GRE programme efforts towards comprehensive capacity building under Output 2.3.2, targeting decision-makers, municipal engineers and policymakers rather than plant operators. Key priorities include strengthening technical competencies, supporting alignment with EU UWWTD requirements, conducting training needs assessments and empowering stakeholders to develop fundable project proposals for treatment system upgrades. Regulatory reform should adopt a phased approach, prioritizing organic matter and nutrient removal for larger agglomerations while establishing frameworks for future energy recovery and micropollutant removal.

As a general recommendation, nature-based solutions, notably constructed wetlands, represent important options for many rural areas in Armenia to improve treatment and reduce local pollution through relatively simple and low-cost solutions.

Sustainable sector transformation requires coordinated action across infrastructure modernisation, institutional strengthening, regulatory harmonisation and financial mechanisms that ensure cost recovery while maintaining affordability. The baseline established in this report provides the evidence foundation for targeted interventions that will build Armenia's capacity to achieve climate-resilient, energy-efficient wastewater management aligned with EU standards.

2 Introduction

2.1 Purpose

This report has been developed as a foundational document to support Output 2.3 of the EU4GRE Programme. It supports the efforts to advance sustainable wastewater management practices in Armenia. Furthermore, the report aims to provide a comprehensive baseline assessment of the current state of wastewater generation, treatment and management, as well as the regulatory and institutional frameworks governing these processes. By establishing a clear understanding of the existing infrastructure, operational performance, energy consumption and policy environment, it serves as a critical reference point for identifying areas requiring intervention. The findings presented herein will guide subsequent technical assistance, policy support and capacity-building actions, ensuring that future interventions are grounded in robust evidence and tailored to the national context.

2.2 Main Objectives

The primary objective of this report is to map and evaluate the status of wastewater treatment systems, the associated regulatory framework and capacity-building needs in the wastewater sector in Armenia, with a focus on energy efficiency, operational effectiveness and alignment with EU directives. Specifically, the report seeks to:

(i) Assess the condition and performance of existing wastewater treatment plants (WWTPs), including infrastructure and technologies

(ii) Identify critical gaps in governance, capacity and technical capabilities

(iii) Propose actionable recommendations to improve WWTP operations, enhance energy efficiency and support sustainable sludge management practices

The aim is to consolidate data at WWTP level across the country, as far as possible, in order to identify potential sites where measures can be suggested to improve energy efficiency and recovery options, including the reuse potential of treated wastewater and sewage sludge. The result of this report is intended to inform decision-making, providing the foundation for targeted interventions where applicable, as part of the further activities of Output 2.3, aimed at building a climate-resilient and energy-efficient wastewater sector.

3 Scope

The report encompasses a detailed analysis of the current state of wastewater management in Armenia, with particular attention to treatment efficiencies, by-product handling and reuse, the regulatory framework and capacity-building requirements for wastewater treatment. The report covers the entire wastewater value chain, from generation and collection to treatment, discharge and sludge management. It includes detailed data from the WWTPs across Armenia, with the highest possible level of granularity to support the identification and selection of potential sites for proof-of-concept activities.

The assessment maps the geographical distribution, capacity and performance of WWTPs, as well as treatment technologies, energy consumption and pollutant loads, and evaluates operational efficiency. Additionally, the report reviews the national legal and regulatory framework, assessing its compatibility with EU directives such as the UWWTD, Water Framework Directive (WFD) and Industrial Emissions Directive (IED).

The report also addresses specific topics of interest raised by national counterparts, including the reuse potential of treated wastewater and sewage sludge. Drawing on the available data, it identifies opportunities to enhance the performance and sustainability of existing wastewater treatment processes, as well as areas where targeted improvements can be made.

4 Country Overview

4.1 Geographic Overview

Armenia is a landlocked country located in the South Caucasus region of Eurasia. It shares borders with Georgia to the north, Azerbaijan to the east, Iran to the south and Turkey to the west. Despite its relatively compact area of approximately 29,800 km², Armenia features a complex and rugged topography that significantly influences its hydrological regime.

Around 75% of the country lies at elevations exceeding 1,500 metres above sea level, making it one of the most mountainous countries in the region. The country's climatic variability and terrain result in an uneven distribution of surface and groundwater resources. Annual precipitation levels vary significantly, with approximately 60% of Armenia receiving more than 600 mm, while 20% receives less than 200 mm, contributing to highly localised water availability patterns.[1]

Armenia does not have access to seas or oceans and thus relies exclusively on its internal freshwater resources, including rivers, lakes and aquifers, reinforcing the importance of sustainable freshwater and aquifer management. The nation is home to a dense but seasonally variable river network, comprising approximately 400 rivers longer than 10 kilometres. These watercourses are essential for domestic, agricultural and industrial water use.

For administrative and management purposes, Armenia is divided into six main River Basin Management Districts (RBMDs) under the national water governance framework: Akhuryan RBMD, Ararat RBMD, Hrazdan RBMD, Sevan RBMD, Northern RBMD and Southern RBMD[2] (Figure 1).

Each basin encompasses distinct hydrological features. The Akhuryan RBMD, located in the northwest, includes the Akhuryan River, a major tributary of the Araks River. The Ararat RBMD spans central and southern Armenia and includes the Araks River and its tributaries. The Hrazdan RBMD follows the Hrazdan River, which originates from Lake Sevan and flows through Yerevan, Armenia’s capital. The Sevan RBMD includes the basin area surrounding Lake Sevan, the largest freshwater lake in the country. The Northern RBMD, in the northeast, features steep terrain and dense forest cover and is traversed by the Debed River. The Southern RBMD includes two key tributaries of the Araks River: the Vorotan and the Voghji.

Figure 1: Map of River Basins of Armenia[8]

4.2 Institutional Roles and Responsibilities

Armenia is administratively divided into 11 regions, known as marzes, as illustrated in Figure 2. The governance of the water sector in Armenia is shared among several key institutions, with responsibilities split between policy, regulation, infrastructure management and service delivery.

The two primary ministries overseeing water-related functions are the Ministry of Environment and the Ministry of Territorial Administration and Infrastructure. The Ministry of Environment is responsible for formulating and implementing environmental policy, including water resource management, water policy, pollution control and water quality monitoring. It plays a central role in aligning national water governance with environmental protection objectives. The Ministry of Territorial Administration and Infrastructure is tasked with overseeing infrastructure planning and management, including water supply, wastewater treatment, irrigation systems and hydropower facilities. Within this ministry, the Water Committee operates as the executive government agency responsible for coordinating and regulating water infrastructure across the country.

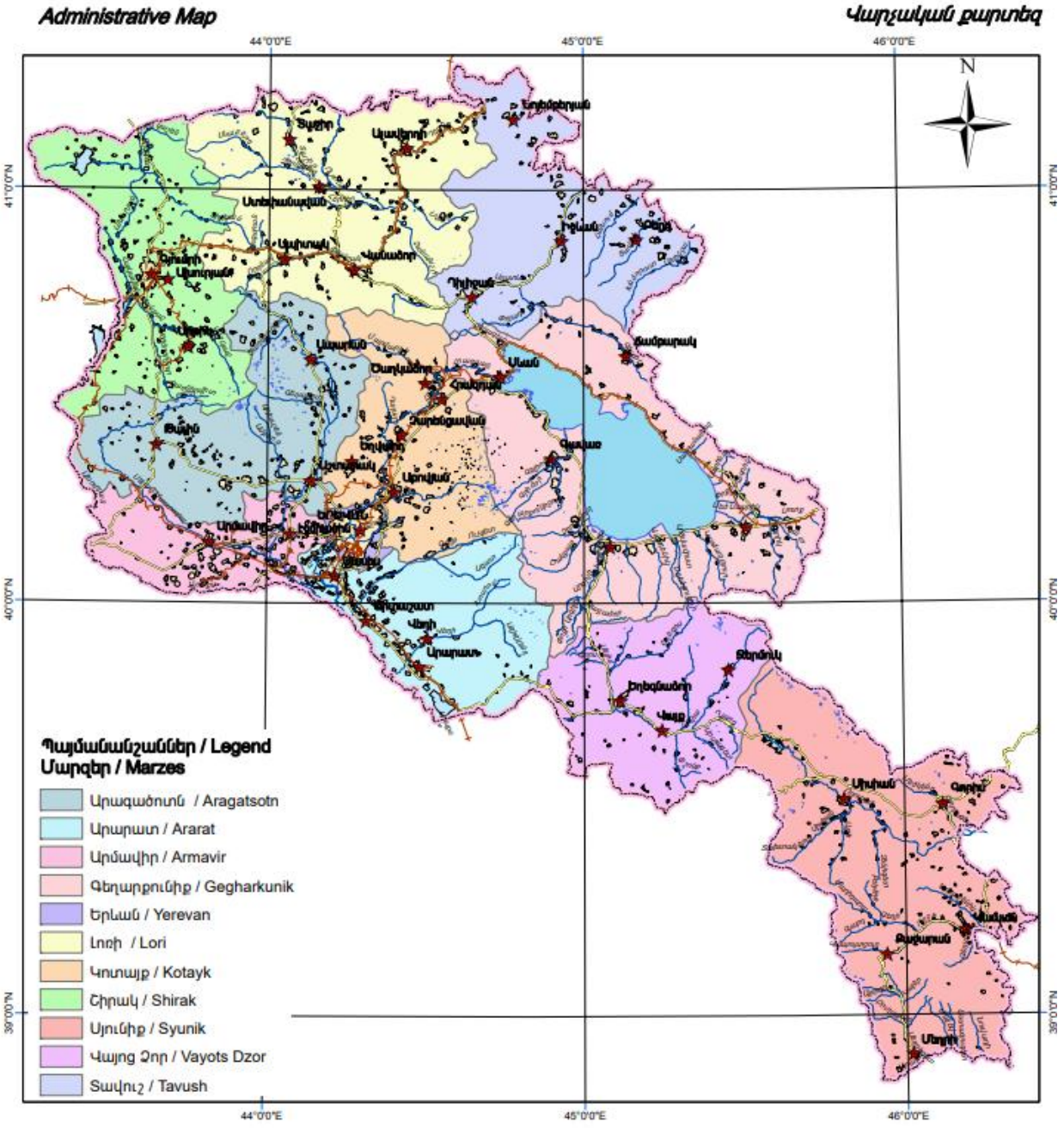


Figure 2: Administrative Regions (Marzes) in Armenia[8]

The Public Services Regulatory Commission (PSRC) of Armenia functions as an independent regulatory authority under the Government of Armenia. It regulates tariffs, service quality and compliance for public utilities, including water supply and sanitation services. Water quality monitoring and enforcement fall under the mandate of the Environmental Protection and Mining Inspection Body, an autonomous entity responsible for ensuring compliance with environmental and water quality regulations, including pollution control.[3]

Veolia Djur CJSC, a private water utility company, is the main service provider for water supply and wastewater services in Armenia. Since 2017, Veolia Djur has been contracted to provide

water services to 373 settlements, including 45 towns and 328 villages, covering approximately 73% of the national population. Out of these settlements, only 80 have wastewater infrastructure, and Veolia Djur is responsible for operating systems in 74 of them. The remaining settlements' systems fall under the administration of local self-government bodies (LSGBs). Between 1997 and 2017, water supply and wastewater networks were transferred to the control of LSGBs. However, many LSGBs, particularly in small or rural communities, lacked the technical and financial capacity to manage these systems effectively. This institutional weakness contributed to the deterioration and near-collapse of water and wastewater services in numerous settlements.[4]

4.3 Industrial and Other Economic Activities

The industrial sector plays a key role in Armenia's water demand profile. Water is used extensively in manufacturing processes, mining operations and thermal energy generation. According to 2021 data from UNIDO, Armenia's industrial landscape is dominated by the manufacturing sector, which comprises 2,845 registered establishments. The leading subsectors include food and beverage production.[9]

Armenia's industrial activity is heavily concentrated in the capital, Yerevan, which accounts for a substantial share of the country's overall manufacturing output. Additional industrial hubs include the cities of Gyumri and Vanadzor, particularly known for machine building, as well as the Kotayk, Ararat and Shirak regions, which also contribute significantly to national industrial production.[5] The Sevan catchment is of particular environmental concern due to a high concentration of industrial activity, which has resulted in elevated pollution loads entering Lake Sevan and threatening water quality and aquatic ecosystems.

