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EU4GREEN RECOVERY EAST

NATIONAL BASELINE REPORT OF WASTEWATER TREATMENT INFRASTRUCTURE

Republic of Moldova

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

(700002623)

Implementing partners:

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EU4Green Recovery East (700002623)
Recovery Through a Circular Economy and Pollution Reduction in the Eastern Partnership Countries

ABOUT THIS REPORT

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Disclaimer

The preparation of this assessment was constrained by limited availability of reliable operational data from wastewater treatment plants in Moldova, as well as the absence of consolidated national-level reporting on wastewater generation, treatment capacity and plant performance. The significant proportion of facilities with incomplete or missing information highlights existing gaps in sector-wide monitoring and reporting systems, which limits the ability to fully assess the operational status of WWTP infrastructure across the country.

The findings and proposed measures presented in this report are therefore based on the data that could be collected during the assessment. These measures should be considered as potential options for further investigation rather than final recommendations. Detailed technical recommendations will be developed following comprehensive assessments of the selected pilot plants in the next stage of the project. The pilot sites were selected based on the availability of data and comparative analysis with other facilities for which information was accessible.

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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

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LIST OF ABBREVIATIONS

AGMR	Agency for Geology and Mineral Resources (Moldova)
AMR	Antimicrobial resistance
AM	Public Institution National Administration Apele Moldovei
ANRE	National Agency for Energy Regulation (Moldova)
API	Application Programming Interface (for system interoperability)
BAT	Best Available Techniques
BOD	Biochemical Oxygen Demand
CAPEX/OPEX	Capital expenditures / Operating expenditures
COD	Chemical Oxygen Demand
DIPPC/IPPC	(Directive on) Integrated Pollution Prevention and Control; predecessor/companion framework to IED
DLV(s)	Discharge Limit Value(s) (permit-specific emission limits)
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EEA	European Environment Agency
ER	Energy Recovery
EHGeoM	Acronym used for the geology/mineral resources authority in Moldova (paired with AGMR in the text)
EIONET	Abbreviation used for the 2019 methodology on pollution charges (Order No. 15/2019)
EMPOLDEP19	Abbreviation used for the 2019 methodology on pollution charges (Order No. 15/2019)
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
EQS	Environmental Quality Standards
EU4GRE	EU4Green Recovery East programme
EUR-Lex	EU legal database/portal
GD/HG	Government Decision
GHG	Greenhouse gases
IED	Industrial Emissions Directive

IFI(s)	International Financial Institution(s)
IWRM	Integrated Water Resources Management
KPI(s)	Key Performance Indicator(s)
LEAP	Law and Environment Assistance Platform (UNEP)
MAC(s)	Maximum Admissible (or Permissible) Concentration(s) at the sewer connection (under HG/GD 950/2013)
MAFI	Ministry of Agriculture and Food Industry
MEDD	Ministry of Economic Development and Digitalization
MIRD	Ministry of Infrastructure and Regional Development
MoE	Ministry of Environment
NBS	Nature-based Solutions
NIC	National Integrated Code
NFPs	National Focal Points
NPD	National Policy Dialogue (on water policy)
OECD	Organization for Economic Co-operation and Development
OiEau	International Office for Water (Office International de l'Eau, France)
p.e.	Population equivalent (load unit used by UWWTD)
PFAS	Per- and polyfluoroalkyl substances
QA/QC	Quality Assurance/Quality Control
RBMP(s)	River Basin Management Plan(s)
RDA	Regional Development Agencies
SEI	Stockholm Environment Institute
SHS	State Hydrometeorological Service
SWC	State Water Cadastre
TSS	Total Suspended Solids
UBA	Environment Agency Austria (Umweltbundesamt)
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNIDO	United Nations Industrial Development Organization
UWWTD	Urban Wastewater Treatment Directive
VSD(s)	Variable speed drive(s)

WAREG	European Water Regulators network
WB	World Bank
WFD	Water Framework Directive
WSS	Water Supply and Sanitation
WW	Wastewater
WWTP	Wastewater Treatment Plant

1 Executive Summary

This report presents a baseline assessment of the wastewater treatment sector in the Republic of Moldova, developed under Output 2.3 of the EU4Green Recovery East (EU4GRE) Programme. The assessment aims to establish an understanding of the current status of wastewater generation, treatment infrastructure, operational performance, regulatory framework and institutional capacity of the sector. It further seeks to identify opportunities for improving wastewater treatment performance, enhancing energy efficiency in wastewater treatment plants (WWTPs) and exploring the potential for energy recovery and by-product valorization where feasible.

The preparation of this baseline assessment was significantly constrained by the limited availability of reliable and comprehensive operational data across the national wastewater sector. Moldova currently lacks centralized databases and standardized monitoring systems for WWTP performance. As a result, many critical parameters, such as influent and effluent pollutant concentrations, treatment process steps, sludge production volumes and energy consumption, are not systematically recorded or reported. These limitations required the assessment to rely primarily on fragmented data obtained from the Environmental Protection Inspectorate and supplementary consultations with sector stakeholders. Consequently, the findings and recommendations presented in this report should be interpreted within the context of these data constraints.

The assessment indicates that wastewater management services remain unevenly distributed across the country, with approximately 35% of Moldova's population connected to sewer networks and around 31% connected to centralized WWTPs. A pronounced disparity exists between urban and rural areas. In urban areas, approximately 76% of the population is connected to sewer networks and 68% to centralized treatment facilities, whereas in rural areas only about 3% of the population is connected to sewer networks and centralized WWTPs. Consequently, most rural households rely on on-site sanitation systems such as septic tanks or pit latrines, many of which operate under suboptimal conditions.

According to data obtained from the national reports, the country currently has 272 WWTPs of varying sizes and operational status. However, the performance of this infrastructure remains limited. Only 31 facilities are reported to achieve normative treatment performance in accordance with national discharge standards for key parameters such as biochemical oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids. In addition, ageing infrastructure, insufficient operational capacity and incomplete sludge management systems contribute to persistent environmental and public health risks.

Moldova has demonstrated strong commitment to reforming its wastewater sector, particularly following its June 2022 designation as an EU candidate country. The November 2023 amendments to Water Law No. 272/2011 represent a significant milestone, strengthening permitting procedures, clarifying institutional responsibilities and aligning monitoring requirements with EU Water Framework Directive principles. Second-cycle River Basin Management Plans have been developed for the Danube-Prut-Black Sea District (2023–2028) and the Nistru District (2025–2030), providing spatial prioritization frameworks for investment in pollution abatement, with more effective wastewater management having top priority in the Programmes of Measures. Governance reforms implemented in 2024–2025 extended the National Agency for Energy Regulation's (ANRE) authority to approve tariffs for water and sanitation operators, established a national water and sanitation information system and

strengthened the Environmental Protection Agency's permitting and enforcement capabilities. The adoption of Law No. 227/2022 on industrial emissions in September 2022 introduced integrated environmental permits and Best Available Techniques requirements, aligning industrial discharge control with EU standards. However, the legal and regulatory framework is dispersed across many different texts, making it difficult to draw a coherent picture of roles and responsibilities of all involved actors or to assess the alignment of this framework with the UWWTD (91/271/EEC).

Achieving full compliance with the recast Urban Wastewater Treatment Directive (EU) 2024/3019, which took effect in late 2024 and will be in force from August 2027, will therefore be complicated, as the transition from the original UWWTD to this new text cannot be clearly defined. In addition, several weaknesses can be identified: Moldova currently lacks explicit national frameworks for agglomeration mapping and obligations for settlements above 1,000 population equivalents, reclaimed water classification and reuse standards aligned with EU Regulation 2020/741, comprehensive sludge management regulations, quaternary treatment specifications for micropollutants with extended producer responsibility financing mechanisms and binding energy-neutrality pathways with progressive reduction targets.

Within the EU4GRE programme, emphasis is placed on improving the treatment and energy performance of wastewater treatment facilities, including the promotion of energy efficiency measures and the exploration of energy recovery opportunities from sewage sludge. However, the assessment indicates that the current operational conditions of many WWTPs in Moldova may limit the immediate feasibility of advanced energy recovery technologies. Many facilities operate below their design capacity or have insufficient operational data. As a result, the report adopts a cautious and phased approach, recognizing that energy recovery solutions may become viable primarily after improvements in basic plant operation, monitoring and infrastructure rehabilitation have been achieved. However, feasibility studies on these options can support the mobilization of funds for modernization activities by demonstrating that improvements in WWTP would not only enhance wastewater treatment performance but also enable energy recovery.

To support future interventions under EU4GRE, the assessment establishes a structured methodology for identifying potential pilot sites where improvement of operation, energy efficiency and energy recovery concepts can be further evaluated. Due to data limitations, the initial evaluation was restricted to 112 WWTPs for which basic operational information was available. From this group, facilities were screened according to several criteria, including treatment capacity, operational status, strategic relevance and the absence of overlapping development assistance. Approximately 80% of WWTPs in Moldova have very small treatment capacities, below 1,000 m^3/day (approximately 6,000 PE).

Following the criteria-based evaluation process and consultation with national stakeholders, three pilot sites were selected for further feasibility studies: Căușeni, Ungheni and Fălești WWTPs. These facilities were selected as they represent different operational scales and contextual conditions within Moldova’s wastewater sector.

Căușeni WWTP was selected due to its adequate treatment performance and its potential to complement ongoing activities on treated wastewater reuse conducted by the Stockholm Environment Institute (SEI). Integrating energy efficiency improvements with water reuse initiatives could demonstrate a more holistic approach to sustainable wastewater management.

Ungheni WWTP was selected primarily due to its substantial treatment capacity of approximately 15,000 m^3/day (approximately 100,000 PE), making it one of the largest municipally operated

treatment plants in the country. Its connection to a nearby industrial park further increases the strategic importance of improving operational efficiency at this facility.

Fălești WWTP was selected as a representative medium-scale treatment plant, with relatively better access to operational data compared with other candidate facilities. Including this site also allows the programme to demonstrate that operational improvements and energy optimization measures may also be applicable to smaller and medium-sized treatment facilities, which constitute the majority of WWTPs in Moldova.

The selection of three pilot sites does not imply that implementation of energy recovery technologies is viable at all of them. Instead, the detailed assessments will aim to verify operational conditions, assess sludge production characteristics, evaluate current energy consumption patterns and identify opportunities for energy efficiency improvements and potential by-product valorization where technically and economically feasible.

As a general recommendation, nature-based solutions, notably constructed wetlands, are important options for many rural areas in Moldova to improve treatment and reduce local pollution with rather simple and low-cost solutions.

Overall, the analysis suggests that Moldova's wastewater sector faces significant structural and institutional challenges but also presents opportunities for improvement. Strengthening monitoring systems, modernizing infrastructure, improving operational practices and introducing energy efficiency and recovery measures can significantly enhance the performance and sustainability of wastewater treatment services. In this context, the pilot activities proposed under EU4GRE can generate practical evidence of achievable improvements, build technical capacity and demonstrate replicable approaches for broader application across the country's wastewater infrastructure.

2 Introduction

2.1 Purpose

This report is developed as a foundational document to support Output 2.3 of the EU4GRE Programme, reinforcing efforts to advance sustainable wastewater management practices in the Republic of Moldova. It 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, the report 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 the Republic of Moldova, 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 the WWTP level in the country as much as possible to understand the 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 results of this report are 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 Moldova, with particular attention to treatment efficiencies, by-product handling and reuse, 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 WWTPs across Moldova, 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, identifies 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

Moldova is a landlocked country located in Eastern Europe, with a total land area of approximately 33,850 km². The country is characterized by a gently undulating plain that gradually slopes from the northwest to the southeast, toward the Black Sea basin. Elevation across the territory varies moderately, with the lowest point situated near Lake Cahul at 3 metres above sea level and the highest point at Bălănești Hill in the Central Moldavian Plateau, reaching 428 metres. The average elevation stands at approximately 139 metres.

Hydrologically, Moldova is entirely part of the Black Sea drainage basin, with most river systems feeding into two major rivers: the Dniester (Nistru) and the Prut. Originating in the Carpathian Mountains, the Dniester River basin spans the eastern and central regions of the country, covering around 65% of the national territory. The Prut River, which delineates Moldova's entire western border with Romania, drains approximately 24% of the country and eventually flows into the Danube River at Giurgiulești. Additionally, a small southern portion of Moldova drains into the Danube.