A major challenge in Armenia's industrial water management is the widespread discharge of untreated industrial wastewater. A large number of industrial enterprises release effluent directly into municipal wastewater networks, irrigation canals, rivers, lakes or even boreholes drilled specifically for disposal.[4] These practices severely impair the functioning of wastewater treatment plants, contribute to groundwater contamination, pose risks to food safety and degrade aquatic and terrestrial ecosystems.

As of 2023, water use in Armenia was predominantly driven by the agricultural sector, including irrigation, fish farming and forestry activities. Other significant water-consuming sectors included mining and quarrying, manufacturing and energy production. A breakdown of water use by economic activity is presented in Table 1.

Table 1: Volume of Water Used by Main Types of Economic Activities (2023)[6]

Economic Activity	Volume of Water (million m^3)	Proportion of Water Use
Irrigation	1,488.1	51%
Fishing and fishery	733	25.1%
Minning and quarrying	63.8	2.2%
Manufacturing	14.2	0.5%
Electricity, gas, steam and air conditioning supply	15.7	0.5%
Water supply, sewage, waste management and remediation activities	596.3	20.4%
Other types of economic activities	6.5	0.2%

4.4 Population Overview

According to the most recent census data from 2022, Armenia's population is 2.96 million, distributed across 11 administrative regions. The capital city, Yerevan, alone accounts for over 1.09 million residents, or approximately 35% of the national population.[7] The breakdown of the population by administrative region is given in Table 2. Ararat, Armavir and Kotayk are among the most populous regions, with over 250,000 residents each. Vayots Dzor is the least populated region, with just 48,100 inhabitants. The combined population of the regions, excluding Yerevan, is approximately 1.87 million, indicating a high degree of urban concentration in the capital.

Table 2: Population by Administrative Region[7]

Administrative Region	Population
Aragatsotn	124,500
Ararat	256,600
Armavir	264,000
Gegharkunik	227,300
Kotayk	251,200
Lori	212,600
Shirak	231,000
Syunik	135,800
Tavush	120,500
Vayots Dzor	48,100
Yerevan	1,091,700
Total	**2,963,300**

The population is distributed across 1,003 settlements, comprising 49 cities and towns and 954 villages. As illustrated in Table 3, cities and towns host approximately 1.9 million people, while villages are home to about 1.07 million. This corresponds to an urban population share of 63.7% and a rural population share of 36.3%, reflecting Armenia's ongoing urbanisation trends. Despite the dominance of urban areas, a significant portion of the population still resides in rural communities. These rural settlements often face challenges related to limited access to centralised water and wastewater infrastructure, posing risks for environmental health and service equity. By contrast, urban centres, particularly Yerevan, tend to benefit from more advanced infrastructure but also generate higher volumes of wastewater, requiring robust treatment systems.

Table 3: Settlements of Armenia[4]

Type of Settlements	Number of Settlements	Population (in Thousands)
Cities and towns	49	1,896,100
Villages	954	1,070,700
Total	**1,003**	**2,966,800**

5 Wastewater Generation

5.1 Wastewater Volumes

According to the report on Environment and Natural Resources in the Republic of Armenia prepared by the statistical committee, the total volume of wastewater discharged in Armenia amounted to 721.9 million m³ in 2023. A substantial portion, 505.3 million m³ (70%), was considered clean according to national standards, even without undergoing treatment. The remaining 216.6 million m³ was polluted, of which 154.3 million m³ was untreated and the remaining 62.3 million m³ was partially treated.[6] The breakdown is illustrated in Figure 3. The proportion of wastewater treated is only 9% of the total wastewater generated in Armenia. The fact that only a minor share undergoes even partial treatment highlights a significant gap in treatment capacity and suggests heavy dependence on direct discharge rather than on actual wastewater processing. This indicates a system where existing treatment infrastructure is insufficient.

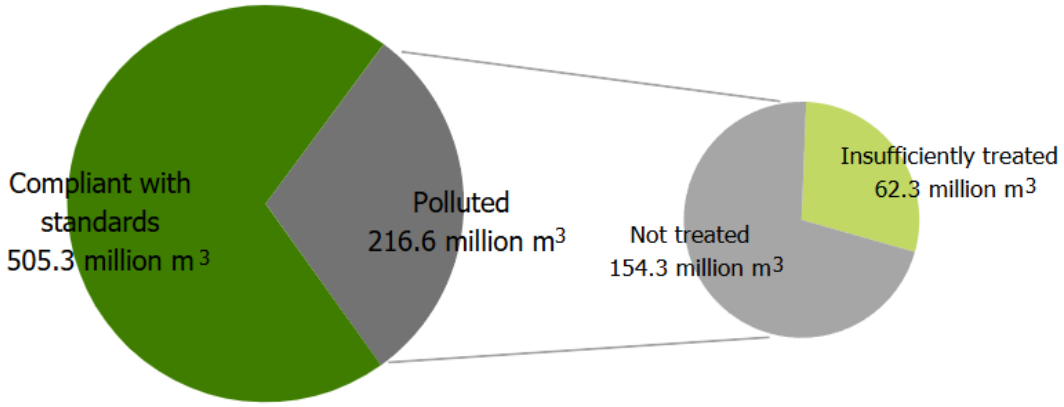


Figure 3: Breakdown of Wastewater Volume

A regional breakdown of the wastewater discharge is given in Table 4. It reveals that Ararat Province alone accounts for more than 52% of the national wastewater discharge, with a total of 374.9 million m³. Of this, over 76% was deemed clean, while 71.3 million m³ was discharged as polluted, untreated wastewater. Yerevan City, the capital and industrial hub, was the second-highest contributor, discharging 106.2 million m³, of which approximately 75% met the required effluent quality standards without any pretreatment, while 26 million m³ was polluted and untreated. Several other regions, despite having smaller discharge volumes, show a high proportion of polluted or insufficiently treated wastewater. Notably, Gegharkunik discharged 17.8 million m³, of which 15.4 million m³ (87%) was polluted and untreated. Kotayk released 15.6 million m³, with 14.6 million m³ (94%) classified as polluted. Syunik reported 42.8 million m³ of total discharge, including 38.6 million m³ of insufficiently purified wastewater. By contrast, regions such as Armavir and Shirak demonstrated relatively better performance, with the majority of discharged water either treated or meeting purity standards without purification.

Table 4: Regional Breakdown of Wastewater Discharge[6]

Region	Total Wastewater Discharged (million m³)	Polluted (without purification) (million m³)	Pure According to Standards (without purification) (million m³)	Insufficiently Purified (million m³)
Yerevan City	106.2	26	80.2	n/a
Aragatsotn	1.4	1.4	n/a	n/a
Ararat	374.9	71.3	285.7	17.9
Armavir	140.4	9.1	130.9	0.4
Gegharkunik	17.8	15.4	0.7	1.7
Lori	7.7	5.8	0.6	1.3
Kotayk	15.6	14.6	0.8	0.2
Shirak	2.3	0.8	0.9	0.6
Syunik	42.8	4.2	n/a	38.6
Vayots Dzor	5.2	4.6	0.1	0.5
Tavush	7.6	1.1	5.4	1.1
Total	**721.9**	**154.3**	**505.3**	**62.3**

Currently, there is no system in place for the quantitative or qualitative monitoring of industrial wastewater discharges into the wastewater network in Armenia. As a result, industrial and commercial enterprises discharge effluents into municipal systems, surface water bodies or underground basins without any oversight or regulation. In some cases, industrial wastewater is released directly into natural watercourses or aquifers, bypassing treatment facilities altogether.[4] This results in inconsistencies in the available data on wastewater volumes from different sources.

5.2 Sewer Network Connections

According to the Concept Paper for the Development of the Wastewater Sector of the Settlements of the Republic of Armenia, the total length of wastewater pipelines across Armenian settlements was approximately 4,174.3 km as of 2020. The network includes 690.9 km of sewer collectors, 2,900.9 km of street sewer lines and 582.5 km of inter-yard pipelines.[4] The majority of these sewerage systems were constructed over 50 years ago, and due to decades of insufficient maintenance, cleaning, repair and reconstruction, the infrastructure is now in a severely deteriorated condition. This degradation has led to high levels of infiltration and inflow, where groundwater and stormwater enter the sewer network through damaged or unsealed pipes. At the same time, wastewater frequently leaks out, contaminating surrounding soil and groundwater. The inflow of rainwater can also overwhelm the system's capacity during heavy rainfall or snowmelt, leading to frequent overflows and blockages.

In many urban areas, including Yerevan and Gyumri, stormwater and municipal sewer systems have been partially or fully interconnected, often without proper planning or approval from water utilities. This has created serious operational challenges, especially during torrential rains or periods of snowmelt, where the combined load leads to pipe overflows, street flooding, traffic disruption and sanitary hazards due to raw sewage reaching the surface.

Approximately 50% of Armenia's sewerage network requires full replacement, with the problem being especially acute in Yerevan and Shirak, where more than 80% of the sewer lines are considered obsolete.[5]

6 Wastewater Management

For the application of the EU Urban Wastewater Treatment Directive (UWWTD) 91/271/EEC, it is necessary to define the boundaries of agglomerations, as well as the receiving water bodies that are sensitive due to nitrogen, phosphorus or other factors, which in turn determine the required level of wastewater treatment. This is particularly relevant for agglomerations above the threshold of 10,000 p.e. Currently, Armenia has not yet defined the option under the UWWTD that it intends to apply for the sensitive areas; however, this forms part of the commitments under the Comprehensive and Enhanced Partnership Agreement (CEPA), which Armenia has agreed to implement in the coming period.

6.1 Wastewater Treatment

Since the data on treatment process lines were not available from the consulted sources for 2023, data from the Concept Paper for the Development of the Wastewater Sector, published in 2021, were used as a reference. These data indicate that, out of the 310 million m^3 of municipal wastewater generated in 2021, approximately 8% underwent only mechanical pretreatment, while about 92% was discharged without any treatment.[4]

In terms of sanitation access, urban areas exhibit relatively high coverage of sanitation facilities, yet 4% of the urban population still lacks access. The situation is markedly worse in rural areas, where 51% of the population relies on on-site sanitation facilities. Out of Armenia's 930 territorial units, approximately 830 lack sewerage services entirely, depending instead on on-site sanitation solutions.[5]

A significant concern is that many of the on-site sanitation facilities are poorly managed and unregulated, with some systems discharging directly into nearby surface water bodies or even groundwater aquifers. In parallel, a considerable portion of industrial and commercial establishments remain unconnected to sewerage networks, releasing untreated effluents directly into surface or groundwater bodies.[4] This represents a major environmental and public health risk, especially in areas where groundwater is used for drinking or irrigation. The pollution load associated with these discharges is neither consistently measured nor effectively monitored, due to the absence of a robust industrial wastewater tracking system. This data gap significantly undermines planning, regulation and investment decisions and limits the country's ability to develop targeted interventions for pollution reduction and improved water resource management.

6.2 Wastewater Treatment Plants

According to data provided by the State Water Committee, six municipal WWTPs are currently operational in Armenia. These facilities are located in the cities of Gavar, Martuni, Vardenis, Jermuk, Dilijan and the capital, Yerevan. However, all six plants are limited to only mechanical pretreatment processes, which are insufficient for removing nutrients and organic pollutants to meet environmental discharge standards.