The country's hydrographic network includes approximately 3,600 rivers and streams, with a combined length exceeding 16,000 km and 4,483 natural lakes and artificial basins covering a total surface area of 43,494.6 hectares[1]. While major rivers maintain perennial flows, many smaller tributaries and internal rivers, such as the Răut, Bâc and Cogâlnic, exhibit low discharge rates and are highly susceptible to seasonal drying, making them particularly vulnerable to climate variability.

The efficient management of the water resources in the Republic of Moldova is carried out, in line with WFD, based on two river basin districts. There are the Dniester River Basin District and the Danube-Prut and Black Sea River Basin District, as defined in Water Law no. 272/2011, as illustrated in Figure 1.

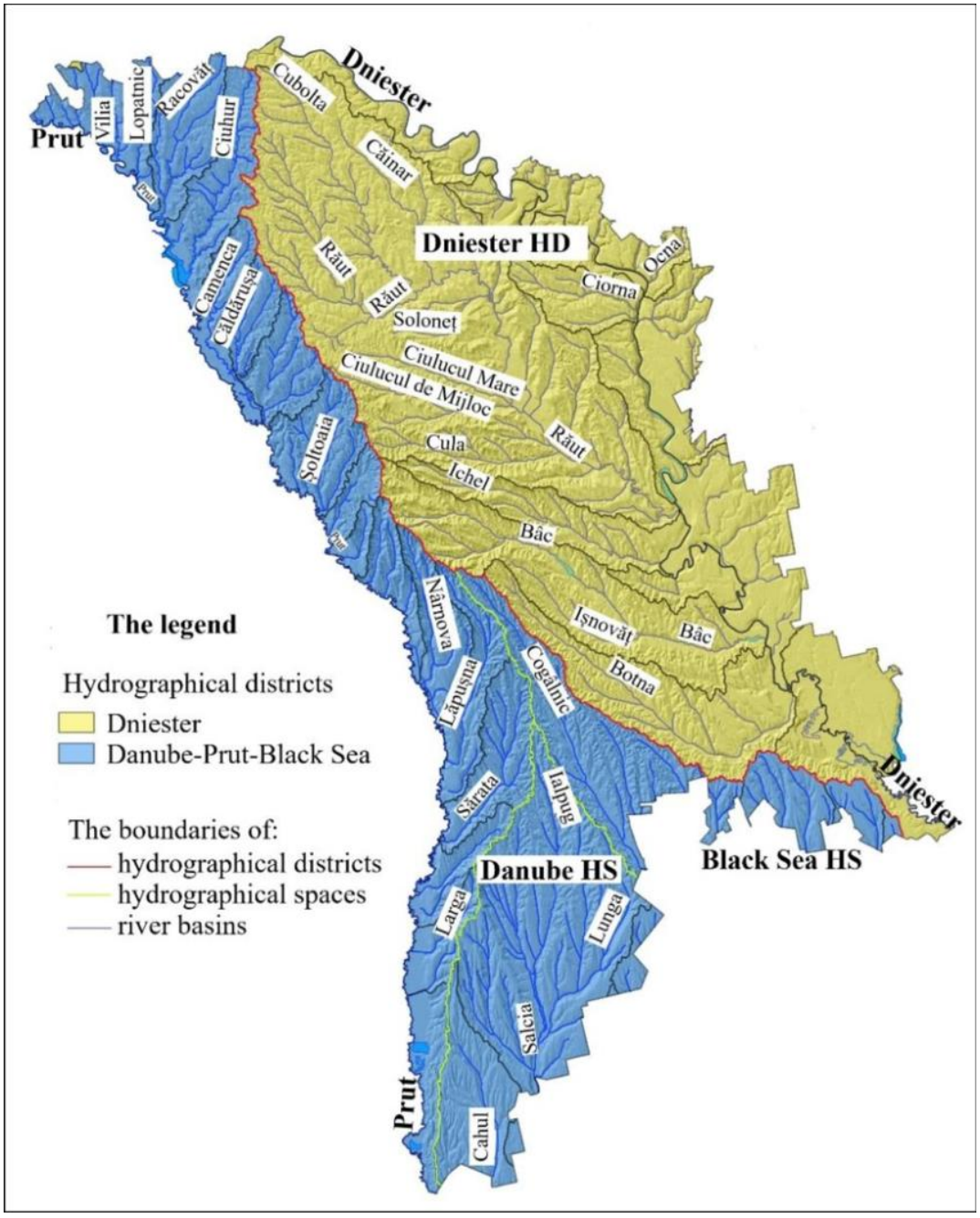


Figure 1: Map of River Basins of Republic of Moldova[2]

4.2 Institutional Roles and Responsibilities

In the Republic of Moldova, institutional responsibilities for water management, regional development and environmental protection are distributed across several ministries and agencies. Following the 2021 reorganization of the former Ministry of Agriculture, Regional Development and Environment (MARDE), three separate ministries were established: the Ministry of Infrastructure and Regional Development (MIRD), the Ministry of Environment (MoE) and the Ministry of Agriculture and Food Industry (MAFI).

The MIRD holds the policy and investment mandate for drinking water supply and sanitation (WSS) services, overseeing the Regional Development Agencies (RDAs) responsible for territorial planning and the execution of regional investment funds. The MoE retains the policy mandate for Integrated Water Resources Management (IWRM), flood and drought management and the development of environmental policies and legislation. Under the MoE's authority, the Public Institution National Administration Apele Moldovei is tasked with management and protection of water resources and ensuring the protection of the population and agricultural lands from floods and droughts. The recent reforms were oriented to strengthen basin-level water management.[44]

Additional key institutions include the Inspectorate for Environmental Protection, which enforces environmental protection regulations and oversees the rational use of natural resources and the National Agency for Energy Regulation (ANRE)[4], which develops methodologies for calculating, approving and implementing tariffs for water supply, sewage and wastewater treatment services.

Administratively, Moldova is divided into 32 districts, five municipalities (including Chișinău, Bălți, Tighina, Tiraspol and Comrat) and a region with special status (Autonomous Territorial Unit Gagauzia) (Figure 2). A district is a territorial administrative unit made up of villages (communes) and cities united by the territory, economic and social cultural relations. A municipality is a locality of urban type with a special role in the economic, social-cultural, scientific, political and administrative life of the country, with important industrial and commercial structures and institutions in the fields of education, health protection and culture.

Figure 2: Administrative Regions of the Republic of Moldova[5]

4.3 Industrial and other Economic Activities

In the country, industrial activity is limited, with food processing being the predominant sector. Most operations are small-scale, including meat slaughterhouses, dairy processing, juice production, fruit and vegetable canning, wineries and distilleries, typically generating wastewater flows of up to 300 m³/day. Exceptions include the Orhei-Vit canning factory in Căușeni, which discharges 1,000–1,100 m³/day and the Cricova winery, with a flow of around 600 m³/day[6].

Each locality's industrial-to-household wastewater ratio, as well as pollutant concentrations, varies according to the type of industry. A common challenge is that most industries lack pretreatment facilities or equalization basins to regulate industrial wastewater discharges. As a result, effluents are released into communal wastewater treatment plants or into surface water bodies (e.g. food industry, petrol and gas treatment), often in pulses via cyclic piston pumping, leading to high flow rates and elevated pollutant concentrations. These concentrations are industry-specific; for instance, COD levels can reach up to 12,300 mg/L at the Cricova winery and up to 6,800 mg/L at the Floreni poultry slaughterhouse[6].

4.4 Population Overview

As of 1 January 2024, the population of the country was 2,423,287, comprising approximately 1.37 million residents in rural areas and 1.05 million in urban centres[7]. The population has been following a gradual decline compared to previous years. The expansion in urban areas is due to an increase in population, migration from Ukraine and the construction of different industrial facilities.

27% of the total population resides in Chișinău Municipality, followed by Bălți Municipality. The rest of the population is distributed relatively evenly across the country's rayons. While urban centres concentrate a significant proportion of inhabitants, rural communities remain scattered across numerous administrative regions, each accounting for between 1% and 3% of the national total.

Table 1: Population by Administrative Region[7]

Administrative region	Population	% of population
MUN.BĂLȚI	89,357	4%
MUN.CHIȘINĂU	665,461	27%
R-UL ANENII NOI	57,718	2%
R-UL BASARABEASCA	16,200	1%
R-UL BRICENI	47,962	2%
R-UL CAHUL	74,468	3%
R-UL CALARASI	45,214	2%
R-UL CANTEMIR	34,327	1%
R-UL CĂUȘENI	60,926	3%

R-UL CIMISLIA	31,781	1%
R-UL CRIULENI	53,337	2%
R-UL DONDUSENI	29,674	1%
R-UL DROCHIA	56,747	2%
R-UL DUBASARI	23,404	1%
R-UL EDINET	52,752	2%
R-UL FALESTI	61,988	3%
R-UL FLORESTI	60,118	2%
R-UL GLODENI	40,527	2%
R-UL HINCESTI	70,431	3%
R-UL IALOVENI	69,771	3%
R-UL LEOVA	31,405	1%
R-UL NISPORENI	37,127	2%
R-UL OCNIȚA	37,257	2%
R-UL ORHEI	75,228	3%
R-UL REZINA	32,521	1%
R-UL RISCANI	46,868	2%
R-UL SINGEREI	61,629	3%
R-UL SOLDANESTI	27,404	1%
R-UL SOROCA	59,695	2%
R-UL STEFAN VODA	45,136	2%
R-UL STRASENI	61,754	3%
R-UL TARACLIA	29,623	1%
R-UL TELENESTI	41,613	2%
R-UL UNGHENI	78,668	3%
UTA GAGAUZIA	115,196	5%
Grand Total	**2,423,287**	**100%**

5 Wastewater Generation

5.1 Wastewater Volumes

According to the 2025 annual statistical report, the total wastewater collected in the Republic of Moldova reached approximately 83 million m³ in 2025. Out of the total discharge, 78 million m³ (about 95%) was released into surface water bodies. The discharged volume consisted primarily of sufficiently treated wastewater (71 million m³), alongside 5 million m³ of inadequately treated or polluted effluent and 2 million m³ of conventionally clean water.[1] This proportion suggests persistent gaps in treatment capacity, process efficiency, or network integrity as well as the recording of wastewater discharge.

5.2 Sewer Network Connections

The Republic of Moldova's sewerage network has an estimated total length of approximately 2,900 km, of which 2,800 km are currently operational.[3] As per the reports from 2024, only 10% of localities benefit from the sewerage services[17]. A 2020 study covering the Northern Development Region of Moldova illustrates the broader national challenge, namely that access to centralized sewerage services remains limited, particularly in rural areas. While urban centres show relatively higher connectivity, with around 55% of residents connected, rural access is extremely low, with only 0.3% of the rural population of this region served by centralized sewerage systems.[8]

It remains uncertain how representative this situation in the Northern Region is for the entire country. However, the figures indicate clearly that poorly treated or untreated wastewater exerts a very high pressure on Moldova's environment, notably surface waters.

This rural–urban disparity is further reflected in access to safely managed sanitation services. Over the past decade, progress in expanding sewer connectivity has been minimal. Nearly all rural households depend on on-site sanitation solutions such as septic tanks or soak-away pits. Despite these systems' potential when properly designed and maintained over years, many remain rudimentary and largely ineffective. As per the World Bank report in 2022, 63% of rural households continue to use outdoor dry pit latrines, which are typically unhygienic and lack basic amenities such as handwashing facilities. The sanitation gap is further stratified by income. Among the poorest rural households, 87% rely on dry pit latrines, whereas this figure falls to 34% among the wealthiest rural quintile. Conversely, 60% of high-income rural households have installed indoor flush toilets, compared to just 12.6% of households in the poorest quintile. This disparity highlights how income directly influences sanitation investments, with indoor water-based systems generally offering improved hygiene conditions, ease of maintenance and safer handling of wastewater.[3]

Overall, despite various efforts from both the government and international aid, Moldova faces persistent challenges in expanding and modernizing the sewer network and sanitation facilities. Ageing infrastructure and limited investment in repairs are the major constraints for the development of the sector, which collectively pose risks and deterioration to both the environment and public health. Given that fewer than 10% of localities are currently connected to the sewer network and many settlements are small and dispersed, a mix of solutions is essential. Collective sewerage and wastewater treatment plants should be prioritized in towns, larger villages, pollution hotspots and areas near sensitive water bodies where population

density, pollution risk and affordability justify such investments. In compact hamlets or peri-urban clusters, small-scale or cluster systems such as package plants, constructed wetlands, or small simplified sewer networks provide an effective alternative.