Five WWTPs (Gavar, Martuni, Vardenis, Jermuk and Dilijan) are equipped with preliminary mechanical treatment consisting of coarse screens, fine drum screens and grit and grease removal aeration chambers with screw presses, while the Aeratsia WWTP in Yerevan conducts

only preliminary mechanical treatment via coarse screening. This means that these treatment plants achieve a level below primary treatment, as defined in the UWWTD. In addition, Armenia's only facility providing a biological lagoon system (likely corresponding to a treatment level close to the UWWTD secondary treatment) is a decentralised community-level WWTP located in the Parakar community, which treats 0.13% of the country's total wastewater generated (310 million m³/year).

The total nominal treatment capacity of these six centralised WWTPs is 666,528 m³/day. However, the actual volume of wastewater treated is significantly lower, at 196,024 m³/day, representing less than 30% of the total design capacity. The nominal treatment capacity of the Aeratsia WWTP is 600,000 m³/day, representing 92% of the total nominal capacity of all six WWTPs. However, the actual treatment load is only about 30% of its capacity. As the Aeratsia WWTP is the largest facility and currently treats around 92% of the wastewater that undergoes treatment in the country, any disruption would pose a significant operational risk. At the same time, this plant exhibits the weakest treatment performance, as it consists only of coarse screening. Detailed capacities and energy consumption for each WWTP are presented in Table 5.

The specific energy consumption of Armenia's WWTPs is relatively low, as all facilities employ only mechanical pretreatment processes. When compared with the international benchmark for energy use in mechanical treatment, all plants operate well below the threshold of 0.1 kWh/m³. The Aeratsia WWTP in Yerevan exhibits significantly lower energy consumption than the other facilities. This is likely because it relies solely on a coarse screen, whereas the other plants utilise additional equipment such as fine drum screens and grit and grease removal systems, which require more energy.

Table 5: Wastewater Treatment Plant Capacities (Source: Water Committee)

WWTPs	Nominal Capacity (m^3/day)	Current Capacity (m^3/day)	Current Capacity in %	Energy Consumption (kWh/m^3)
Aeratsia	600,000	180,210	92	0.0069
Gavar	19,008	1,970	1	0.0243
Martuni	9,504	2,120	1.1	0.0215
Vardenis	9,504	5,381	2.75	0.0803
Jermuk	9,504	2,153	1.1	0.0250
Dilijan	19,008	4,190	2.14	0.0192

In addition to the centralised systems, Armenia operates a community-level decentralised WWTP in the Parakar community, the only facility in the country that provides both mechanical pretreatment and a lagoon system. Located approximately 12 kilometres from the capital city,

Yerevan, Parakar is considered one of the leading communities in the region, with a population of around 2,500 households and a well-developed infrastructure. Currently, 60% of the community is connected to a sewerage network. The treatment system in Parakar utilises lagoon-based technology. This technology allows for the treatment of domestic wastewater to irrigation-quality standards, enabling the reuse of treated effluent for agricultural purposes. The facility consists of two main components: a biological lagoon with an operational capacity of 5,350 m³ and a sedimentation lagoon with a capacity of 112 m³.

In an urban context, the usual approach has been to collect rainwater runoff together with wastewater. Increasing variability in rainfall and rainfall intensity has led many European countries and cities to develop separate sewer systems and reduce impervious areas in cities as much as possible, while managing rainwater through a set of nature-based solutions such as infiltration ponds, rain trees and rain gardens. Most soils are able to infiltrate water from typical rainfall events, allowing rainwater to be managed locally with various benefits, including the creation of green spaces, reduced heat in summer and enhanced biodiversity, while also reducing the burden on the sewer networks and the WWTPs. Many of these techniques require mainly some hydraulic adjustments for rainwater collection and gardening competences that are often already available within municipal services.

The introduction of separate sewer systems is recommended, as rainwater does not require treatment and diverting it from the wastewater network can significantly reduce hydraulic loads and lower operational costs. However, current observations, as shown in the subsequent chapter on wastewater composition, indicate that infiltration into the sewer network is substantial, resulting in highly diluted influent. This would likely create operational difficulties for future biological treatment processes, which require sufficient organic load to function effectively. Therefore, measures to reduce infiltration should accompany any long-term planning for sewer separation and treatment system upgrades.

It should also be noted that, particularly in rural areas where sufficient space is available, nature-based solutions for treating urban wastewater could be an interesting option, as they require less complex infrastructure and are generally easier to maintain. Various types of constructed wetlands can be used, such as combinations of anaerobic pretreatment (baffled reactors or septic tanks) with horizontal or vertical flow reed beds, vertical flow reed beds combined with secondary vertical or horizontal flow reed beds or a set of natural or aerated lagoons. A polishing pond can also be used as a final stage of treatment.

A general approach to identifying locally suitable nature-based solutions, such as constructed wetlands for wastewater treatment or rain gardens and other runoff management solutions, is available in the *Catalogue of Nature-based Solutions*, published by the EU4Environment – Water and Environmental Data Programme in 2024.[56]

Under the current EU4GRE project, a regional framework note for the implementation of nature-based solutions is expected to provide guidance on implementing such projects, particularly for wastewater treatment. This note will be developed in the coming year.

6.3 Wastewater Composition

Available data on influent and effluent quality across multiple sampling points in Armenia's wastewater treatment systems reveal limited pollutant removal efficiency. Monitoring is conducted for biochemical oxygen demand (BOD) and total suspended solids (TSS) at the inlet and outlet of all WWTPs, while parameters such as chemical oxygen demand (COD) and nutrients (total nitrogen and total phosphorus) are measured only at the Aeratsia WWTP (Table 6).

Table 6: Pollutant Levels at Inlet and Outlet of the WWTPs (Source: Water Committee)

WWTP		Aeratsia	Gavar	Martuni	Vardenis	Jermuk	Dilijan
BOD (mg/L)	Inlet	101.6	100	93	16	63	102
	Outlet	92.74	89	82	14	60	90
TSS (mg/L)	Inlet	127.04	87	69	26	58	72
	Outlet	117.15	77	59	22	54	63
COD (mg/L)	Inlet	241.52					
	Outlet	201.99					
Total Nitrogen (mg/L)	Inlet	5.32					
	Outlet	5.01	11.3 (ammo-nium)	1.9 (ammo-nium)	2.6 (ammo-nium)	10.2 (ammo-nium)	7.5 (ammo-nium)
Total Phosphorus (mg/L)	Inlet	0.45					
	Outlet	0.44					

On the other hand, the composition of domestic wastewater is typically characterised by the following pollutant concentrations:

- BOD_5 = 300 mg/L
- COD = 600 mg/L
- Ntot = 55 mg/L
- Ptot = 7.5 mg/L

The pollutant concentrations presented in Table 6 indicate that a significant dilution of wastewater occurs in Armenia. According to Guidance No. 9 ÖWAV [9], the dilution factor A can be calculated using the following formula:

$$Dilution\ factor\ (A) = \frac{C_{Standard}}{C_{Inlet}}$$

Example for BOD_5 = 300/101 ≈ 3

The calculated wastewater production per p.e. would correspond to an extraordinarily high water consumption of 600 L/p.e./day.

According to Guidance No. 9 ÖWAV[9], wastewater production can be calculated by multiplying the standard wastewater production of 200 L/p.e./day by the calculated dilution factor:

200*3 = 600 L/p.e./day

According to Guidance No. 9 ÖWAV[9], such a high dilution factor (approximately 3) may be attributed either to exceptionally high specific water consumption (exceeding 200 L/p.e.*day), groundwater infiltration or pollutant degradation occurring due to readily biodegradable organic matter within the sewer network. The results suggest significant infiltration.

The BOD/COD ratio (approximately 0.4, based on ~95 mg/L BOD and ~240 mg/L COD) is typical for domestic wastewater. This means the wastewater is still biodegradable but is too diluted for efficient biological treatment. Addressing infiltration in sewer network should therefore be considered a priority in any future planning for biological wastewater treatment

Overall, the operational efficiency of the WWTPs remains significantly constrained, primarily due to the absence of biological treatment processes. BOD and TSS removal rates average around 10%. At the Aeratsia WWTP, nutrient removal efficiency is also minimal, with reductions of approximately 1–2% for total nitrogen and phosphorus.

The concentration of heavy metals, specifically cadmium, lead and nickel, was measured at the Aeratsia WWTP and found to be 0.0031 mg/L in total, which is not considered significant in terms of toxicity for reusing water for irrigation purposes. However, the lack of consistent heavy metal monitoring across other facilities represents a data gap that may mask localised risks. Overall, the data reflect minimal to no significant reduction in organic matter, nutrients or suspended solids, confirming that the treatment processes employed are not sufficient for achieving environmental discharge standards.

6.4 Wastewater Disposal

Treated effluent from all centralised wastewater treatment plants in Armenia is primarily discharged into nearby rivers. The only exception is the lagoon-type WWTP in the Parakar community, where treated wastewater is reused for irrigation, providing a localised example of safe and beneficial reuse of treated water in agriculture. This highlights the limited implementation of water reuse practices across the country, despite their potential to reduce pressure on freshwater resources and support sustainable agricultural activities.

6.5 Sludge Management

Currently, wastewater treatment plants in Armenia do not implement active sludge removal through primary settling or biological treatment processes. The only waste generated from treatment operations consists of screen refusals, as well as grit and grease. At the Aeratsia WWTP in Yerevan, approximately 6.4 tonnes of screen refusals are produced daily from the treatment of 180,210 m^3 of wastewater. By contrast, the other plants generate less than 1 tonne of debris and screen refusals per day. This significant difference is primarily attributable to the

much larger volume of wastewater treated at the Aeratsia facility. This highlights the limited scope of waste handling within the current WWTP infrastructure. The waste is normally stored onsite within the plant premises or disposed of in landfills.

6.6 Opportunities for Improvement

At present, the six operational WWTPs function far below their intended capacity, treating less than 30% of their original design load. This situation is largely linked to the deteriorated sewerage network, which limits the effective collection of wastewater to the treatment facilities. Therefore, rehabilitation and replacement of sewer lines appear to be the highest priority intervention.

Currently, the WWTPs provide only mechanical pretreatment, which yields minimal improvements in effluent quality. Without primary sedimentation and biological treatment steps, the removal of organic pollutants and nutrients is inadequate. As a second priority, strengthening the process lines to include conventional biological treatment is essential for achieving compliance with environmental discharge standards and providing the minimum conditions necessary for potential treated water reuse.

Within the framework of the EU4GRE programme, emphasis was originally placed on enhancing energy efficiency and exploring opportunities for energy recovery, including through by-product valorisation such as biogas production. However, in the Armenian context, the absence of biological treatment also means that sludge generation is negligible. As a result, there is currently no viable pathway for sludge-based energy recovery. Instead, the most realistic and impactful measures lie in strengthening WWTP management—including improving operational practices, enhancing monitoring and building staff capacity—to ensure that existing facilities operate reliably and are prepared for future upgrades.

6.7 Situation Reported and Actions Listed in the RBMPs

The following text provides an overview of the various River Basin Management Plans (RBMPs) adopted and the measures identified to reduce impacts from wastewater sources:

1) The **Akhuryan RBMP** was developed as a pilot in 2016. It indicates a population of 548,000 inhabitants (as of 2011), distributed across six urban and 253 rural communities, and identifies key economic sectors, including food industry, light industry, mining, hydropower and fish farming. The RBMP estimates that 158 million m³ of drinking water and 66 million m³ of industrial water is consumed annually. As sewer networks are not operational and there are no treatment plants, the generated wastewater is discharged into rivers.

   The RBMP lists the following measures to be implemented:

   - Construction of a new wastewater treatment plant for two identified agglomerations

   - Construction of the sewerage system

   In addition to these, about 100 communities have more than 500 inhabitants each, and the RBMP states that a feasibility study should be initiated to define which type of collection and treatment could be implemented.

   For industry and fish farms, the use of best available techniques (BAT) is recommended, including pretreatment and water recycling in construction material processing and closed

or semi-closed water systems for fish farms.

2) The draft second cycle of the **Ararat RBMP** for the period 2025–2030 indicates a population of about 178,000 inhabitants and five urban and 105 rural communities, as well as tourism, food industry, cement production, mining, hydropower and fish farming as the main water users. The RBMP estimates that 2.5 million m³ of wastewater is generated, and, as sewer networks are not operational and there are no treatment plants, this wastewater is discharged into rivers.

   The RBMP lists the following measures to be implemented:

   - Construction of a new wastewater treatment plant for four identified agglomerations
   - Construction of the sewerage system

   Beyond these, 92 communities have more than 500 inhabitants each, and the RBMP states that a technical and economic assessment should be initiated to determine viable alternative solutions for urban wastewater treatment. It indicates that biological ponds are already considered as the technical solution for five communities.

3) The draft **Northern RBMP** for the period 2025–2030 indicates a population of about 362,000 inhabitants in 2023, with the food industry and mining representing significant point source pollution pressures. The RBMP estimates 123 million m³ of wastewater is produced, but only 11 million m³ is discharged, as most wastewater is not collected. Furthermore, the plan indicates an annual discharge of about 9,000 tonnes of BOD_5, 13,600 tonnes of COD, 2,300 tonnes of total nitrogen and 465 tonnes of total phosphorus. The plan also notes that mining activities are a significant source of heavy metals and sulphates discharged into rivers.

   The RBMP lists the following measures to be implemented for seven identified agglomerations:

   - Construction of new WWTP(s)
   - Construction of the sewerage system
   - Rehabilitation of the wastewater network, including replacement of pipes and collectors
   - Environmental inspection controls on wastewater discharges to rivers

   Industry discharges into the existing sewer network, and it can therefore be assumed that this issue will need to be addressed together with the above, except for mining industry, which relies on tailings dams to store mining residues, one of which has leaks and will require specific action.

   Apart from these, 92 communities have more than 500 inhabitants each, and the RBMP states that a feasibility study should be initiated to determine which type of wastewater collection and treatment could be implemented.

4) The **Hrazdan RBMP** was adopted by the government in December 2022 and covers 2022–2027. It indicates a population of 1,604,000 inhabitants (as of 2011), including the capital Yerevan, 13 urban communities and 190 rural communities, as well as key economic sectors such as tourism, food industry, chemical and metal-processing industries, energy and water

distribution, construction and mining. About 1.302 billion m³ is discharged annually, of which 200 million m³ are domestic wastewater. Some sewer networks are in poor condition due to insufficient maintenance, while existing treatment plants are either non-operational or provide only limited mechanical pretreatment, which remains below primary treatment level.

The RBMP lists the following measures to be implemented for eight identified agglomerations:

- Construction of new WWTP(s)
- Construction of the sewerage system
- Rehabilitation of the wastewater network, including replacement of pipes and collectors

These agglomerations cover the main industrial activities generating significant volumes of wastewater; therefore, the above measures should also address industrial emissions.

In addition to these, 133 communities each have more than 500 inhabitants, and the RBMP indicates that a feasibility study should be initiated to determine which type of collection and treatment could be implemented.

5) The second cycle of the **Southern RBMP** was adopted by the Government for the period 2025–2030 and indicates a population of about 135,000 inhabitants, of which two-thirds are urban. It also identifies other key water users including tourism, small food industry, small non-food industry, fish farming, hydropower and mining associated with tailing dams in poor condition. While about 56 million m³ of drinking water are used, only about 9 million m³ is discharged annually, and urban areas, including small industrial activities, are mainly connected to sewer systems in poor condition and without treatment plants. The plan indicates an annual discharge of about 5,300 tonnes of BOD_5, 7,900 tonnes of COD, 1,400 tonnes of total nitrogen and 264 tonnes of total phosphorus.

   The RBMP lists the following measures to be implemented for three identified agglomerations:

   - Construction of new WWTP
   - Construction of the sewerage system
   - Rehabilitation of the wastewater network, including replacement of pipes and collectors

   These agglomerations gather the main industrial activities generating a significant amount of wastewater; therefore, the above measures should also address the industrial emissions.

   No measures for rural communities are mentioned in this RBMP.

6) The **Sevan RBMP** was adopted by the Government of Armenia in December 2022 and covers the period of 2022–2027. It indicates a population of 212,000 inhabitants (as of 2018) distributed across three urban and numerous rural communities. It also identifies key economic activities including tourism, food industry, textile industry, hydropower and mining. About 4.2 million m³ of domestic wastewater is discharged annually. In the absence of sewer networks across most of the territory, the majority of wastewater is either discharged into private sewage wells or is released into rivers. Only three treatment plants provide mechanical pretreatment, receiving the wastewater from nearby cities and then discharging it into rivers. A total of 14 agglomerations with more than 2,000 p.e. have been identified.

The RBMP lists the following measures to be implemented for three identified agglomerations:

- Extension or enhancement of the WWTP to tertiary treatment, including activated sludge treatment with nitrification and denitrification

- Construction of a new sewerage system to collect wastewater from nearby communities within an agglomeration perimeter

- Rehabilitation of the wastewater network, including replacement of pipes and collectors

These agglomerations include the main industrial activities generating a significant amount of wastewater; therefore, the above measures should also address industrial emissions.

In addition to these, for the remaining 11 agglomerations with more than 2,000 p.e., the RBMP proposes conducting a feasibility study to assess whether constructed wetlands would be suitable.

For all other smaller communities with more than 500 inhabitants each, the RBMP states that the most appropriate solution would be an innovative wastewater system with the separation of urine and faeces in twin pits, with greywater gardens used to treat the remaining wastewater.

In conclusion**,** all RBMPs identify poor conditions of sewer networks and treatment plants in large communities, poor sewer conditions and the absence of plants in most intermediate communities between 2,000 and nearly 10,000 p.e., and poor sewer conditions with no treatment plants in many smaller communities ranging from 500 to 2,000 p.e. There is also no scoping of rural areas with a p.e. below 500 inhabitants. While this situation is mentioned only in the Sevan RBMP, it is probable that most households are not connected to a nearby sewer and instead discharge their wastewater into private sewage wells or nearby ditches.

The food and beverage industry is the main sector discharging its wastewater into existing sewers without pretreatment, but all other economic sectors generally do the same. In the absence of a sewer system, untreated wastewater is discharged into nearby water bodies. As a consequence, all RBMPs require the rehabilitation and extension of sewer networks and rehabilitation or construction of WWTPs, reaching primary or up to tertiary treatment levels for larger agglomerations, as well as feasibility studies for other agglomerations above 500 p.e.

It is evident that this abundance of long-term water pollution creates enormous economic costs for the state and downstream water users, including agriculture, drinking water supply, recreation and tourism, as well as for public health and natural resources (see Figure 5 in Chapter 9.2.2).

7 Existing Legal and Regulatory Framework

7.1 National Laws and Regulations

7.1.1 Adherence to the EU Water Directive Framework (WFD, UWWTD, IED)

In Armenia, the following legislation establishes the government's priorities in the water sector:

- Law on Lake Sevan (2001)
- Water Code (2002)
- Water Users Associations and Federations of Water Users Associations (2002)
- Republic of Armenia Law "On Fundamental Provisions of the National Water Policy" (2005)
- Republic of Armenia Law "On the National Water Program" (2006)
- The respective river basin management plans (RBMPs)

Over the last 20 years, more than 200 by-laws and regulations have also been adopted. These documents were created to promote the sustainable use of surface and groundwater resources in Armenia and to support the establishment of integrated water resources management (IWRM), as well as the efficient use and allocation of water resources with the aid of economic instruments. Furthermore, these documents also require decision-makers to issue water use permits based on surveillance monitoring results to help manage the river systems of the country, while also meeting the needs of water users.

Most importantly, these laws are broad in scope and form an indispensable basis for water planning and management. However, after signing the Comprehensive and Enhanced Partnership Agreement (CEPA) with the European Union (EU) in 2017, Armenia made bold and time-bound commitments to align its legislation with EU law, in particular the Water Framework Directive (WFD). This led to corresponding updates to water sector legislation. The Water Code, for example, was updated in 2022 to reflect the main aspects of definitions and approaches of the EU WFD, including the concepts of surface water bodies, groundwater bodies, status of water bodies and water bodies at risk.

In order to achieve good status for water bodies, programmes of measures must be put in place. Many of these measures relate to sanitation and wastewater treatment and are often implemented as part of the UWWTD or the Industrial Emissions Directive (IED).

However, there are major gaps between Armenian water sector legislation and the EU water acquis. For example, the objectives and scope of the RBMPs differ significantly within the Armenian legal context. This issue will need to be analysed in detail during the project. In addition, certain important elements of the UWWTD, Floods Directive, Drinking Water Directive and Nitrates Directive have not yet been incorporated into the Water Code of Armenia. During the inception phase of the EU4Green Recovery East Programme, the Ministry of Environment therefore requested that a short analytical document be developed to investigate the merits of adopting new Water Code for Armenia.

The coverage of the following two sections is illustrated in Figure 4.

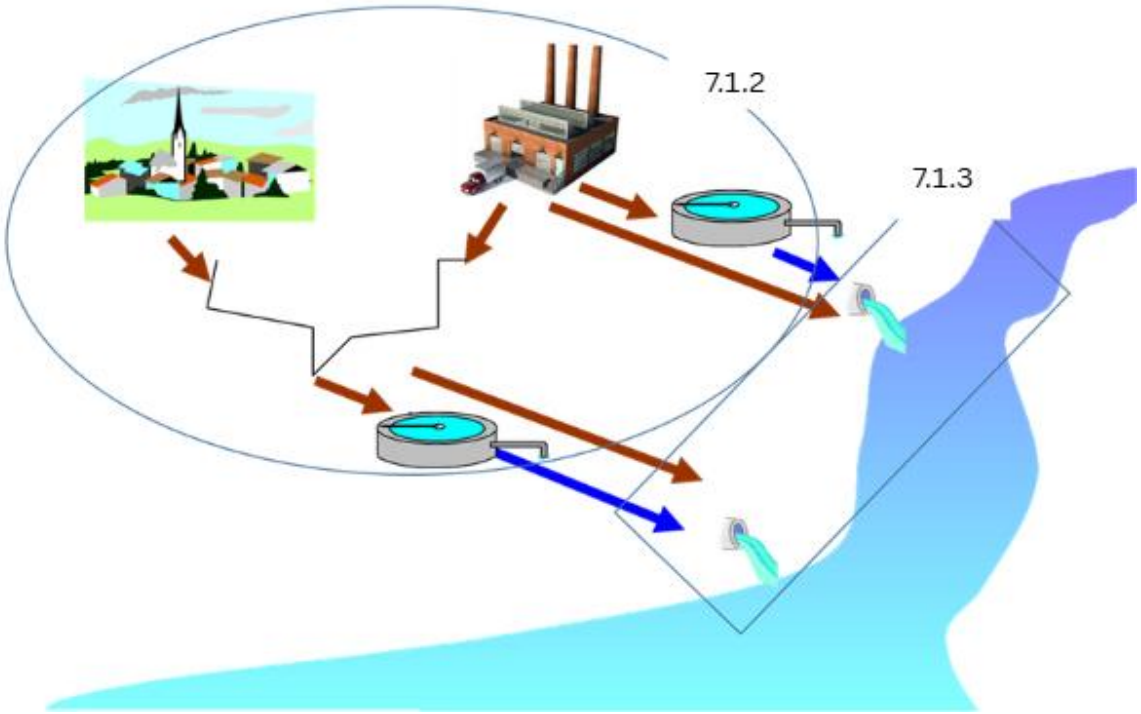


Figure 4: Illustration of Discharge into Sewer and Aquatic Environments (7.1.2) and Discharge into Surface Water Bodies or Groundwater (7.1.3).