6 Wastewater Management

For the application of the European Directive on wastewater management (91/271/EEC), the level of wastewater treatment depends on the sensitivity of the receiving water bodies. The latest RBMPs for Moldova (implementing the EU Water Framework Directive), which cover the two main river basins of the country— (1) Danube, Prut and Black Sea and (2) Nistru—identify these sensitive areas. In the Danube-Prut-Black Sea catchment, the entire area is designated as sensitive, requiring all agglomerations above 10,000 PE to treat nitrogen and phosphorus, while in the Nistru basin, only eight main rivers are classified as sensitive areas, with associated agglomerations above 10,000 PE. (Oikomena, 2020; Republic of Moldova, December 2023)

6.1 Wastewater Treatment

This assessment found that data availability on wastewater treatment infrastructure in the Republic of Moldova is severely constrained by systemic gaps in monitoring and reporting mechanisms. Treatment facilities across the country demonstrate inconsistent reporting practices, as will be shown below. Even national-level data on wastewater generation and treatment volumes are absent from official records. This data deficiency stems primarily from insufficient institutional capacity for systematic monitoring and the lack of standardized reporting protocols among wastewater treatment facilities. The absence of comprehensive baseline data poses significant challenges for infrastructure planning, performance assessment and evidence-based policy development in the wastewater sector.

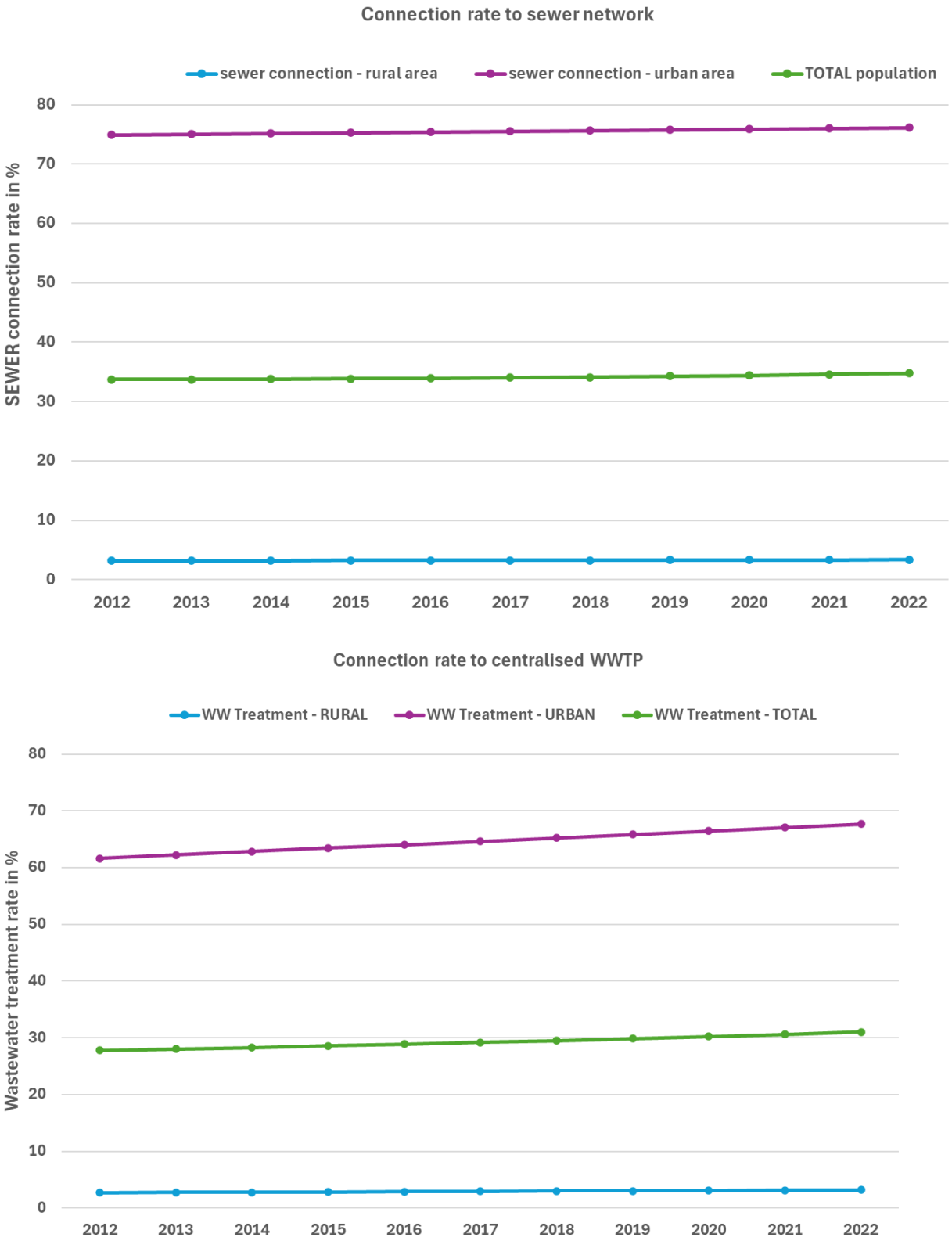
For this assessment, data were obtained from the Environmental Protection Inspectorate, drawing on both published reports and direct communication with the institution. The information collected includes key characteristics of many wastewater treatment plants (WWTPs) across the country, such as their location, design capacity and basic treatment performance.

However, several critical data categories were not available. Indicators such as influent and effluent pollutant levels, sludge production volumes and energy consumption profiles were missing. The absence of these parameters significantly restricts the ability to perform a comprehensive evaluation of treatment plant performance.

To complement the available data, additional publicly accessible sources were reviewed, and outreach efforts were made to organizations active in Moldova's wastewater sector, including the Stockholm Environment Institute (SEI) and the World Bank (WB). Collaboration with SEI, in particular, proved productive. Multiple meetings facilitated the exchange of information and discussion of potential areas for synergy in supporting sectoral improvements.

According to the WHO/JMP public database, in 2022 approximately 35% of the population was connected to the sewer network and 31% to centralized WWTPs. However, there are important differences between urban and rural areas, as shown in Figure 3. In urban areas, 76% of the population is connected to the sewer network, compared with only 3% in rural areas. In urban areas, 68% of the population is connected to centralized WWTPs, whereas in rural areas only 3% is connected to centralized WWTPs.

Figure 3: Development of Sewer and WWTP Connection Rates in Urban and Rural Areas in Moldova Between 2012 and 2022 WHO/JMP 2023



6.2 Wastewater Treatment Plants

According to the Annual Report of the Environmental Protection Inspectorate (2024), Moldova has 271 WWTPs across the country, including smaller WWTPs with a capacity of less than 500 PE. The operational performance of this infrastructure reveals significant deficiencies. Only 31 plants (11.4% of the total) are reported to function with normative treatment, meaning they meet basic discharge standards for biochemical oxygen demand (BOD5 $\leqslant$ 25 mg/L), chemical oxygen demand (COD $\leqslant$ 125 mg/L) and suspended solids ($\leqslant$ 35 mg/L). However, it is important to note that these normative standards do not consider nutrient concentrations such as nitrates (NO2, NO3), ammonium (NH4) or phosphates (PO4) in the discharged water.

The majority of facilities, 161 plants (59.2%), are classified as providing insufficient treatment, failing to meet National Integrated Code (NIC) discharge standards for BOD_5, COD and suspended solids. Many of these facilities rely exclusively on biological ponds, a technology with inherently limited treatment efficiency, as evidenced by operations at sites such as Anenii Noi.

An additional 19 plants (7%) provide only partial treatment. Despite incorporating biological treatment stages, these facilities fail to achieve the required discharge standards for BOD_5, COD and suspended solids. Their treatment processes typically consist of mechanical treatment stages or biological ponds without fully integrated secondary or tertiary treatment capabilities. The remaining 61 treatment plants are currently non-functional.

A more comprehensive dataset obtained from the Environmental Protection Inspectorate provides detailed operational information for 112 of the 271 WWTPs (see Annex). This dataset encompasses plant location, operational responsibility, treatment capacity, treatment processes employed and infrastructure repair requirements. The analysis of these 112 facilities reveals the following distribution:

- **24 plants (21.4%)** provide sufficient treatment in accordance with Government Decision No. 950/2013, meeting national discharge standards for organic pollution and suspended solids
- **56 plants (50.0%)** provide insufficient treatment, failing to meet required effluent limits
- **5 plants (4.5%)** remain in testing status without achieving stable operational performance
- **6 plants (5.4%)** are non-functional
- **21 facilities (18.8%)** lack available performance data

The substantial proportion of plants with missing performance information underscores critical gaps in national monitoring and reporting systems, fundamentally limiting the ability to assess the true operational capacity of Moldova's wastewater treatment infrastructure.

The capacity assessment reveals a treatment infrastructure dominated by small-scale facilities. The majority of plants operate at capacities below 1,000 m^3 per day, indicating limited technical and economic potential for implementing advanced treatment processes or resource recovery systems. Only 24 plants exceed this threshold, representing the country's higher-capacity treatment facilities (Table 2).

Table 2: Wastewater Treatment Plants with a Capacity of More Than 1,000 m^3/day[9]

WWTP	Design Capacity (m^3/day)	Estimated capacity (p.e.)*	Treatment Performance	Process Line	Requirement for Major Repair
Chișinău	137,546	916,973	Insufficient	Biological treatment	Yes
Bălți	60,000	400,000	Insufficient	Biological treatment	No
Ungheni	15,000	100,000	Insufficient	Biological treatment	No
Fălești	10,000	66,667	Insufficient	Biological treatment	No
Orhei	10,000	66,667	Insufficient	Biological treatment	Yes
Glodeni	8,000	53,333	Insufficient	Biological treatment	No
Anenii Noi	7,500	50,000	Insufficient	Biological treatment	Yes
Ceadîr-Lunga	6,900	46,000	Sufficient	Biological treatment	No
Comrat	5,700	38,000	Insufficient	Only mechanical	Yes
Edineț	5,300	35,333	Insufficient	Biofilter	Yes
Căușeni	4,800	32,000	Sufficient	Biotal	No

Selișteе, Orhei	4,600	30,667	Sufficient	Biological treatment	No
Hîncești	3,700	24,667	Insufficient	Biological treatment	Yes
Cahul	3,200	21,333	Insufficient	Biological treatment	No
Călărași, Moldova	2,400	16,000	Insufficient	BBR	No
Rîșcani	2,400	16,000	Insufficient	Biological treatment	Yes
Bălăbănești, Criuleni	2,125	14,167	Insufficient	Biological treatment	Yes
Cricova	2,000	13,333	Insufficient	Biological treatment	Yes
Florești, Moldova	1,500	10,000	Insufficient	Biological treatment	No
Vulcănești	1,500	10,000	Insufficient	Only mechanical	No
Nisporeni	1,500	10,000	Insufficient	Flexidibloc	Yes
Basarabeasca	1,200	8,000	Insufficient	Biological treatment	No
Cimișlia	1,200	8,000	Insufficient	Topaz	No
Briceni	1,020	6,800	Sufficient	Topaz	No

* The capacities of the WWTPs were reported only in m³/day across all national reports and databases. BOD values were also not monitored or reported at the WWTPs. Therefore, a simplified calculation method was applied, using an assumed average daily wastewater generation of 150 L per person, to estimate the population equivalent capacity of the WWTPs.

Among these 24 higher-capacity plants, operational performance remains suboptimal. Only four facilities provide treatment levels that meet permissible pollutant discharge limits according to Government Decision No. 950/2013 and are therefore classified as plants with sufficient treatment. While the database indicates that biological treatment processes are applied at all WWTPs except two of the 24, the available information does not specify the particular types of biological treatment applied. As a result, the assessment is limited to confirming the presence of biological treatment without characterizing the specific technologies involved. However, several facilities utilize compact, prefabricated biological treatment systems (such as Topaz or Flexidibloc), which offer advantages in terms of lower energy requirements compared to

conventional biological treatment technologies and are generally well-suited for medium-scale municipal applications. Despite these technological advantages, infrastructure degradation poses a significant challenge. Eleven of the 24 higher-capacity facilities require major infrastructure repairs, indicating substantial capital investment needs to restore and maintain treatment capacity.