7.1.2 Discharge Permit Requirements for Industries and Other Economic Activities – Into Sewer and Aquatic Environments

Armenia is revamping discharge permitting in a bid to protect its scarce water resources and to align with EU standards, while dealing with the legacy of the Soviet Union.

Armenia's Ministry of Nature Protection issued Decree N464-N (10 December 2003), which sets the legal framework for establishing the maximum allowable quantities and concentrations of pollutants permitted in surface and other water sources without violating environmental regulations. It governs all classes of discharge agents (industrial plants, utilities and other service providers) and requires the Ministry of Environment to apply the method set out below to determine permissible discharge limits for each point of discharge.

The most basic goal of the decree is to maintain the water quality and public health by ensuring that pollutant concentrations at the downstream control point remain at or below regulatory limits after mixing. To achieve this, a mass balance technique is used that balances effluent characteristics and the condition of the receiving water body. Critical inputs include maximum effluent flow, the pollutant's permitted concentration, the flow regime of the river, cross-sectional and hydraulic parameters relevant for mixing, background (pre-discharge) concentrations and the natural dilution and self-purification capacity of the water body.

In line with the environmental behaviour of pollutants, separate formulas are provided in the decree. Separate calculation pathways exist for persistent pollutants—those with accumulative mechanisms—and for degradable pollutants, which are chemically or physicochemically attenuated, as well as for integrative variables such as biochemical oxygen demand (BOD). For degradable pollutants, decay or transformation rates can be considered, whereas for

conservative pollutants, the method focuses on dilution and background concentrations. The dilution factor is calculated from hydrological data and the configuration of the outfall design, with full consideration given to the distance between the discharge and the control point, allowing for mixing in both the near field and far field. Seasonal accommodations are also included to account for the hydraulic and reaeration impacts of ice-covered winter conditions, ensuring continued protection of limits throughout the year.

The Ministry of Environment interprets these calculations at an administrative level through permits that limit pollutant concentration and mass load. The decree also includes a precautionary rule: if an installation's actual or projected discharge flow is less than the calculated maximum permissible value, then the lower (stricter) figure becomes binding for the design.

OiEau cooperates with Armenia to create regulations that are easier to implement locally while aligning with the EU requirements. Armenian experts were provided with a note relating to this item and views were exchanged on it.

The document sets out wastewater requirements for activities equivalent to domestic use, as well as for industrial sites, covering discharge limits, pretreatment, monitoring and connection to urban wastewater standards. Domestic equivalent uses include drinking, washing, personal hygiene and cleaning buildings. Restaurants are identified as heavy polluters because cooking and dishwashing water contains detergents, surfactants, oils and fats, while organic residues can produce hydrogen sulphide and methane. Cleaning and sanitary water eliminates dissolved oxygen and increases suspended solids. The primary pollutants from restaurants are fats and oils; therefore, grease traps are required and must be periodically maintained—often via a service contract—and additional pretreatment or on-site systems may be required for large or off-network establishments. Local authorities may establish authorisation regimes for other sites with domestic types of pollution and may impose discharge agreements, particularly for sites managing specific micropollutants (e.g. hydrocarbons, cyanides, phenols, metals and biocides).

For example, each establishment (including tenants) must ensure and fund compliance with the regulatory framework. Discharges to public sewers must not exceed the limits for COD, BOD_5, nutrient, pH, suspended solids, heavy metals, hydrocarbons, fats, chloride or sulphate emission. Depending on circumstances, the utility may also set flow rate and flow capacity limits in accordance with treatment capacity. Ideally, direct discharges to receiving waters should achieve levels similar to those set out in the UWWTD, i.e. approximately 25 mg/L for BOD_5, 125 mg/L for COD or 37 mg/L for TOC, and 35 mg/L for total suspended solids. Phosphorus and nitrogen limits should also be implemented in areas sensitive to eutrophication. The document advises that direct discharge is considered a major concern, and that even small businesses can use individual treatment units to reduce discharges to such levels.

Pretreatment is required wherever necessary to meet the required limits. Impacted streams shall be routed through dedicated piping units sized to receive and retain flow and installed near the source. Such combinations include grease separation for food service and starch separation for vegetable processing, as well as screening and settling for wastewater from laundries. By contrast, dual solvent separations are used for dry-cleaning facilities, while disinfection and neutralisation are applied in medical laboratories. Decay tanks are used for short-lived radioactive effluents, and amalgam separation is used in dental offices to retain at least 95% of amalgam residues. The utility company may need to install additional facilities, request self-monitoring when flows are restricted and establish convenient sampling points. Each piece of equipment must comply with current standards for operation, maintenance and calibration.

Standards vary greatly depending on the industry, country and catchment and typically include limits for hydrocarbons, metals, fluoride, cyanide and phenols. Industrial effluents released directly into the environment must at least reach the required domestic wastewater treatment levels and comply with any other site-specific safeguards. Those discharged into a municipal sewer must not interfere with biological processing plants. Regulators are increasingly using mass-based daily or per-unit product caps, monthly averages, daily maxima and limits that are sensitive to analytical studies and treatment and feasible. For urban discharge, parameters such as COD, BOD_5, total suspended solids, nutrients and pH should be managed in the same way as urban wastewater.

Secondary treatment targets the reduction of BOD_5, COD or TOC, and suspended solids in accordance with the specified reference methods. Tertiary treatment involves reducing phosphorus and nitrogen, including size-sensitive levels and creating conditions for natural nitrogen depletion and low bioreactor temperatures. Quaternary treatment must achieve the removal of at least 80% of selected micropollutants derived from two substance groups in dry weather flow. Guidelines are provided for calculating the average removal across at least six measured compounds. For samples removed from the lagoon, the solvent is filtered and unprocessed suspended solids from these streams must not exceed 150 mg/L. A sampling compliance table determines the maximum number of non-conforming samples permitted per year to ensure reliable data. Overall, the document emphasises the importance of pretreatment and controlled discharges to public systems, minimises direct releases to the environment and aligns industrial and domestic activities with strict performance standards that can be enforced at any time.

7.1.3 Discharge Permits Requirements for Industries and Other Economic Activities – Into Surface Water Bodies and Groundwater

As explained in the chapter above, Decree N464-N also applies to wastewater discharge into surface water bodies and groundwater. OiEau works with Armenia to produce regulations that are better aligned with the UWWTD.

The suggestions set out a thorough framework for reviewing and improving Armenia's wastewater regulations, referencing well-established best practice guidelines from France and other European countries. Such a policy aims to promote the effective safeguarding of the environment, human health and water resources by establishing strict regulations, standards and procedures. This framework uses clear and concise definitions for all aspects of wastewater collection and treatment.

Furthermore, this framework involves classifying wastewater types, capacities, receiving environments, pollution loads and sensitive areas. These classifications would establish the basis for uniform regulation and enforcement. The design must meet the minimum performance requirements for wastewater treatment plants, establishing stringent threshold values for five key water quality standards: BOD_5, COD, suspended solids, nitrogen and phosphorus.

The framework focuses specifically on ecologically sensitive or eutrophic areas, where rigorous regulations will be imposed to reduce nutrient discharges and protect the environment. Facility owners are required to implement a specific monitoring and reporting system, such as strict self-monitoring schemes, regular sampling schedules and transparent and traceable operations.

The framework also includes specific procedures for laboratory analysis, including validation of tests, verification of results and prompt notification of non-compliance, environmental damage

or threats to public safety. Documentation requirements, including operational manuals and logbooks, ensure that the management and performance of wastewater facilities are constantly evaluated and that audits are carried out to improve their operation.

The framework adopts transparent compliance rules, including tolerances for the number of non-compliant samples and the sampling frequency. These rules ensure ongoing accountability and enable effective enforcement if a compliance threshold is exceeded.

The design and installation of sanitation systems are based on considerations of technological robustness, operational safety and flexibility in response to particular circumstances in the field, particularly with regard to regional environmental vulnerability or greater system capacity. Secondly, the document summarises the French environmental permit system and indicates how it could be adapted to the Armenian context. This includes a simplified authorisation procedure for environmentally sensitive activities, work affecting water resources and economic activities.

7.1.4 Regulations of Wastewater Reuse and Sludge Disposal and Valorisation

For abstraction, discharge and reuse, the 2002 Water Code governs prior authorisations and continuous quality control, while the 2014 Environmental Impact Assessment Law requires rigorous reviews for treatment plants, large-scale reuse schemes and sludge projects to mitigate risks.

In practice, wastewater treatment, wastewater reuse and sludge recovery are not yet implemented.

Further progress hinges on detailed national guidelines, investment in treatment and monitoring, stronger local implementation capacity and steady convergence with EU best practices to bolster water security and the circular economy.

7.2 Armenia's National Water Strategy

7.2.1 National Support for Alignment with the European Union Acquis

EU acquis convergence is strengthened through the incorporation of integrated water resources management (IWRM) in Armenia with respect to economic uses, social equity and ecosystem health. Decisions are structured according to the river basin, based on evidence-based status and pressure assessments and structured stakeholder engagement to determine objectives and measures. The modernisation of the 2002 Water Code and secondary legislation clarifies rules on drinking water, sanitation and reuse, pollution control, flood risk and technical standards, and institutional reforms define the mandates and coordination among the Ministry of Environment, the Water Committee (WC), basin organisations and local authorities.

Priority investments focus on water supply, wastewater and irrigation network rehabilitation, treatment, leakage control, smart metering, climate-resilient designs and are financed with public budgets, IFI loans and grants and selective public-private partnerships (PPPs). Water quality safeguards are based on strong standards, monitoring and source protection zones, incident response, transparency and open data. The economic tools—tariff reform, abstraction charges and effluent permitting—aim to recover costs while maintaining equity safeguards and demand-side conservation. Climate adaptation is mainstreamed through drought and flood management, ecosystem restoration and resilient operations.

Policy and institutional reforms based on the *Water and Irrigation Services Enhancement Programme (WISE)* Project target the following:

- reviewing and updating the legal and regulatory framework including, including wastewater aspects
- improving tariff and subsidy policies
- transforming the Water Supply Agency into a modern, customer-oriented service provider

These reforms are undertaken in cooperation with the Ministry of Territorial Administration and Infrastructure and its Water Committee, supported by capacity-building across national and local institutions and the establishment of a National Irrigation Centre of Excellence. The programme is carried out with the support of international partners—financed by the World Bank, AFD and backed by an EU grant: *Water and Agriculture Integrated Development for Armenia (WAIDA)* — and combines policy and institutional strengthening with targeted investments at the local level in rural water supply and sanitation and in the modernisation of critical irrigation assets to increase reliability, resilience and equitable access to services.

7.2.2 Planned and Ongoing Initiatives

Component 2 is the main funding source for rural WSS rehabilitation and expansion and includes the provision of piped water and wastewater services, hygiene promotion, sanitary toilets and safe wastewater disposal. Water sources (groundwater or existing reservoirs) will be confirmed in the course of project preparation to ensure water quality and reliable supply.

Component 4 relates to financing for projects, procurement, financial oversight, E&S compliance, studies and supervision.

Aligned with SDG 6, the WISE project combines resilient infrastructure with governance and service reforms tailored to Armenia's river basins.

The WISE Project implements key components of the national water strategy, including wastewater aspects.

The EU4Sevan+ launched in 2025 has the objective to improve wastewater treatment around Lake Sevan. Selected municipalities around Lake Sevan and in the connected river basins will be enabled to implement sustainable water and wastewater services, protecting water resources and enhancing climate resilience. In particular the project aims to work on an improved policy and regulatory framework for integrated water resource and municipal wastewater management.

7.3 EU Regulatory Framework on Wastewater Treatment

The UWWTD, adopted in 1991, was developed to prevent environmental contamination from urban wastewater and certain industrial (food and beverage industry) wastewater discharges and primarily regulates the collection, treatment and discharge of wastewater into rivers, lakes and coastal waters. It establishes minimum standards for the collection, treatment and discharge of wastewater from all urban agglomerations above specified population thresholds and fix specific rules to delineate some specific receiving areas called sensitive areas requiring more stringent treatment.

The Directive requires Member States to:

- Provide for the collection and treatment of urban wastewater in all agglomerations with a p.e. greater than 2,000
- Provide secondary (biological) treatment for the majority of urban wastewater and stricter treatment (tertiary—removal of nutrients) in sensitive areas susceptible to eutrophication
- Establish and enforce standards for the discharge of pollutants (BOD, COD, TSS, nitrogen, phosphorus and others)
- Track performance, publish results and report to the European Commission
- Control the disposal and reuse of sludge following treatment

The Directive therefore presents a legal roadmap, not only for meeting environmental requirements but also for modernizing infrastructure and establishing technical standards.

A revised UWWTD was adopted by the EU with new provisions on 1 January 2025, with the majority of the relevant requirements entering into force 1 August 2027. They must all be enacted by 31 July 2027. This revision extends the coverage level to include all agglomerations ≥1,000 p.e. requires collecting systems and secondary treatment by 2035 and introduces tertiary nutrient removal for all larger plants (≥150,000 p.e.) by 2039. It also requires quaternary treatment to eliminate micropollutants by 2045. The new Directive establishes extended producer responsibility, requiring pharmaceutical and cosmetic companies to finance most of the additional costs associated with micropollutant removal, and establishes an energy neutrality target for wastewater treatment plants serving ≥10,000 p.e. by 2045. It further strengthens monitoring and public health surveillance (e.g. pathogens), widens pollutant monitoring (PFAS, microplastics and micropollutants) and promotes water reuse and circularity, aligning the sector with the EU's zero pollution and climate goals.

7.4 Policy Gaps: EU and National Regulations

7.4.1 Sufficiency of current WW management regulations

Armenia's laws are broadly aligned with EU principles but remain incomplete and require full, binding transposition: specific deadlines, sensitive area designation and enforceable channels for compliance are missing. Coverage requirements are not uniform across all agglomerations above EU population equivalent thresholds and there is no consistent requirement for collection and secondary treatment for all agglomerations, with triggers for tertiary nutrient removal being under-specified. Monitoring and reporting mechanisms are less rigorous than EU norms in terms of frequency, laboratory capacity, data systems and monitoring, public access and reporting, reducing accountability. Permitting is insufficiently risk-based, with only minimal integration of BAT and cumulative basin impacts. Enforcement is still weak—there are few inspections, modest sanctions, haphazard enforcement and inconsistent monitoring—which leaves non-compliance unaddressed. Sludge policy lags behind the EU's circular approach, with very little guidance and few incentives for the safe reuse of sludge or energy recovery. River basin management plans lack sufficient authority to effectively guide permits, investments and operations. Institutional isolation has blurred the lines of accountability between environmental authorities, health institutions, utilities and municipalities. Public participation and transparency are intermittent, with restricted access to permits, performance metrics and risks. Finally, economic instruments do not reliably advance compliance or cost recovery, and infrastructure deficits widen the gap between legal intent and actual service delivery.

Armenia has committed itself to EU alignment under CEPA, yet the enforcement and monitoring of wastewater regulations remain uneven. The Water Code and its reforms have created a credible framework, but key EU provisions have only been partially transposed and timelines remain unclear.

7.4.2 Implementation and Enforcement of Current Policies

Specific sensitive areas have only recently been identified, and agglomerations' obligations to install compliant treatments remain insufficiently specified. Many towns do not have functioning plants, and many existing facilities operate below design capacity because they have been chronically underinvested in. Collection networks, maintenance regimes and treatment technologies are often insufficient to meet permit conditions.

Regulatory authorities have limited funding, inspection capacity and laboratory support. Outside of urban areas, monitoring and reporting are inconsistent, undermining verification and timely enforcement. Data systems supporting monitoring and enforcement are fragmented, reducing transparency and weakening the deterrent effect of sanctions. Overlapping responsibilities among environmental authorities, health institutions, basin bodies and municipalities slow responses to non-compliance.

Public participation is often procedural, with minimal influence and low awareness regarding complaint mechanisms. Donor-funded projects have improved equipment, digital reporting and pilot stakeholder engagement, but scaling up remains slow. Tariff gaps and limited investment capacity constrain the operations and upgrades necessary for compliance. Adoption of new technologies and sludge reuse practices is cautious and uneven.

Consequently, current policies fall short of EU standards. Closing this gap will require enforceable deadlines, stronger institutions, reliable financing, robust monitoring and meaningful public oversight. Monitoring and reporting could also rely more extensively on accredited self-monitoring tools with a national accreditation body and a shared information system with a clear data dictionary.

7.5 Information System relating to WW in Armenia

Decision-makers in Armenia require robust information to inform regulatory and operational choices, long-term planning, risk management and transparent communication with the public.

7.5.1 Collection of Information on WW

Water and environmental information are presently fragmented, which undermines the utility of data and hinders an effective and coherent policy response.

Within the institutional infrastructure, data are generated and accessed by different institutions, including the Ministry of Environment, the Ministry of Territorial Administration and Infrastructures, the Water Committee, the Hydrometeorology and Monitoring Centre and the Statistical Committee of Armenia. Information is often siloed within and across these institutions, with uneven standards and practices that complicate discovery, access and coordination. This fragmentation makes it difficult to obtain a comprehensive overview of environmental conditions or to respond rapidly to new and emerging challenges.

Furthermore, the absence of common standards for sharing, access and quality measurement of information impairs the efficient utilisation and recycling of data. In the absence of common

protocols, interoperable formats and clearly defined responsibilities, institutions struggle to integrate datasets, validate findings and translate evidence into policy. The result is duplication of effort, coverage gaps and reduced confidence in what constitutes an objective and fair analysis for public decision-making.

7.5.2 Key rules for Information System

With Armenia modernizing its environmental management systems and moving towards alignment with EU standards, there is an increasing national need to develop robust information systems for wastewater monitoring and control. Such systems are critical not only for regulatory compliance, but also for the practical management of resources, risk prevention, policy evaluation and public involvement. The reliability and effectiveness of these systems are contingent on transparent, enforceable rules regarding what information should be gathered, how it should be managed, who is responsible for it and how it should be made available.

7.5.3 Alignment with the UWWTD

Alignment with the UWWTD remains a challenge.

A coordinated national strategy is necessary. Such a strategy would establish uniform data governance across the public sector, set standards for data collection, metadata, interoperability and security and define responsibilities for data stewardship across the data life cycle. It would also incentivise capacity development across institutions to facilitate efficient data sharing and reuse, promote open-by-default principles where appropriate and establish mechanisms for regular cooperation between agencies. Through the alignment of practices and expectations, Armenia could transform dispersed datasets into an integrated information infrastructure that enables more effective planning, improved regulation, better risk management and a more informed public.

In sum, the path forward lies in building a cohesive framework that treats water and environmental data as a strategic national asset.

8 Key Challenges and Strategic Recommendations

The baseline assessment indicates that the current scope for implementing energy efficiency and energy recovery measures in Armenia's WWTPs is very limited. Meaningful opportunities for sludge treatment, valorisation and biogas production can only emerge after the treatment plants have been upgraded to include biological process lines that produce sufficient sludge. Similarly, potential initiatives for treated wastewater reuse will require higher effluent quality, which can only be achieved through such process enhancements, including specific tertiary treatments. Therefore, modernisation of treatment processes, particularly the introduction of biological treatment stages, should be prioritised before considering further energy-related interventions.

Given these conditions and according to the orientations of EU4GRE under Output 2.3, no suitable pilot sites are currently available for demonstrating proof-of-concept activities under Output 2.3.3. Instead, efforts should be directed towards Output 2.3.2, which focuses on comprehensive capacity building and awareness-raising among key stakeholders. The objective is to empower local actors to prepare and support subvention project proposals for wastewater treatment improvements.

Within the framework of the EU4GRE programme, the recommended approach is to strengthen the knowledge and technical competencies of personnel responsible for the management and operation of WWTPs. Planned activities under Output 2.3.2 will target various stakeholder groups, ranging from plant operators and municipal engineers to regional administrators and policymakers. For Armenia, the recommendation is to focus primarily on capacity-building programmes for decision-makers, as the operator training will not be beneficial in the absence of required infrastructure facilities. Workshops on the EU UWWTD will also form part of this initiative, supporting alignment with European standards and informing future regulatory development.

A training needs assessment will be conducted to tailor the capacity-building programme to the specific requirements of different stakeholder groups and to identify opportunities to optimise individual treatment processes, reduce energy consumption and improve effluent quality. To maximise effectiveness and inclusivity, capacity-building efforts should not be limited to national-level institutions. Representatives from local communities, LSGBs and municipal decision-makers should be actively engaged.

8.1 Policy and Regulations

In recent decades, Armenia has understandably prioritised drinking water distribution over sanitation. Given the challenges related to human health and environmental protection, as well as Armenia's commitment to the EU accession process, the country must now make sanitation one of its top priorities. Before implementing the requirements of the new UWWTD, Armenia must ensure that it meets all the requirements of the 1991 Directive, which is not currently the case.

This upgrade is all the more necessary given that human health is a fundamental prerequisite for sustainable economic activity, and there are signs that the current management of wastewater is already generating, or may soon generate, significant problems (e.g. current wastewater treatment plants produce very low levels of sludge and solid waste, while wastewater is frequently discharged from communities into irrigation systems, contaminating irrigation water

and creating health risks). It is therefore essential to implement treatment processes that enable the safe reuse of treated wastewater. Such treatment can also provide additional benefits, such as energy production and phosphorus recovery during sludge treatment.

It is also necessary to ensure that the legislative framework enables the implementation of these technical solutions, and to reform it where necessary.

As the new UWWTD includes both stricter requirements from the 1991 Directive (e.g. tighter limits on the pollution parameters) and an extension of its scope to smaller agglomerations, while also introducing requirements related to energy recovery, quaternary treatment and micropollutants, a phased approach is recommended. This approach should focus first on reducing organic matter and nutrients in larger agglomerations, while progressively addressing the broader scope of the Directive, including rural areas, energy and micropollutant removal.

A national prioritisation programme should be developed to consolidate the priority measures identified in the RBMPs, aggregate them and define a phased implementation strategy with clear national priorities for wastewater collection and treatment. In particular, the rehabilitation and expansion of sewer collection networks, together with the implementation of effective wastewater treatment systems, should be prioritised in order to provide a larger share of the population with adequate wastewater collection and treatment. This will lead to higher energy consumption and increased sludge production, which will require further refinement of the legal framework.

Capacity-building and technical support will also be needed to improve the situation.

This will raise the question of financing the improvement and construction of urban wastewater sanitation and treatment infrastructure. The price of water is a very sensitive issue in Armenia. If the country does not want to increase water prices, the only alternative is to finance the infrastructure through taxes, even though this may conflict with the principle of cost recovery.

9 Conclusion

This baseline assessment of Armenia's wastewater sector has documented the current state of infrastructure, treatment performance, regulatory frameworks and institutional arrangements. The findings reveal significant gaps between existing capacity and the requirements set by EU directives, particularly the UWWTD.

9.1.1 Critical Gaps in WW Infrastructure, Treatment and Governance

The country's six operational wastewater treatment plants provide only preliminary mechanical treatment, achieving minimal pollutant removal and operating at less than 30% of their design capacity. With 721.9 million m³ of wastewater generated annually, a very large discrepancy becomes evident when compared with estimated domestic wastewater production (with 2.96 million inhabitants and an average water use of 80 L/day per person, fully discharged as wastewater, total domestic wastewater generation would be approximately 86 million m³ per year), and only 8% of wastewater receiving pretreatment, the gap between current performance and environmental protection requirements is substantial.