It should also be noted that beyond the aforementioned treatment technologies, **nature-based solutions** (NBS) have been widely tested, especially in rural areas where sufficient space is available. Various types of constructed wetlands have been implemented using a combination of anaerobic pretreatment (baffled reactor or septic tank) and horizontal- or vertical-flow reed beds, or vertical-flow reed beds combined with secondary vertical- or horizontal-flow reed beds or a polishing pond. These tests have demonstrated that the technology offers efficient treatment capacities with low operational requirements, particularly suitable for application in rural areas in Moldova (Apasan, 2019)[40]. Since 2013, a very large, constructed wetland treatment plant (5 ha, treating wastewater from 26,000 inhabitants and the food industry) for Orhei municipality has been in operation (see also chapter 6.6.2). It was expected to allow 40% savings in energy use (Aqua Consult). These experiences provide important lessons learned to spread and extend the use of NBS for wastewater treatment in Moldova. And beyond this, NBS can also be used to manage rainwater runoff in cities, thereby reducing the burden on the sewer networks and providing additional co-benefits to inhabitants. Many of these techniques require mainly minor hydraulic adjustments for the collection of rainwater and gardening competences which are often found in city services.

A general approach for local decision-makers in Moldova 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 that was published by the EU4Environment — Water & Environmental Data Programme in 2024 (also in Romanian)[43]. Under the current EU4GRE project, a regional framework note for NBS implementation will be developed in 2026 and is expected to provide advice for implementing NBS projects, particularly for wastewater treatment.

6.3 Wastewater Composition

Quantitative and qualitative data on the volume and composition of incoming wastewater to treatment plants in Moldova are severely limited. Most WWTPs do not conduct routine monitoring of influent pollutant concentrations. Limited compositional data are available from a study by the Stockholm Environmental Institute (SEI). The data, collected from the Environmental Ecological Laboratory for selected localities, covers only chemical oxygen demand (COD), total nitrogen (Ntot) and total phosphorus (Ptot) parameters (Table 3). Since the influent parameters at the WWTPs are not monitored, the wastewater composition of the localities is considered as a proxy. The localities listed in Table 3 are not where the WWTPs listed in Table 2 are located; rather, they provide an overall idea of wastewater composition in the southern region of Moldova.

Table 3: Wastewater Composition Before Treatment[6]

Locality	COD (mg O_2/L)	N_{tot} (mg/L)	P_{tot} (mg/L)	N/COD	P/COD
Dondușeni	997.7	88.4	10.1	0.088	0.010

Cricova	930.5	81.4	9.7	0.087	0.010
Căușeni	560.4	76.5	9.9	0.137	0.018
Chișinău	618.8	65.7	20.4	0.107	0.033
Ocnița	1,022.1	63.1	11.6	0.062	0.022
Cantemir	1,109.5	109.2	9.3	0.098	0.008
Basarabeasca	996.6	74.6	9.6	0.075	0.010
Ermoclia, Ștefan Vodă	819.8	74.4	7.9	0.090	0.010

The available data reveal significant variation in raw wastewater quality across different localities. COD concentrations range from 560.4 mg O_2/L in Căușeni to 1,109.5 mg O_2/L in Cantemir, indicating a nearly twofold difference in organic load. Total nitrogen concentrations exhibit substantial variation, ranging from 63.1 mg/L (Ocnița) to 109.2 mg/L (Cantemir). Total phosphorus concentrations are relatively consistent across most localities, with the notable exception of Chișinău.

The composition of domestic wastewater, defined by the German DWA and Austrian ÖWAV standards, is typically characterized by the following pollutant concentrations:

- BOD5 = 300 mg/L
- COD = 600 mg/L
- TOC = 175 mg/L
- N_{tot} = 55 mg/L
- P_{tot} = 7.5 mg/L

Table 4: Typical Pollutant Proportions in Municipal Wastewater Inflow

		N_{tot}/COD	**P_{tot}/COD**
Raw WW	0.5 – 0.6	0.08 – 0.1	0.01 – 0.015

When examining the wastewater, the absolute concentrations may initially appear unusually high, which could suggest the presence of industrial discharges. However, the pollutant ratios N/COD and P/COD fall within the expected ranges for municipal wastewater (see Tables 3 and 4), except in Căușeni and Ocnița localities. These proportional relationships are strong indicators of domestic origin and are not consistent with the patterns typically observed in industrial effluents. Therefore, despite the elevated concentrations, the composition aligns with normal municipal wastewater rather than with industrial contamination.

The pollutant concentrations presented in Table 3 indicate that wastewater is more concentrated. The respective dilution factor is calculated by using the following formula:

$$Dilution\ factor = \frac{C_{Standard}}{C_{Inlet}}$$

The dilution factor in Chișinău is relatively typical at 0.96 (COD = 600/619 ≈ 0.96), suggesting typical municipal wastewater composition. For the other localities listed in Table 3, however, this dilution factor is relatively low, at approximately 0.65. According to ÖWAV guidance document No. 9 (*ÖWAV-Arbeitsbehelf 9: Kennzahlen für Abwasserreinigungsanlagen. Teil 1: Ablaufqualität – Bewertung und Beurteilung*), such a low dilution factor may be attributed either to (1) low specific water consumption (less than 100 L/p.e.·d), (2) concentrated discharges like septic tanks or (3) industrial discharges. Effluent quality monitoring is equally constrained.

Among the 56 WWTPs classified as providing insufficient treatment as per the database of Environmental Protection Inspectorate, only 25 facilities (44.6%) have reported pollutant levels for treated wastewater. Critically, the available data do not include actual measured concentrations but merely indicate which parameters exceed permissible limits as established by Government Decision No. 950/2013. The detailed information is presented in Table 5. This binary reporting approach (exceeds/compliant) provides insufficient information for assessing the magnitude of non-compliance or for prioritizing remedial interventions.

Table 5: Data on Pollutants at the Outlet of WWTPs[9]

WWTP	BOD	COD	TSS	N_{tot}	P_{tot}
Vadului lui Vodă town, Balabanesti village	Exceeds	Exceeds			
Chișinău			Exceeds	Exceeds	
Cruzești	Exceeds			Exceeds	
Budești	Exceeds	Exceeds	Exceeds	Exceeds	
Anenii Noi	Exceeds		Exceeds		
Speia, Anenii Noi	Exceeds		Exceeds		
Chetrosu, Anenii Noi			Exceeds		Exceeds
Merenii Noi	Exceeds		Exceeds		Exceeds
Bălți				Exceeds	Exceeds
Cahul Municipality	Exceeds	Exceeds	Exceeds	Exceeds	
Cantemir, Moldova					
Cimișlia				Exceeds	
Porumbeni-Pașcani village	Exceeds		Exceeds		
Fălești	Exceeds		Exceeds		
Florești District	Exceeds		Exceeds	Exceeds	
Gura Camencii	Exceeds		Exceeds		
Leova District				Exceeds	
Lurceni	Exceeds	Exceeds			
Ermoclia	Exceeds	Exceeds		Exceeds	Exceeds
Șoldănești	Exceeds		Exceeds		
Șoldănești	Exceeds		Exceeds		
Șoldănești	Exceeds		Exceeds		
Telenești	Exceeds				
Valea Mare Commune	Exceeds	Exceeds	Exceeds		

The effluent quality data reveal widespread non-compliance across multiple pollutant parameters. BOD_5 exceedances are most prevalent, with 18 of 25 facilities exceeding discharge limits, indicating inadequate biological treatment capacity across the majority of monitored plants. Total suspended solids (TSS) violations are similarly common, affecting 14 facilities and suggesting deficiencies in solids separation processes. Total nitrogen exceeds permissible limits at 9 facilities, reflecting the absence of nitrification/denitrification processes, while COD and total phosphorus exceedances occur at 6 and 4 facilities, respectively.

6.4 Sludge Management

Sludge production data are not systematically monitored at WWTPs across Moldova. While it is theoretically possible to estimate sludge quantities based on treated water volumes and total suspended solids (TSS) concentrations at plant inlets and outlets, the lack of accurate TSS monitoring throughout Moldova's treatment infrastructure fundamentally limits such calculations. Consequently, there is no reliable baseline assessment of national sludge generation or management practices.

The most significant documented sludge management challenge occurs at the Chișinău WWTP, where inefficient sludge dewatering and treatment facilities have resulted in severe accumulation problems. The plant generates approximately 70,000 tonnes of sludge annually, which is dewatered in geotubes and stored on land due to inadequate processing capacity. Approximately 30 hectares of land are covered with untreated sludge from this facility, creating substantial environmental and public health concerns. This open storage arrangement generates significant odour pollution affecting surrounding communities and represents a major source of greenhouse gas (GHG) emissions. The situation at Chișinău exemplifies the broader deficiencies in sludge management infrastructure and highlights the urgent need for investment in sludge treatment, dewatering and disposal facilities across the national wastewater sector.

6.5 Situation Reported and Actions Listed in the RBMPs

In June 2022, the Moldovan government approved the Danube-Prut and Black Sea River Basin District Management Plan (Cycle II) for the period 2023–2028. It reports that 63% of urban wastewater is not collected or treated and that urban wastewater is the main water quality issue. In light of insufficient monitoring data, it calls for improved monitoring and control of urban and industrial pollution being discharged into surface and groundwater bodies. Nearly 60% (some 2 billion MDL) of listed measures relate to reducing wastewater pollution.

The second RBMP of the Nistru for the period 2025–2030 states that 43% of the population has access to centralized wastewater collection, treatment and discharge systems, mainly due to high levels of access in Chișinău and Bălți. However, it estimates that all water bodies are at risk due to the discharge of wastewater. While the population for the basin is not indicated in the RBMP, it provides figures on discharge which seem very low with an annual discharge of 317,000 m^3, 9,160 t BOD5, 877 t of phosphorus and 241 t of nitrogen.

The RBMP of the Nistru lists the following measures to be implemented:

1. Construction of new wastewater treatment (purification) plants (Soroca Town, Criuleni Town, Otaci Town, etc.);
2. Rehabilitation of non-functional sewage treatment plants. In total, there are 39 non-functional stations;
3. Modernization of treatment technologies in existing treatment plants (Chișinău, Ciorescu, Rezina, etc.). Eighty-five stations treat wastewater insufficiently;
4. Control of industrial sources of pollution (reduction of pollution at the source reduces costs associated with clean-up and produces environmental benefits). There are six economic agents that operate without a sewage treatment plant and another 13 have plants that function insufficiently;
5. Construction of constructed wetlands (ZUC; see NBS in this report) for localities with less than 10,000 inhabitants;
6. Construction of individual sewage treatment systems for agglomerations with less than 2,000 equivalent inhabitants;
7. Construction, expansion and modernization of sewage systems;
8. Inventory and control actions by the Environmental Protection Inspectorate regarding sources of wastewater discharge into rivers;
9. Implementation of the water resource monitoring programme;
10. More rigorous controls by the Environmental Protection Inspectorate at wastewater discharge points (in particular, at economic operators).

In the Danube–Prut–Black Sea River Basin District, only 11% of the population has access to centralized systems for wastewater discharge and treatment and abandonment of sewerage networks has been observed, mostly in rural areas and in small mono-specialized and highly ruralized towns over the last two decades, while the total length of sewerage networks has increased by 41%. The RBMP also identifies 48 wastewater treatment plants, of which 39 are working to some extent, but overall, only 14% of the load is treated. The Programme of Measures lists a subset of water bodies and associated agglomerations for which completion or construction of sewer networks and/or construction or reconstruction of treatment plants are included as basic measures. A total of seven basic measures cover the wastewater topic:

1. Development of a master plan for water supply and sanitation (WSS) and improved governance for WSS, including municipality association development for larger project management capacities
2. Construction of wastewater treatment plants
3. Modernization of treatment technologies in existing treatment plants
4. Construction of individual wastewater treatment systems for areas with low population density
5. Construction, extension and modernization of sewage systems
6. Control of industrial pollution sources (reducing pollution at the source lowers the costs associated with treatment and increase environmental benefits)
7. Inventory action and more rigorous control by the Environmental Inspectorate of the sources of wastewater discharge into rivers

It also proposes a subset of water bodies for which supplementary measures for wastewater discharge include construction and modernization of stormwater sewer systems, control of environmental impacts from wastewater through the use of low-phosphorus detergents and introduction of a tax for wastewater collection and treatment.