Without biological treatment processes, BOD and TSS removal averages around only 10% and nutrient removal is virtually non-existent. The Aeratsia WWTP in Yerevan processes 92% of all treated wastewater in the country, creating a critical dependency on a single facility. Currently, the sewer collection infrastructure is in a deteriorated condition. Approximately half of the sewage network requires complete replacement. This deterioration causes extensive infiltration and system overflows, particularly during rainfall events. The absence of systematic monitoring for industrial discharges further compounds water quality challenges, as untreated industrial effluents enter municipal systems or discharge directly to receiving waters without oversight.

Reducing infiltration in the sewer network and progressively converting combined sewers into separate systems should therefore be prioritised in future planning for biological wastewater treatment. Such measures not only help maintain sufficient influent strength for stable biological processes, but also reduce unnecessary hydraulic loads, making the overall system more efficient and cost-effective to operate.

Armenia's regulatory framework demonstrates partial alignment with EU directives through the Water Code and recent amendments, yet significant gaps remain in binding implementation timelines, sensitive area designations and enforcement mechanisms. Institutional responsibilities are distributed across multiple ministries and agencies with limited coordination, while many local self-government bodies lack the technical and financial capacity for effective service delivery. The sanitation coverage gap between urban areas (96%) and rural areas (49%) reflects these institutional and infrastructure challenges.

It is also important for the Government to regularly monitor progress in the implementation of RBMPs in order to assess progress and benefits, as well as remaining gaps and shortcomings, including in reducing wastewater pollution, which continues to be a significant burden on the national economy. RBMPs should therefore be reviewed every six years, with updated plans prepared and formally adopted. These are addressed by EU4GRE under Output 2.1.

9.1.2 Recommendations by the EU4GRE programme

Given the current conditions, meaningful opportunities for energy efficiency improvements, sludge valorisation or biogas production under Output 2.3.3 of the EU4GRE Programme are not

currently available. The specific energy consumption of existing WWTPs reflects the simplicity of mechanical treatment rather than optimisation potential. Priority must therefore be given to rehabilitating collection networks and introducing biological treatment processes before advanced resource recovery becomes feasible.

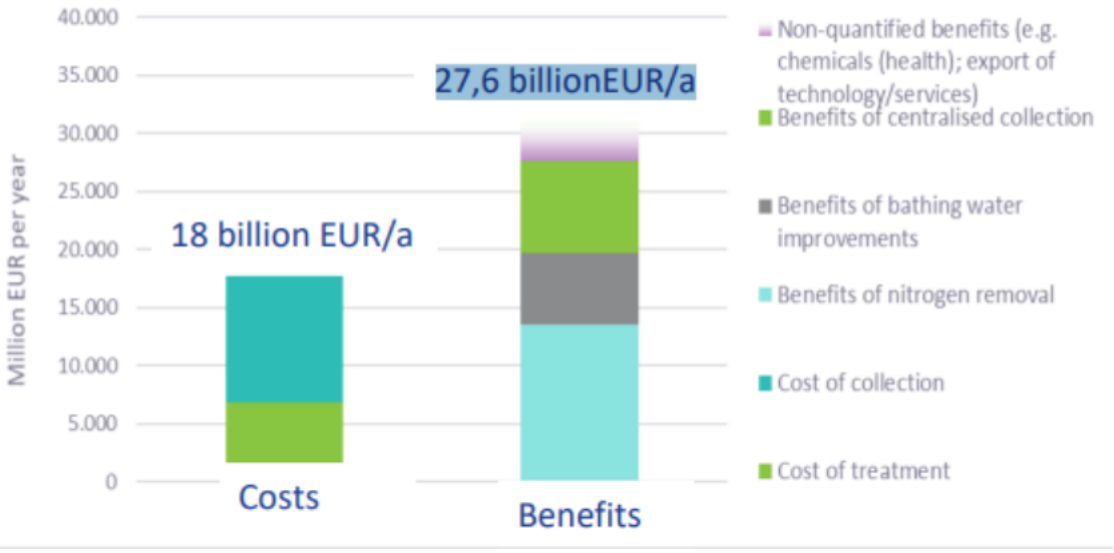
The EU4GRE Programme redirects efforts towards comprehensive capacity building under Output 2.3.2. The focus should be placed on decision-makers and policymakers rather than plant operators, as training on operational improvements will not be beneficial without the necessary treatment infrastructure. Capacity building will support compliance with the EU UWWTD, the development of fundable project proposals for treatment system upgrades and the strengthening of stakeholder competencies in planning and regulatory development.

A general approach for local decision-makers in Armenia on how to find a locally suitable nature-based solution, such as a constructed wetland for wastewater treatment, is available in the *Catalogue of Nature-based Solutions* published by the EU4Environment – Water and Environmental Data Programme in 2024 (also available in Armenian).[56] Under the current EU4GRE project, a regional framework note for the implementation of nature-based solutions will be developed in 2026 and is expected to provide guidance on implementing such projects, particularly for wastewater treatment.

Regarding policy and regulation, Armenia must prioritise sanitation alongside its historical focus on drinking water supply. Before implementing the requirements of the new 2024 UWWTD, the country must first ensure full compliance with the 1991 Directive. A phased approach is recommended, focusing initially on organic matter and nutrient removal in larger agglomerations while progressively establishing frameworks for smaller settlements, energy recovery and micropollutant control in subsequent phases. The financing challenge—balancing infrastructure investment needs with water tariff constraints—also requires careful consideration, as tax-based financing alone may not be sustainable in the long term.

It is clear that the lack of comprehensive wastewater collection and proper treatment in Armenia leads to major direct and indirect economic damage to public health and the environment. Experience across the EU in implementing the 1991 UWWTD shows that the economic benefits of compliance significantly outweigh the costs of capital investment and system maintenance. Annual costs are estimated at around EUR 18 billion, while the benefits amount to approximately EUR 27.6 billion (Figure 5).

Figure 5: Comparison of Annualised Benefits and Costs at Current Implementation Levels (Source: COMMISSION STAFF WORKING DOCUMENT, Brussels, 13 Dec. 2019)



9.1.3 Path Forward

Transforming Armenia's wastewater sector requires sustained commitment across multiple dimensions. Immediate priorities should focus on participation in capacity-building programmes, completion of the regulatory framework and detailed investment planning. Medium-term actions should scale up infrastructure development, introduce biological treatment at major WWTPs and establish systematic monitoring of industrial wastewater discharges. Long-term objectives should ensure comprehensive access to improved sanitation, full compliance with the EU UWWTD, including energy and resource recovery and the integration of circular economy principles.

Success will require coordinated action among government agencies, utilities, local authorities, civil society and international partners. The EU4Green Recovery East Programme provides crucial technical assistance and capacity-building support, while major infrastructure investments will depend on mobilizing domestic and international financial resources through programmes such as WISE and WAIDA and potential future initiatives.

This baseline report establishes the evidence base for these interventions by documenting current conditions, identifying critical gaps and proposing strategic priorities. The path to sustainable wastewater management is clear, although challenging. Armenia's commitment to EU alignment and sustainable development provides the political foundation for this transformation.

10 Sources

1. World Bank Group. (2018). *Modernizing Weather, Climate and Hydrological Services: A Road Map for Armenia*. Washington, D.C.: World Bank Group. https://www.worldbank.org

2. EU4Environment Water and Data Programme. (n.d.). *River Basin Management in Armenia*. EU4WaterData. https://eu4waterdata.eu/en/where-we-work/armenia/water/river-basin-management.html

3. World Bank. (2023). *General Water Security Assessment: Armenia*. World Bank. https://www.worldbank.org/en/topic/water/publication/water-security-diagnostic-initiative

4. Mesropyan E. (2022). *Concept Paper for the Development of the Wastewater Sector of the Settlements of the Republic of Armenia.* Environmental Protection of Lake Sevan Project (EU4Sevan).

5. OECD Environment Directorate (2024). *Assessing the Enabling Conditions for Investment in Armenia's Water Security: Scorecard Pilot Test*. https://dx.doi.org/10.1787/be989b9c-en

6. Armstat (2023). *Environment and Natural Resources in Armenia Eco Book 8 - Water Use and Discharge*. https://armstat.am/file/article/eco_book_2023_8.pdf

7. Statistical Committee of Armenia. (2022). *Population Census 2022*. https://armstat.am/en/?nid=743

8. EU Environmental Protection of International River Basins Project. (2012-2016). https://capacity4dev.europa.eu/groups/env-east/info/project-environmental-protection-international-river-basins-epirb-2012-2016_en

9. ÖWAV (2000). *Kennzahlen für Abwasserreinigungsanlagen. Teil 1: Ablaufqualität – Bewertung und Beurteilung (ÖWAV-AB 009)*.

10. United Nations Industrial Development Organization. (n.d.). *INDSTAT Dataset (Revision 3) – Armenia*. https://stat.unido.org/data/table?dataset=indstat&revision=3&country=051

11. Acopian Centre for the Environment, American University of Armenia. (2023). *Water Sector Political Economy Analysis (PEA) for USAID/Armenia Improved Water Management Program*. Prepared for Deloitte Consulting and USAID/Armenia. Unpublished report.

12. Ministry of Environment of Armenia. (2024–2025). *Additional notes on Water Code amendments and implementation (riverbed cleaning, Ararat Valley restrictions, permit procedures)*.

13. Republic of Armenia. (2009). *National Water Program of the Republic of Armenia (Annex: Phased Program of Measures for Implementation of the National Water Program)*.

14. Ministry of Environment of the Republic of Armenia. (2024–2025). *Notices on Permits, Metering and Ararat Valley Controls*.

15. Brief Analysis (n.d.). *New Water Quality Standards of Armenia*. Unpublished report.

16. Republic of Armenia. (n.d.). *Concept for a National Water Strategy*. Unpublished report.

17. European Union. (1991). *Council Directive 91/271/EEC of 21 May 1991 Concerning Urban Waste-Water Treatment*. Official Journal L 135.

18. Republic of Armenia. (2003, December 10). *Decree N464-N on Maximum Permissible Pollutant Quantities/Concentrations in Water Bodies*.

19. United States Agency for International Development (USAID) *&* Deloitte Consulting LLP. (2023). *Water Governance Gap Analysis (Legal, Policy, Institutional): Armenia Improved Water Management for Sustainable Economic Growth, Objective 2*.

20. European Union. (2024). *Directive (EU) 2024/3019 concerning urban wastewater treatment (recast).*

21. European Union. (2000). *Directive 2000/60/EC (Water Framework Directive).*

22. European Union. (2010). *Directive 2010/75/EU (Industrial Emissions Directive).*

23. European Union. (1991). *Directive 91/676/EEC (Nitrates Directive).*

24. Environmental Protection of Lake Sevan Project (EU4Sevan). (2022). *Concept Paper for the Development of the Wastewater Sector of the Settlements of the Republic of Armenia.*

25. European Union. (n.d.). *EU–Armenia CEPA Texts and EU Briefing Notes*. https://www.eeas.europa.eu/eeas/eu-and-armenia-comprehensive-and-enhanced-partnership-agreement-enters-force_en

26. European Union. (2021). *EU–Armenia Comprehensive and Enhanced Partnership Agreement (CEPA).*

27. European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2025). *The European Union's Strategic Approach to the Black Sea Region (JOIN(2025) 135 final).* Brussels.

28. Gharagyozyan, M., Tamoyan, S., Margaryan, S., Chitchyan, T., & Soghomonyan, T. (2022). *Piloting of Sustainable Manure/Dairy Production Waste Management in Gegharkunik Region.* Yerevan: Armenian National Agrarian University (ANAU).