In both RBMPs, the proposed Programme of Measures includes as the first basic measure the rehabilitation, modernization and extension of wastewater sewerage networks, as well as of the wastewater treatment plants and installations and the construction of urban wastewater treatment plants.[41,42]

It should be noted that after six years, the third RBMP for the next cycle has to report on the specific progress achieved during the previous period, such as the results and effects of implemented measures, as demonstrated by monitoring data from affected water bodies. Furthermore, based on these results, the new Plan must present the next Programme of Measures. For the Danube–Prut–Black Sea District, this new draft RBMP is due in early 2027 for public consultation and therefore must be drafted by Apele Moldovei in 2026.

6.6 Opportunities for Improvement

Within the framework of the EU4GRE programme, emphasis is placed on improving the treatment performance and enhancing energy efficiency and exploring opportunities for energy recovery at wastewater treatment facilities, including through by-product valorization such as biogas production from sewage sludge. The presence of WWTPs with biological treatment processes indicates sludge production and corresponding opportunities for energy recovery through anaerobic digestion and biogas generation.

The programme aims to identify two to three WWTPs that can receive targeted support for energy efficiency improvements and climate resilience measures. However, the site selection process faces substantial challenges stemming from systemic data deficiencies across Moldova's wastewater treatment sector. Critical operational parameters, including pollutant concentrations at plant inlets and outlets, energy consumption profiles and quantitative and qualitative characteristics of sludge production are either not monitored or inadequately reported by most facilities. These data gaps significantly constrain evidence-based decision-making and complicate the identification of facilities with the greatest potential for energy efficiency and recovery interventions.

To address these challenges, a strategy has been formulated for selecting locations where proof-of-concept activities can be implemented within the coming two years, demonstrating practical measures for improving energy efficiency (EE) in overall WWTP operations and enabling energy recovery (ER) from sewage sludge. The strategy encompasses two principal components:

First, clear selection criteria have been established to systematically evaluate and shortlist eligible WWTPs, ultimately identifying two to three pilot sites nationwide. These criteria account for treatment capacity, existing infrastructure, operational status, accessibility of data and potential for replication of successful interventions at other facilities.

Second, active engagement with key stakeholders in Moldova's wastewater sector has been prioritized to leverage existing knowledge, coordinate interventions and identify potential synergies. The SEI and the World Bank have been identified as major organizations working in this sector. Engagement with the SEI has yielded productive outcomes, facilitating improved data collection and identifying opportunities for collaboration in future planned activities.

6.6.1 Criteria for Site Selection

The establishment of clear selection criteria serves two essential purposes: ensuring fairness and transparency in the decision-making process and guaranteeing that all WWTPs in Moldova receive equitable consideration for external support aimed at operational improvements.

- **Data availability**

The selection process fundamentally depends on the availability of sufficient baseline data. While critical operational information remains absent for most WWTPs nationwide, the assessment was able to proceed with 112 facilities for which data were obtained from the Environmental Protection Inspectorate. These plants represent the only facilities with adequate basic information such as treatment capacity, operational status and process configurations necessary to conduct a meaningful evaluation. Consequently, the initial selection pool was limited to these 112 WWTPs.

- **Treatment capacity**

Treatment capacity emerged as a primary selection criterion, as both sludge production and energy requirements are dependent on the volume of wastewater treated. Collected data (Table 2) revealed that approximately 80% of the above-mentioned WWTPs have low nominal treatment capacities, ranging from 10 to 800 m³/day. Such small-scale facilities typically generate insufficient sludge volumes to make energy recovery interventions technically or economically viable. Therefore, the selection process focused on the 24 treatment plants with capacities exceeding 1,000 m³/day, a threshold considered essential for achieving the critical mass of sludge necessary for meaningful energy recovery options. Moreover, WWTPs with higher capacity are given priority, as this makes the ER processes more efficient and profitable.

- **Other ongoing projects**

Facilities currently receiving support from other development programmes or international organizations were excluded from consideration. Many large WWTPs in Moldova already benefit from external assistance, while smaller facilities are sometimes overlooked. This criterion ensures equitable distribution of support and prevents redundancy in interventions. For instance, the Chișinău WWTP faces significant sludge accumulation challenges; however, the European Bank for Reconstruction and Development (EBRD) is already constructing a biogas facility at this location. Including such sites would result in duplicated efforts and inefficient resource allocation.

- **Geographic and strategic relevance**

Priority consideration was given to localities where interventions would benefit larger populations or address specific environmental concerns. Cities with larger populations and those categorized as areas with high strategic relevance by the World Bank in the environmental assessment report for selected towns under the National Water Supply and Sanitation Project (2008) were considered under this criterion. Locations hosting industrial parks received particular attention, as these areas often generate more heavily polluted wastewater streams requiring enhanced treatment. For example, Ungheni hosts an industrial park whose operations would benefit substantially from WWTP improvements, creating both environmental and economic value.

- **Treatment performance and process line**

The project focuses on three pilot WWTPs where facility studies and proposals for improving energy efficiency will be developed. At this stage, however, only limited technical information is available for these sites and no reliable data on their current treatment performance or

operational efficiency has been provided. This creates both a challenge and an opportunity: before meaningful energy-efficiency measures can be identified, it is essential to first understand and, where necessary, optimize the treatment performance itself. Pollution reduction, hydraulic stability and compliance with effluent standards must take precedence, as energy efficiency can only be meaningfully addressed once the core treatment processes are functioning effectively. Within the project, performance assessment will therefore be a central step and any recommendations for energy-efficiency improvements will be developed in parallel with, or subsequent to, the evaluation of treatment effectiveness. Where the available data allow, targeted measures to reduce energy consumption such as process optimization, equipment upgrades or operational adjustments will be proposed. In cases where performance information remains insufficient, EU4GRE will outline the additional monitoring and data collection needed to enable future energy-efficiency planning. This approach ensures that the proposed improvements are realistic, technically sound and aligned with both environmental and operational priorities.

6.6.2 Selection of Pilot Sites

Based on the selection criteria for capacity, 24 WWTPs were shortlisted. As a first step, the WWTPs were sorted based on the plant capacity from highest to lowest (Table 6). The other set of criteria were then incorporated into the table to find the most relevant site for implementation of proof-of-concept activities. Each criterion was used to establish filters for further shortlisting and the final selection of three WWTPs where feasibility studies will be conducted for EE and ER implementation.

Table 6: Shortlisted WWTPs in Moldova Based on Criteria Discussed in 6.5.1

WWTPs	Capacity (m^3/day)	Other Ongoing Projects	Strategically Relevant City[10]	Process Line
Chișinău	137,546	EBRD	No	Biological treatment
Bălți	60,000		Yes	Biological treatment
Ungheni	15,000		Yes	Biological treatment
Fălești	10,000		No	Biological treatment
Orhei	10,000		Yes	Biological treatment

Glodeni	8,000		No	Biological treatment
Anenii Noi	7,500		No	Biological treatment
Ceadîr-Lunga	6,900		No	Biological treatment
Comrat	5,700	WB (Security of water supply and sanitation in Moldova)	No	Only mechanical
Edineț	5,300		No	Biofilter
Căușeni	4,800	SEI	Yes	Biotal
Seliște, Orhei	4,600		Yes	Biological treatment
Hîncești	3,700	Feasibility study by Czech Aid	No	Biological treatment
Cahul	3,200	Reconstruction by KfW	Yes	Biological treatment
Călărași, Moldova	2,400		No	BBR
Rîșcani	2,400		No	Biological treatment
Bălăbănești, Criuleni	2,125		No	Biological treatment
Cricova	2,000		No	Biological treatment
Florești, Moldova	1,500		Yes	Biological treatment
Vulcănești	1,500		No	Only mechanical
Nisporeni	1,500		No	Flexidibloc

Basarabeasca	1,200	No	Biological treatment
Cimișlia	1,200	No	Topaz
Briceni	1,020	No	Topaz

The analysis of 24 shortlisted WWTPs reveals a highly concentrated treatment infrastructure, with Chișinău (137,546 m³/day) and Bălți (60,000 m³/day) accounting for over half of the total capacity. Five facilities (21%) were excluded due to ongoing support from international organizations (EBRD, World Bank, SEI, Czech Aid and KfW), including Chișinău despite its substantial energy recovery potential. Seven plants are located in strategically relevant cities, offering broader developmental impact. Some of the facilities utilize conventional biological treatment with possible potential for energy optimization, while six employ energy-efficient compact systems and two operate only mechanical treatment, which is unsuitable for advanced interventions.

By excluding WWTPs currently supported by other projects and those employing process lines other than conventional biological treatment, the candidate pool narrowed to 13 facilities. From this group, the five plants with the highest treatment capacities were prioritized for further consideration: Bălți, Ungheni, Fălești, Orhei and Glodeni. To gather additional operational details and validate the selection, extensive engagement was undertaken with key stakeholders and the programme's national focal points (NFPs): the Ministry of Environment (MoE) and the Ministry of Infrastructure and Regional Development (MIRD).

Subsequent consultations with stakeholders revealed important information that modified the initial assessment. A follow-up meeting with SEI clarified that their work at Căușeni WWTP focuses exclusively on reuse of treated wastewater for agricultural irrigation, with no interventions planned for plant operations or sludge management. This distinction enabled the reintroduction of Căușeni into consideration, as EU4GRE interventions on EE or ER would be complementary rather than duplicative.

However, stakeholder consultations also identified constraints at other initially prioritized sites. It was revealed that Bălți WWTP is operated by a private company, a fact subsequently confirmed by both the MoE and the MIRD. Private operation may complicate programme implementation due to potential differences in investment priorities, data accessibility and long-term commitment to proof-of-concept activities. Additionally, while Orhei WWTP has no current ongoing projects, the facility previously received EU support for construction incorporating constructed wetlands, a design specifically intended to ensure energy-efficient treatment.[11] When it was opened in 2013, the Orhei Plant was the first to use such environmentally friendly technology in Eastern Europe and the largest such facility in the whole of Europe. This existing energy optimization reduces the potential impact of additional EE interventions at this site.

To obtain operational data for the remaining candidate sites, the Regional Development Agency (RDA) North of Moldova was contacted, as both Fălești and Glodeni WWTPs operate under its administrative authority. A detailed questionnaire was distributed and the information collected is presented in Table 7.

Table 7: Detailed Data of Fălești and Glodeni WWTPs[12]

Parameter	Fălești WWTP	Glodeni WWTP
Nominal Capacity (m^3/day)	10,000	360
Actual Capacity (m^3/day)	1,000-1,200	240
Process line	Mechanical treatment, biological treatment, tertiary treatment through biological lakes and chlorination with lime slurry	Pretreatment, primary settling, biological treatment, secondary settling, disinfection,
Energy consumption (kWh/m^3)	0.37	1.06
Treated water discharge	Discharged into the lower Sovat River	Discharged to surface water
Quantity of sludge (tonnes/day)	2.4	0.5
Sludge treatment process	Stored on ground	Processed, stabilized and stored

The information collected through the RDA North questionnaire revealed significant discrepancies that underscore the broader data reliability challenges within Moldova's wastewater sector. The reported capacity of Glodeni WWTP according to the Environmental Protection Inspectorate records (8,000 m^3/day) contrasts sharply with the actual operational capacity of only 360 m^3/day, a discrepancy of more than 95%. This substantial variance demonstrates the unreliability of official datasets and disqualifies Glodeni from further consideration, as its actual capacity falls well below the 1,000 m^3/day threshold considered for viable energy recovery interventions.

7 Existing Legal and Regulatory Framework

This chapter identifies and describes Moldova's legal and regulatory framework regarding wastewater management and related texts. After describing this framework, an attempt is made to link it to the situation described in previous chapters.

7.1 National Laws and Regulations

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

Between 2022 and 2025, the Republic of Moldova fast-tracked the transition of its legislative and institutional framework to EU water law. On 28 November 2023, a substantial revision of Water Law No. 272/2011 was adopted. This revision is an important step forward because it unifies the river basin district approach and increases the ability of the Environment Agency to establish discharge limits, issue permits and withdraw them. It mandates the use of accredited laboratories and the registration of protected areas. Hydrotechnical works are included in the State Water Cadastre automated information system. The reform explicitly seeks to reflect the Water Framework Directive (WFD) in such a way that the length of authorizations should be consistent with basin planning cycles and that prevention and transparency should be increased.[13]

With regard to basin planning, in June 2022, the government approved the Danube-Prut and Black Sea River Basin District Management /Plan (Cycle II) for the period 2023–2028. In addition, the Nistru (Dniester) River Basin District Management Plan for the period 2025 to 2030 was adopted on 19 February 2025. These documents present a combined hydrological and ecological diagnosis, prioritization of pressures and investment priorities and cross-border cooperation, focusing on wastewater infrastructure, reduction of pollutant loads and drought and flood risk management. They confirm alignment with the WFD regarding good status objectives, monitoring and economic analysis.[14]

Progress has been made in meeting the monitoring demands of the WFD, although this depends on the upgrading of networks and analytical capacities. The 2023 reform and programmes supported by partners, notably UNDP and Sweden, are helping to increase physico-chemical and biological monitoring and integrate data into the water cadastre. This system will be able to interoperate with national information systems, which are vital for robust categorization and regular reporting of water body status.

With regard to the Urban Wastewater Treatment Directive (UWWTD), Moldova has guided its efforts with the National Water Supply and Sanitation Strategy and the governance reforms introduced during 2024–2025. Under these reforms, a national information system for the management of water and sanitation services was devised, broadened the scope for economic regulation and gave the National Agency for Energy Regulation (ANRE) the power to approve tariffs for regional operators that cover more than 3,000 customers. This promotes the financial viability of UWWTD investments. The direction is clear: to standardize the collection of performance data, regionalize and professionalize operations and link pricing to multi-year investment plans. This will be of high relevance when preparing the reporting under UWWTD Article 17, but the homogeneity of such data and the availability of the collected data, at least for national authorities, will have to be ensured to allow this reporting.

It is also currently not clear how each article of the UWWTD is effectively introduced in Moldovan legislation.

This work coincides with the overhaul of the European Union's Urban Wastewater Treatment Directive at the end of 2024. Directive (EU) 2024/3019, which will take effect on 1 August 2027, will reinforce the requirements for collection, secondary and tertiary treatment in eutrophication-sensitive areas and even quaternary treatment, as well as access to sanitation, while setting out progressive milestones. It will also introduce obligations for a national implementation plan by 2028 and greatly extend the scope of public information. Furthermore, it will address energy, greenhouse gas (GHG) emissions and micropollutants via gradual requirements. For Moldova, a candidate country, this means that the upgrading of wastewater treatment plants and sewer networks (including industrial pretreatment and, eventually, advanced treatment) must be planned.

In the Nistru basin, for example, projects underway on the ground already prioritize the construction and rehabilitation of plants and networks. However, access to sanitation services remains unequal. Although water supply coverage is improving, less than 10% of localities are connected to a sewerage system. This means there is an urgent need for catch-up measures, especially in rural areas. Tariff regulation is evolving to reconcile economic sustainability and social acceptability, with ANRE-approved adjustments and mechanisms to cushion the impact of energy and reagent cost increases.[15,16]

With the adoption of Law No. 227/2022 on industrial emissions on 30 September 2022, a milestone in the transposition of the Industrial Emissions Directive (IED) was achieved. This legislation introduces an integrated environmental permit, the systematic application of Best Available Techniques (BAT), emission limits that comply with legal requirements for large combustion plants and a strengthened control and inspection regime. Amendments in 2024–25 continued the procedural alignment and extended the requirement for an integrated permit to the energy sector, while clarifying the powers of the inspectorate to suspend or withdraw permits. Consequently, adherence to the IED paves the way for more stringent control of industrial discharges into water, in line with the WFD and UWWTD.[18, 19, 20]

The success of this plan relies on good governance and financing. The 2024 reform, which establishes ANRE tariff approval for all water and wastewater operators, will reduce asymmetries and establish conditions that will enable financing for compliance with the UWWTD, while basin management plans will enable spatial prioritization of investments and pressure-reduction measures. In the short term (2025–2028), the key challenge is twofold: consolidating ecological and hydromorphological monitoring for the WFD and launching a national UWWTD compliance-related programme reflecting the 2024 recast timetable, while completing the operationalization of integrated permits under the IED Directive for the relevant operators.[21, 22]

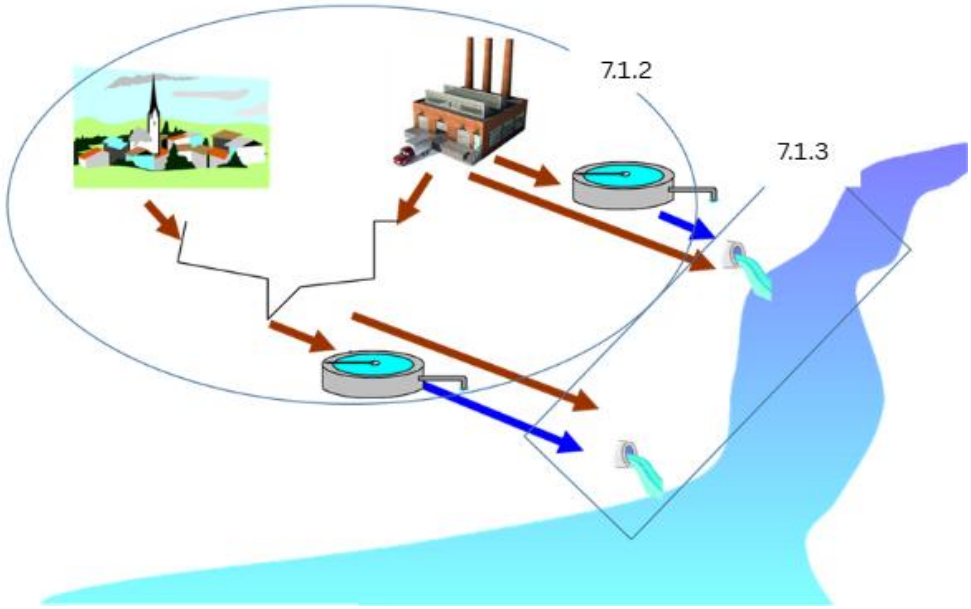


Figure 4: Illustration of Discharge into Sewer and Aquatic Environments (7.1.2) and Discharge into Surface Water Bodies or Groundwater (7.1.3).

7.1.2 Discharge Permits Requirement for Industries and Other Economic Activities – Into Sewer and Aquatic Environments

Moldova regulates industrial and commercial wastewater in two different directions: from discharges to publicly run sewers and direct discharges to the aquatic environment (see Figure 4 above). The main legislation is the Water Law No. 272/2011 (as amended in November 2023 in order to ensure coherence with the EU water acquis) and the sanitation regime under Law No. 303/2013 and Government Decision (HG) No. 950/2013. These specify when authorizations are required, who issues them, how restrictions are imposed and the monitoring, reporting and payment responsibilities of operators. For direct discharges into rivers, lakes, reservoirs or groundwater, authorization for special water use must be obtained from an environmental authority under the Water Law.

Note: Moldova's laws do not create a stand-alone category called "commercial wastewater". Instead, they distinguish:

- domestic/household wastewater (ape uzate menajere)
- non-domestic wastewater from economic activities, commonly referred to in practice as "industrial wastewater" (ape uzate industriale).

Discharges from commercial establishments (restaurants, hotels, car washes, workshops etc.) are treated in law as non-domestic/industrial discharges to the public sewer, subject to connection contracts, maximum admissible concentrations at the control point (MAC), possible pretreatment, operator sampling and surcharges for exceedances under Government Decision (HG) No. 950/2013 and within the service framework of Law No. 303/2013.

The Environmental Agency issues, suspends or withdraws authorizations and establishes discharge limits for the receiving water body according to the logic of the EU WFD. In 2023, the reform decreased the duration of most permit terms to six years (12 years could still apply for potential long-term projects), bringing them closer into alignment with river basin planning and climate risk and strengthening role of the Agency in setting limits and coordinating monitoring to consider environmental quality standards and optimal technology. For sewer discharges, a contract governs relations between the sewer operator (public utility) and the non-domestic user according to Law No. 303/2013 and HG No. 950/2013.

The operator specifies technical conditions, control points, control sampling and enforcement methods. HG No. 950/2013 sets out acceptance criteria, including whether substances are permitted and the concentrations allowed at the control manhole. If effluent could damage infrastructure or interfere with treatment, operators may refuse the flows or require the discharging entity to install pretreatment. HG No. 656/2023 amended HG No. 950/2013 for clarification and expansion of activities requiring mandatory on-site pretreatment. Compliance differs by pathway: sewer discharges are compared against HG No. 950/2013 acceptance standards at the entry to the network, where the operator acts as a front-line overseer, while direct discharges are evaluated against permit-specific limits established by the Environmental Agency with reference to ambient conditions and EU-derived objectives.[23]

It is, however, not clear if the data generated are collected or made available by the operator to the Agency or if a central database exists for permits and monitoring results that would be available to the inspectorate and used to provide nationwide summaries.

The state retains control over all investigations under the Environmental Protection Inspectorate, although accredited laboratory analyses, self-monitoring and spot checks are standard

procedures for national public health investigations. Regulation is complemented by economic instruments. Under Law No. 1540/1998 and the Ministry's Order No. 15/2019 (EMPOLDEP19) methodology, operators calculate and pay annual pollution charges. Recent reforms tightened permit cycles, clarified the role of agencies and expanded pretreatment obligations for higher-risk sectors, promoting river basin management and improved municipal plant performance.

Note: The pollution charges calculated under Law No. 1540/1998 (using the EMPOLDEP19 methodology) are paid to the State Budget via the State Treasury accounts of the Ministry of Finance and administered by the State Tax Service, not retained by the Environmental Protection Agency.

Context

- Since 2017, these environmental payments have been routed to the state budget (Treasury) under specific economic classification codes and collected by the State Tax Service; they are no longer paid into separate fund IBANs.
- Environmental projects are financed through the National Fund for Environment (formerly National Ecological Fund) as a budgetary instrument governed by regulations approved in 2022; this fund is fed from general budget revenues rather than directly earmarked agency receipts.

Funds therefore go first to the general state budget; the agency in charge (Environment/EPA) does not directly retain or spend the collected charges.[24]

Many e-government services simplify special water use applications and technical guidance enables enterprises to design pretreatment and fulfil their obligations. In practice, direct dischargers must obtain permission, meet permit limits, monitor dischargers and pay pollution charges. Sewer dischargers must secure operator acceptance under HG No. 950/2013, install pretreatment where required to not exceed maximum allowable concentrations, adhere to control-point monitoring and reporting and pay exceedance surcharges and national pollution payments. Incident notification and mitigation are standard practice, embodying the principles of prevention, precaution and polluter pays.[25]

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

Moldova governs sewage through a tiered system that links the revised Water Law to stringent implementing regulations and ecological quality requirements. The Water Law No. 272/2011 (updated in November 2023 to comply with the EU acquis) amended the permit periods to reflect the river basin planning cycle, together with an emphasis on the control, monitoring and the roles of institutions in charge of the control of pollution, most notably the Environmental Protection Agency (EPA). These reforms represent progress in the implementation of the WFD and similar directives. Two governmental policies apply the framework to enforceable limits at discharge sites:

- HG No. 802/2013 concerns discharges to natural recipients (surface waters and, where appropriate, subsurface waters), including instructions for deriving permit-specific discharge limit values (DLVs), information pertaining to analytical methods and compliance procedures and prohibitions on priority hazardous substances. It also contains specific rules to preserve fish life in surface waters.
- HG No. 950/2013 establishes rules for the collection, treatment and discharge of wastewater in public sewers (and, where applicable, in receiving waters in urban and

rural areas). The maximum admissible concentrations (MACs) at the connection point are set out in the service agreements under HG 950 and a surcharge is applied if the MACs exceed those specified by national standards, as confirmed by standard sampling.