29. Republic of Armenia. (2006). *Law No. HO-232-N Validating the National Water Program.* https://leap.unep.org/en/countries/am/national-legislation/law-no-ho-232-n-validating-national-water-program

30. Republic of Armenia. (2005). *Law No. HO-96-N on the Fundamental Provisions of the National Water Policy.* https://leap.unep.org/en/countries/am/national-legislation/law-no-ho-96-n-fundamental-provisions-national-water-policy

31. Republic of Armenia. (2005). *Law No. HO-96-N on the Fundamental Provisions of the National Water Policy.* https://leap.unep.org/en/countries/am/national-legislation/law-no-ho-96-n-fundamental-provisions-national-water-policy

32. Republic of Armenia. (2006). *Law No. HO-232-N on the National Water Program.* https://leap.unep.org/en/countries/am/national-legislation/law-no-ho-232-n-validating-national-water-program

33. Republic of Armenia. (2001). *Law on Lake Sevan.* *https://leap.unep.org/en/countries/am/national-legislation/law-republic-armenia-lake-sevan*

34. Mesropyan, E. (2022). *Concept Paper for the Development of the Wastewater Sector of the Settlements of the Republic of Armenia.*

35. Mesropyan, E. (2022). *Concept Paper for the Development of the Wastewater Sector of the Settlements of the Republic of Armenia.* Environmental Protection of Lake Sevan Project (EU4Sevan).

36. Ministry of Environment of Armenia. (2023, August 3). *The Process of Granting a Water Use Permit in Armenia Will Be Clarified and Become Accessible to Citizens.*

37. OECD. (2017). *Reforming Sanitation in Armenia: Towards a National Strategy*. Paris: OECD Studies on Water. https://doi.org/10.1787/9789264268982-en.

38. OECD. (n.d.). *Water Policy Reforms in Armenia.*

39. OECD. (2024). *Assessing the Enabling Conditions for Investment in Armenia's Water Security: Scorecard Pilot Test.*

40. OECD. (2017). *Reforming Sanitation in Armenia: Towards a National Strategy*.

41. Energy Regulators Regional Association (ERRA). (n.d.). *Public Services Regulatory Commission Profile.*

42. Public Services Regulatory Commission of Armenia. (2016). *Decision No. 378-N: Regulation on Supply of Fresh Water and Sewerage.*

43. OECD. (2017). *Reforming Sanitation in Armenia: Towards a National Strategy*. https://www.oecd.org/en/publications/reforming-sanitation-in-armenia_9789264268982-en.html

44. Republic of Armenia. (2005). *Law No. HO-96-N On the Fundamental Provisions of the National Water Policy. https://leap.unep.org/en/countries/am/national-legislation/law-no-ho-96-n-fundamental-provisions-national-water-policy*

45. Republic of Armenia. (2006). *Law No. 1384 on the National Water Program.*

46. European Union. (2021). *EU–Armenia Comprehensive and Enhanced Partnership Agreement. https://www.eeas.europa.eu/eeas/eu-and-armenia-comprehensive-and-enhanced-partnership-agreement-enters-force_en*

47. Trémolet, S., Melikyan, L., Mansour, G., Mesropyan, E., Iskoyan, A., & Hakhverdyan, H. (2014). *Towards a Development of a National Strategy on Sustainable Sanitation in Armenia: Stage 1 Report – Setting the Scene.*

48. Trémolet, S., Melikyan, L., Mansour, G., Mesropyan, E., Iskoyan, A., & Hakhverdyan, H. (2014). *Towards a Development of a National Strategy on Sustainable Sanitation in Armenia: Stage 2 Report – Principles for a Sanitation Strategy in Armenia.*

49. UNECE. (2024). *Environmental Performance Review: Armenia (Second Review).*

50. UNECE. (2022). *Environmental Performance Review Recommendations.*

51. UNECE. (2024). *National Policy Dialogues and Environmental Performance Review.* https://unece.org/environment-policy/water/areas-work-convention_protocol/country-dialogues/armenia

52. United Nations Armenia. (n.d.). *SDG 6 Overview*.

53. Republic of Armenia. (2002). *Water Code of the Republic of Armenia (Law No. HO-373-N), with amendments.* https://leap.unep.org/en/countries/am/national-legislation/water-code-republic-armenia-law-no-ho-373-n

54. World Bank. (2025). *Water and Irrigation Services Enhancement Programme (WISE).* https://www.worldbank.org/en/news/press-release/2025/06/13/armenia-to-strengthen-drinking-water-supply-and-irrigation-services-with-world-bank-support

55. World Bank. (2025, June 13). *Armenia to Strengthen Drinking Water Supply and Irrigation Services with World Bank Support.*

56. EU4Environment – Water & Environmental Data. (2024). *Catalogue of Nature-based solutions for water management in the Eastern Partnership countries*. https://eu4waterdata.eu/en/resource-library-hidden/56-eap-region-3/378-catalogue-of-nature-based-solutions-for-water-management-in-the-eastern-partnership-countries.html

57. EU Neighbours East - Water and Agriculture Integrated Development for Armenia (WAIDA) 2025-2028. https://euneighbourseast.eu/projects/eu-project-page/?id=3014&title=eu4sevan-sustainable-water-management-for-resilient-community-development-in-armenia

11 Annex I : SWOT Analysis

Strengths	Weaknesses
• Existence of a national policy framework for water management, including the Water Code, RBMPs and alignment efforts with EU directives. • Ongoing alignment with EU Water Framework Directive (WFD) and UWWTD under the CEPA framework. • Existence of River Basin Management Plans identifying infrastructure priorities and pollution hotspots. • Availability of baseline data and institutional awareness of sector deficiencies. • Presence of six operational municipal WWTPs and one decentralised lagoon-based system in Parakar. • Recognition within national planning documents of the need for rehabilitation and expansion of WWTP infrastructure.	• Only approximately 8–9% of wastewater receives any form of treatment, and treatment is limited largely to mechanical pretreatment. • Absence of biological and tertiary treatment processes results in extremely low pollutant removal efficiency. • Approximately 50% of the sewer network requires complete replacement. More than 80% is obsolete in Yerevan and Shirak. • Severe infiltration and inflow problems dilute wastewater and overload sewer systems during rainfall events. • Lack of industrial wastewater monitoring and enforcement mechanisms. • Fragmented institutional responsibilities and limited technical and financial capacity of local self-government bodies. • Significant gaps remain between Armenian legislation and EU wastewater acquis requirements.
Opportunities	**Threats**
• EU4Green Recovery East Programme provides institutional support through capacity building initiative for WWTP operators and decision makers. • Progressive alignment with EU directives may support regulatory strengthening and international financing. • Rehabilitation of sewer networks could significantly improve hydraulic performance and treatment efficiency. • Introduction of biological treatment processes could substantially improve compliance with environmental standards.	• Continued discharge of untreated wastewater pollutes rivers, groundwater and Lake Sevan ecosystems. • Public health risks associated with untreated domestic and industrial discharges, particularly in rural areas relying on groundwater. • Further deterioration of ageing infrastructure may increase leakage, overflows and service interruptions. • Industrial discharges without monitoring or pretreatment may increasingly impair future WWTP operations.

• Expansion of nature-based solutions and constructed wetlands offers cost-effective treatment options for rural communities. • Feasibility studies identified in RBMPs create a structured basis for phased investment planning.	• Financial constraints and affordability challenges may delay large-scale infrastructure rehabilitation. • Failure to meet EU-aligned environmental obligations may affect future cooperation and financing opportunities.

12 Annex II : Overview of EU4GRE Outputs

The EU4Green Recovery East programme is a regional initiative supporting the Eastern Partnership countries on their path towards a greener, more resilient, and competitive economy.

With an EU contribution of €21.3 million over four years (2025-2028), this programme builds on a decade of EU support, advancing efforts in circular economy, sustainable water management, and environmental data management. Through the programme, the EU further promotes alignment with EU environmental legislation (Chapter 27 of the EU acquis) and the EU Green Deal.

Implementing partners

The programme is implemented by a consortium of EU Member State agencies and international organisations, including the Environment Agency Austria (UBA), leader of the consortium, Expertise France, the International Office for Water (OiEau), the Organisation for Economic Co-operation and Development (OECD), the United Nations Economic Commission for Europe (UNECE) and the United Nations Industrial Development Organisation (UNIDO)

Five Programme Components for a Greener Future

1. Promote Circular Economy & Resource Efficiency. Helping businesses adopt circular models to foster local job creation, reduce costs, decrease reliance on imports and facilitate access to EU markets by aligning environmental policies with EU standards
2. Protect Water Resources & Reduce Pollution. Improving water quality through better management and monitoring to safeguard public and ecosystem health.
3. Align with EU Environmental Standards. Supporting governments in aligning with EU environmental policies (Chapter 27 of the EU acquis).
4. Strengthen Environmental Data & Digitalisation. Improving environmental data integration and sharing at country and EU level for better policy-making.
5. Enhance Transboundary Cooperation on Environmental Issues. Encouraging regional collaboration on shared water and air resources to address cross-border pollution.

What This Means for Public Actors

- Policy support: Assistance in designing and enforcing effective environmental policies and regulations.
- Capacity building: Targeted guidance, training and knowledge sharing on circular economy, water resources and environmental management as well as financing of measures.
- Access to EU Networks: Opportunities to participate in European environmental cooperation initiatives.
- Data and information: Improved environmental data management and reporting systems to achieve fact-based policy decisions.

Programme Outcomes and Outputs

Component 1: Circular economy promotion

- Output 1.1 CE progress is ensured along nationally prioritized value-chains, building on decision-making tools (including digital ones) and demo cases in support of CE
- Output 1.2 Knowledge and good practice transfer related to the EU Circular Economy Action Plan bolstered across EaP countries, with enterprises empowered to make their production more circular
- Output 1.3 Policy dialogue and business-to-business links in priority CE value-chains are enhanced

Component 2: Water as a critical resource for the economy

- Output 2.1 Additional River Basin Management Plans are prepared, adopted, and their implementation is strengthened, including by using nature-based solutions;
- Output 2.2 Additional river basin councils are established and supported to be fully operational;
- Output 2.3 Measures for improving existing wastewater treatment processes including its energy efficiency a climate resilience identified and promoted;
- Output 2.4 Economic aspects of water management are further addressed;
- Output 2.5 Measures for addressing pollution from priority sectors/sources are identified;
- Output 2.6 Water monitoring is expanded and a wastewater-based epidemiological surveillance system is established, including further capacity building for COVID-19 monitoring.
- Output 2.7 National water governance and cooperation are further strengthened.

Component 3: Legislative alignment with the European Green Deal, including, where relevant, with Chapter 27 of the EU acquis and facilitation of the accession process

- Output 3.1 Officials and other stakeholders are better acquainted with the European Green Deal/Chapter 27 and the EU acquis
- Output 3.2 Compliance checks of draft legal acts (under Chapter 27 of the EU acquis) are performed and their feasibility and enforceability is assessed
- Output 3.3 Compliance and enforcement mechanisms are promoted
- Output 3.4 Cooperation under the regional Team Europe Initiative is facilitated

Component 4: Institutional integration in EU-wide environmental cooperation, data management, and digitalisation

- Output 4.1 Regular participation of EaP countries in EU environmental cooperation networks like EEA-EIONET and other relevant networks is ensured
- Output 4.2 Relevant environmental data are regularly submitted to EEA and Eurostat;
- Output 4.3 Regular use of European Air Quality Index and comparable platforms is facilitated;
- Output 4.4 Further possibilities offered by the remote sensing data sources are exploited;
- Output 4.5 Access to existing data sources is reinforced and the national platforms facilitating the access to data and the production of key information are operational.

Component 5: Transboundary regional environmental cooperation

- Output 5.1 The establishment/functioning of 2-3 international river basin commissions is facilitated;
- Output 5.2 Governments and communities are assisted to address the water, climate, and security nexus;
- Output 5.3 Compliance with UNECE conventions and international reporting obligations and frameworks is monitored and enabled.

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