The protection of receiving waters is based on environmental quality standards (EQS). This principle is enshrined in Regulation No. 890/2013, which introduces EQS and priority/hazardous substances in accordance with EU regulations. However, the law has been undergoing revision since late 2023 in Moldova to update priority substances and clarify status classes. EQS serve as binding ambient constraints that the EPA must observe when determining permit DLVs in order to reduce degradation and promote the attainment of good status. Groundwater quality requirements were laid down in HG No. 931/2013 and amendment work commenced in mid-2025 to enhance protection and streamline use-based criteria, stressing the principle of "no deterioration".

The provisions follow an environmental quality–based regulatory logic. All direct discharges require EPA authorization for special use, setting pollutant-specific DLVs based on receiving-water status, background, flow, EQS and prohibitions under HG 802. Where discharge is to a sewer, the operator (most commonly an Apa Canal utility) establishes connection CMAs under HG 950/2013 and defines them in contracts; operator sampling may occur at any time and exceedances incur surcharges. This CMA regime is intended to protect municipal treatment plants and ensure downstream EQS compliance. Not all discharge routes are subject to similar prohibitions and protected-area rules. HG 802/2013 prohibits discharges of listed priority hazardous substances (e.g. organohalogen, organosilicon, organotin and organophosphorus compounds; certain carcinogens; organic mercury; radioactive waste) to surface waters or groundwater, alongside additional limits in sanitary protection zones.

Compliance relies on monitoring and economic tools: HG 950 standardizes sampling calculations and surcharge calculations; HG 802 specifies verification methods and frequencies for direct discharges and HG 932/2013 establishes national status monitoring. Moldova also levies pollutant charges (per "conventional tonne"), which may include differential city-rate calculations as well. The rulebook continues to develop. After 2023, the government reorganized HG 950 (sampling, surcharges and contract certainty), continued updating HG 890 in line with EU priority lists and status disclosure and initiated amendments to HG 931 between June and July 2025 to improve groundwater protection. Moldova is moving towards the EU model with emission limits based on ambient standards and the "no deterioration" principle at the scale of the water body.[13, 26]

Operator checklist:

- Choose route: sewer or direct
- Sewer: MACs to be approved as per HG 950; standard sampling is required; pretreatment is required and installed if MACs are exceeded to protect WWTPs
- Direct: EPA authorization is sought; the treatment system is planned to meet DLVs calculated from EQS and water-body status; no priority hazardous substances above prescribed threshold restrictions
- For infiltrations within aquifers: demonstrate compliance to HG 931 and non-deterioration

- Use accredited laboratories, maintain chain of custody, be prepared for unannounced sampling and plan for pollutant charges and exceedance surcharges

7.1.4 Regulations on Wastewater Reuse and Sludge Disposal/Valorization

Current situation:

Moldova is reforming wastewater reuse and sewage sludge guidelines to align with the EU acquis. However, there is currently no national regulation defining reclaimed water classes and end uses (e.g. EU Regulation 2020/741), although the institutional and normative foundation is being established. Wastewater recycling is currently based on Water Law No. 272/2011 and related discharge, sewer and EQS regulations; policy work is determining how to transpose EU minimum provisions. Sludge management is more sophisticated. A set of binding norms through sectoral acts are supplemented by the non-binding *Guide to WWTP Sludge Management* (Order No. 39, 30 March 2022) issued by the Ministry of Environment and, from 2025, by a technical soil protection regulation governing agricultural utilization of sludge.

Preparation for the future:

Wastewater reuse: In the absence of national reclaimed-water laws, reuse may be determined through existing permits for water use. An investigation phase on agricultural reuse under the Green Agenda, focusing on WWTP performance and irrigation baselines, began with an initial analytical stage that was finalized in March 2025. In the future, a specific Moldovan legal framework may categorize reclaimed water used for irrigation, require risk management plans and establish monitoring, liability and notification obligations in line with EU practice.

Sludge treatment and valorization: In May 2025, the Ministry of Agriculture and Food Industry promulgated binding soil standards and regulations governing the use of WWTP sludge in agriculture to align with EU-style limits, suitability screening, crop and seasonal constraints and traceability requirements. These provisions establish agronomic protections at the land application site.

The EPA authorizes sludge uses through permits and monitors compliance. Utilities generate, characterize, manage and record sludge flows and application sites. Land managers must also comply with agronomic restrictions and monitoring requirements under the 2025 agricultural regulation. The Ministry of Environment and the EPA supervise large-scale plant improvements (e.g. Chișinău's sludge line) with national and donor funding.

Moldova still requires a codified reclaimed-water regulation with classes, uses, risk plans and monitoring requirements, together with a consolidated technical regulation for sludge use in agriculture, including quantitative thresholds, minimum treatment standards, buffer and exclusion zones, crop prohibitions and a national register. The scaling of higher-value options such as AD/biogas, co-composting and pyrolysis will also necessitate future end-of-waste criteria and product standards.[27, 28]

7.2 National Strategy

7.2.1 National Support Activity on the European Union Acquis

After obtaining EU candidate status (June 2022) and beginning accession talks (2024), Moldova has fast-tracked its alignment with the EU water acquis. Most of the reforms on wastewater focus on revitalizing the Water Law, National Policy Dialogue (NPD) and the Water Supply and

Sanitation Strategy (WSS). Priority areas include enhanced monitoring and an investment pipeline in conformity with the UWWTD (revised 2024).

Key milestones:

- 28 November 2023: binding amendments that strengthened permitting, roles and monitoring
- 20–21 March 2024: Chișinău stock-take, financing, monitoring and transboundary priorities, linking targets to RBMPs
- Ongoing: Upgrading surface water and groundwater EQS so WWTP limits are aligned with ambient goals

The WSS Strategy is under development to reflect the UWWTD, effective from 1 January 2025. It includes tertiary and quaternary treatment for micropollutants supported by extended producer responsibility (EPR) and pathways towards energy neutrality (coverage from 1,000 p.e.). The tariff and surcharge rules are converging. Recent ANRE decisions in major cities identify higher costs and upgraded requirements, complementing industrial surcharge regulations.

Monitoring capacity has been increased through the EU4Environment Water and Data programme (priority substances, laboratories and a Chișinău wastewater-based epidemiology pilot), underpinning compliance with the UWWTD and risk-based permitting.[29]

Priorities for 2025–2027:

- Implement the updated WSS Strategy with risk-based targets per agglomeration size
- Conclude the ambient quality by-laws and reporting rules
- Consolidate the financing (tariffs, pollution charges and IFI pipelines) to achieve tertiary and quaternary and energy targets
- Develop a cost-effective national programme for small agglomerations and on-site sanitation

This convergence is facilitated by the NPD platform, the 2025 WSS strategy agenda and donor support.

7.2.2 Planned and Ongoing Initiatives

Moldova's next phase of wastewater management involves a revised national policy, basin-based planning and EU-style compliance. Implementation is linked to second-cycle RBMPs, specifically Nistru 2025–2030, which incorporate sewer and WWTP expansion, municipal load reduction, improved surface and groundwater monitoring, climate resilience and transboundary coordination. Projects include new or rehabilitated WWTPs and rural solutions (not centralized systems). Starting in 2025, a national WSS planning exercise across the country will provide a long-term investment plan, financing strategy (tariffs, taxes and transfers) and regulatory refinements to harmonize the 2014–2030 WSS Strategy with EU rules for coverage thresholds, tertiary and quaternary treatment and energy performance. Further changes to surface and groundwater quality regulations are expected to establish WWTP emission limits and publish transparent status classifications.[30]

Service-governance reforms will introduce a national water/sewer information system, extend licensing to larger regional operators, standardize KPIs and retain tariff approval with the economic regulator to prevent fragmentation and to support viable, compliant utilities.

Investment pipelines mix large municipal works (e.g. Chișinău sludge facility, Soroca WWTP) with priority rural extensions based on basin plans. Studies, designs and co-financing are provided by donor programmes (the EU, IFIs and the UN) and irrigation-law changes allow future reclaimed-water pilots. Monitoring and laboratory alignment with EU criteria include enhanced chemical and ecological surveillance, priority-substance methods and wastewater-based epidemiology at large WWTPs.

Public dashboards and periodic reports will inform corrective action. Taken together, these moves will enable the execution of the 2025–2030 plan with the following results: recalibrate ambient standards, order investments by agglomeration and risk, bundle regulation and finance, complete major plants and networks and institutionalize modern oversight and transparency.

The difficulties found in identifying relevant data and information for the current document show that many of the above steps have not yet begun and that substantial work is still needed to establish a reliable information system.

7.3 EU Regulatory Framework

7.3.1 UWWTD – Council Directive 91/271/EEC (1991) and Recast Directive (EU) 2024/3019 (2024)

The original UWWTD, adopted on 21 May 1991, set minimum EU standards for the protection of the environment from the negative impacts of urban wastewater discharges. It also established the agglomeration principle based on population equivalent, requiring Member States to provide collection systems and appropriate treatment within specified periods. Secondary (biological) treatment was the norm for most of the flows collected in the European Union, with discharges to "sensitive areas" at risk of eutrophication generally being subject to more stringent treatment and often including nutrient removal. The directive regulated the pretreatment of major industrial discharges to the sewer where necessary to prevent damage and to improve the performance of the treatment network and prohibited the disposal of sludge at sea as well as regulating its safe land application. Enforcement was ensured by systematic control over the influent and effluent, compliance verification and national reporting to the European Commission. The 1991 UWWTD stimulated extensive sewerage and secondary treatment capacity expansion across the entire continent during the 1990s and 2000s, laying the practical groundwork for future upgrades.[31]

In its latest form adopted in 2024, three decades of implementation experience had enabled the revised directive to modernize the regulatory framework to cover residual pollution, climate and energy objectives, emerging chemical threats, the impact of stormwater and public health surveillance. Retaining the essence of 1991 rules, it reduces the coverage threshold by applying collection and treatment responsibilities to agglomerations of 1,000 population equivalent or more and introduces phased tertiary treatment to address eutrophication. The main innovation is to include a requirement for quaternary treatment to remove specific micropollutants in larger plants. This will be largely funded through the extended producer responsibility concept for human pharmaceuticals, cosmetics and other sectors. The reconceptualization is expected to put urban wastewater on a path to energy neutrality by 2045. It requires frequent energy audits and further encourages energy efficiency standards and on-site generation of renewable sources and energy recovery. It enhances stormwater and combined sewer overflow management, formalizes wastewater-based surveillance for pathogens and antimicrobial resistance (AMR) indicators and expands monitoring, open data and near real-time public transparency. Industrial interfaces are strengthened through improved upstream control harmonized with the best available techniques under industrial emissions legislation. Overall, the recast turns the UWWTD from a pollution-

control tool mainly into an integrated environmental, health and climate tool closely aligned with the objectives of both the WFD and contemporary data governance.[32]

7.3.2 Moldova's Path to the UWWTD

Moldova is pursuing its wastewater strategy to align its legal framework with the EU's recast Urban Wastewater Treatment Directive (Directive (EU) 2024/3019), which raises collection and treatment coverage to ≥1,000 person equivalents (p.e.), introduces tertiary removal and quaternary treatment for micropollutants financed through EPR and pushes the sector towards energy neutrality with greater transparency and health surveillance.

These aspects are currently included in new WSS planning processes and the second round of RBMPs. Moldova does not yet have a dedicated national regulation on water reuse. A two-stage trial started in late 2024, but this will enable the country to transpose basic EU minimum standards for agricultural irrigation such as quality ratings, risk-management plans and monitoring controls. The outputs will support the wastewater chapter and RBMP measures, as well as inform pilots where WWTP upgrades and irrigation modernization are underway.[31]

For its part, Moldova is moving towards recovery of by-product valorization, shifting from disposal towards resource recovery. The rehabilitation of Chișinău's WWTP will complete a modern sludge line and a proposed pyrolysis facility jointly financed by the National Ecological Fund. Other municipal projects (e.g. Soroca) allow for digestion and biogas production, co-composting and nutrient recovery, aligning with the UWWTD's circularity focus.[33]

The new UWWTD also sets energy-related audit expectations and milestones for becoming clean and neutral. Moldova has to embed high-efficiency process design (e.g. aeration, controls, VSDs and heat recovery) and on-site renewables or biogas into each WWTP project. It is expected to publish plant-level energy and compliance dashboards, based on the requirements of the EU through the national water information system. However, current action to upgrade Chișinău and the investment pipeline under the RBMPs offer a window of time to implement these measures. Taken together, reuse legislation and pilots, as well as sludge, biogas or pyrolysis valorization and the roadmapping of energy neutrality transform the UWWTD into an investment-ready agenda. This will upgrade service quality, reduce costs and emissions and drive a smoother transition towards the EU for Moldova.

7.4 Policy Gaps: EU and National Regulations

7.4.1 Sufficiency of Current WW Management Regulations

Moldova's wastewater legal framework has undergone significant modernization, particularly following the November 2023 amendments to Water Law No. 272/2011, which improved permitting and enforcement, enhanced monitoring, harmonized authorization cycles with river-basin planning and delineated EPA responsibilities. Core acts include HG 802/2013 (discharges to water bodies), HG 950/2013 (sewer acceptance, surcharges and pretreatment) and EQS rules (surface water, HG 890/2013; groundwater, HG 931/2013). Second-cycle basin plans are now shaping Programmes of Measures and governance reforms further extend economic regulation and utility performance reporting. On paper, the system can control point sources, protect receiving waters and enable investment. Compared to the EU's recast UWWTD (2024), however, it is necessary but insufficient for three structural reasons:

1) Scope and ambition: The recast UWWTD enlarges coverage to agglomerations > 1,000 p.e. establishes updated tertiary nutrient removal standards and implements quaternary treatment for micropollutants using EPR, as well as energy-neutrality and overflow-control routes. Moldova has not yet codified enforceable targets at these thresholds, financing for advanced micropollutant removal, energy neutrality, an EU 2020/741-aligned reclaimed-water regime, or consolidated binding sludge standards and end-of-waste criteria.

In addition, Moldova does not use the term "agglomeration" in the sense of the UWWTD (an area where the population or activities are sufficiently concentrated to allow for the collection and conveyance of wastewater to a WWTP or discharge point).

Furthermore, to our knowledge, there is currently no explicit national rule in Moldova requiring households or businesses to connect to the sewerage network as soon as it is installed (unlike, for example, France).

The Moldovan framework mainly regulates:

i) connection conditions via the ANRE framework regulation and framework contract,

ii) obligations once connected (compliance with CMAs, fees, etc.) and

iii) deadlines and procedures for processing connection requests.

Local regulations may supplement this, but there is no single "national connection obligation clause" in Law 303/2013 or the available ANRE acts.[34]

2) Capacity and coverage: Urban plants are expanding, but sewer and treatment access is limited in many settlements; on-site sanitation lags behind EU standards. Enforcement of industrial pretreatment is inconsistent. Monitoring has become more flexible, but laboratory capacity, priority-substance analytics, QA/QC and EU-level monitoring frequencies remain incomplete. National information systems and the State Water Cadastre are developing, but robust, timely and machine-readable dashboards are still under development.

3) Delivery and finance: ANRE tariffs and surcharge rules function, but utilities require multi-year, UWWTD-linked investment plans, ring-fenced depreciation and performance incentives (compliance, energy, infiltration/overflows). Basin plans promote the prioritization of projects, but converting those into financed, shovel-ready designs across the country will require a sequenced programme combining tariffs, budget transfers and IFI co-financing that integrates energy and micropollutant needs.[35]

7.4.2 Implementation and Enforcement of Current Policies

While wastewater policy has improved in Moldova, implementation still lags behind EU practice, as demonstrated by the situation of collection and treatment detailed in Chapter 6. A 2023 Water Law revision, adopted 28 November, enhanced permitting, elucidated EPA mandates and strengthened monitoring with accredited laboratories. River basin plans for Cycle II (Danube–Prut–Black Sea 2023–2028, Nistru 2025–2030) have moved from planning to execution. Governance reforms in 2024–2025 increased economic regulation and national utility information systems were rolled out. Although these tools exist on paper, their implementation remains uneven in three areas:

1) Coverage and infrastructure

- The use of centralized sewerage systems is still scarce.
- Connection rates are low.

- Basin Programmes of Measures are priority lists that progress from feasibility to financing and construction, which differ depending on local capacity and donor support.

2) Monitoring and enforcement

- EPA labs monitor a broad range of hydrochemical and biological indicators and are implementing WFD-type biological quality elements monitoring, but full programme sustainability remains challenging.
- Roles in groundwater monitoring are changing; data interoperability between agencies is incomplete.
- The water and sewer information system should be linked to an online State Water Cadastre, which in practice does not currently provide any information on wastewater and should also include near-real-time machine-readable data and consistent QA/QC procedures, which are still lacking.

3) Economic and institutional management

- ANRE tariff approvals and standardized sewer-surcharge regulations are progressing, yet many utilities still lack multi-year, directive-linked investment plans, ring-fenced depreciation or performance incentives (compliance, energy, infiltration/overflows, service and connection rates).
- Industrial pretreatment duties (HG 950/2013, enhanced in 2023) also require stronger sector-specific enforcement.
- River basin councils have voluntary membership and uneven support and could benefit from continuous oversight.

Coordination has improved through the National Policy Dialogue and donor platforms, while legal alignment continues through EQS updates, restructuring of monitoring institutions and pending EIONET cooperation. Nevertheless, limitations remain, including staffing and budget constraints in inspectorates and labs, as well as limited procurement and project-management capacity at utilities. The 2014–2030 WSS Strategy must also be revised to reflect current EU requirements.

Note: The Moldovan framework already provides for self-monitoring of discharges by the operator, with analyses carried out by accredited laboratories and regular reporting to the authorities. This places a de facto "initial burden of proof" on the operator. However, the administration (EPA/Inspectorate) retains powers of counter-sampling, verification and sanctioning. This is not a complete or irrefutable transfer of the burden of proof.

Enforcement chains (permits, self-monitoring, operator checks, inspectorate action, penalties and remediation) are in place but are not uniformly effective. Closing the gap requires:

- Completing monitoring and information systems (accredited laboratory feeds and public dashboards)
- Embedding tariffs and licenses within multi-year investment and performance regulation
- Reinforcing industrial pretreatment and incident resolution
- Accelerating pipelines for small rural agglomerations as part of basin plans

Under such controls and continued donor and budget support, Moldova can translate its strong legal framework into verifiable outputs at treatment plants and in receiving waters.[35]

7.5 Information System

7.5.1 Collection of Information on WW

Although wastewater data in Moldova are reportedly collected at different levels, the research conducted for this report did not identify a coherent set of—even minimal—information describing the overall situation of wastewater management and treatment. Utilities are responsible for monitoring daily influent and effluent volumes, incidents and overflows and for conducting annual audits of service coverage, assets and treatment stages. They must also self-monitor effluents for BOD_5, COD, TSS, ammonium, total nitrogen and phosphorus, as well as pH, conductivity, temperature and dissolved oxygen. Permits further stipulate the monitoring of priority substances and microbiological parameters. Sampling is to be carried out on a weekly to monthly basis (with seasonal intensification) and samples are analysed by accredited laboratories, with reports issued on a monthly or quarterly basis.

Industrial discharges to sewers are to be checked at control manholes against the limits set out in HG 950/2013 and any exceedances, surcharges and pretreatment status are compiled on a monthly or quarterly basis.

Sludge amounts, dry solids, treatment quality and destinations are to be monitored monthly, with annual summaries. Energy, chemicals and KPIs, such as kWh per m^3, are summarized monthly or quarterly and audited annually.

For all these obligations, it is not clear whether the monitoring results and other data and information are centrally collected or maintained by each utility and whether utilities are required to provide them to the authorities. The monitoring of surface water for the EPA Reference Laboratory covers approximately 50 sections: 72 chemical parameters are monitored monthly to quarterly and seasonal biological surveys are conducted (including phytoplankton with chlorophyll a, zooplankton, phytobenthos, macrozoobenthos, macrophytes and aquatic microbiology). The hydrometeorological staff provide flow and level data on a continuous daily basis. AGMR/EHGeoM oversees groundwater status (monthly to quarterly) and quality (quarterly to biannual) while the public health service monitors drinking and bathing waters on a regulatory schedule and has piloted wastewater-based epidemiology in Chișinău.

On an event-by-event basis, the compliance and enforcement data record permit limits, monitoring plans, incident notices and non-compliance measures, with monthly and annual summaries. Sewer acceptance enforcement adds logs of exceedances and surcharges. The State Water Cadastre (https://www.csa.gov.md/) should report abstractions, returns and discharges, permits, protected areas and infrastructure annually, but nothing is currently visible online. Meanwhile, the National Bureau of Statistics issues indicators such as abstraction, wastewater generated and treated by level, discharges, coverage and investment. RBMPs update the registers of pressures and impacts, status and Programmes of Measures every six years. Since 2024–25, a national information system has standardized operator reporting of assets, coverage, performance, compliance, energy and overflows and is being connected to the Cadastre and laboratory systems to enable monthly data feeds, quarterly KPIs, annual audits and EU-compatible agglomeration and WWTP dashboards. However, the location of this information is still unclear and the Water Cadastre does not yet display it.[36]

7.5.2 Key Rules for the Information System

The information system for wastewater in Moldova is based on Water Law No. 272/2011 (amended in 2023), which emphasizes the automated information system State Water Cadastre (SWC) that collects digital records of discharges, permits, monitoring, protected areas and hydrotechnical assets. Law No. 303/2013 on public water supply and sewerage requires utilities to produce auditable operational and monitoring data. Meanwhile, Government Decision No. 950/2013 (as amended by Decision No. 656/2023) sets out the technical rules for the collection, treatment and acceptance of industrial effluents as well as the frequency of monitoring, incident notification and surcharge calculation for exceedances. Direct discharges into water bodies are regulated by GD No. 802/2013 and include prohibitions for particularly hazardous substances. Analyses for permitting and compliance purposes must be carried out by accredited laboratories and shortened permit durations ensure reporting is aligned with basin planning cycles.

Governance and data production are shared. The Ministry of Environment is responsible for governing the SWC, while the EPA is responsible for issuing permits, validating operator data and conducting surveillance via reference laboratories. The National Public Authority "Apele Moldovei" is responsible for accounting for abstractions, returns and infrastructure, while the State Hydrometeorological Service contributes hydrological data and the Agency for Geology and Mineral Resources supplies groundwater data. The National Agency for Public Health is responsible for overseeing sanitary surveillance. The Environmental Protection Inspectorate records inspections, incidents and sanctions. ANRE approves sewerage tariffs and requires standardized submissions on costs, performance and coverage, integrating economic and environmental evidence. Utilities (Apa Canal and regional operators) collect influent and effluent, sludge and industrial discharge data, reporting to the EPA, the Ministry and ANRE on statutory schedules.

Core datasets include:

- agglomeration and network inventories
- WWTP design, operation and sludge lines
- Influent and effluent parameters (BOD/COD, nutrients, TSS, metals/priority substances and microbiology, where required)
- industrial acceptance contracts with pretreatment obligations
- events and emergency releases with corrective actions
- economic and service indicators for tariff decisions
- permit metadata and compliance histories

Operators manage permit plans in compliance with GD No. 950/2013 and inform the relevant authorities immediately in case of an emergency. They verify and transmit validated results for chronological, versioned storage in the SWC. Since January 2025, ANRE tariff approvals have relied on standardized evidence from operators and accredited laboratory requirements maintain data credibility. The SWC is implemented to enable interoperability with national statistics and EU-aligned reporting (WFD/UWWTD) and to widen public access under Aarhus obligations, thus maintaining a trade-off between transparency and confidentiality. Enforcement applies those same measurements to impose surcharges and sanctions. In 2025–2028, top priorities focus on closing digital coverage gaps, further establishing machine-readable industrial pollutant and

sludge datasets and enhancing operator-authority data flows such that the SWC emerges as the sole authoritative and single source of truth for wastewater management.[37]

7.5.3 Alignment with the UWWTD

Central to Moldova's legal and digital approach to compliance with the UWWTD is the Automated Information System "State Water Cadastre" (SWC), which is established under Water Law No. 272/2011 (amended in 2023) and Law No. 303/2013. Government Decision (GD) No. 950/2013 (updated by GD No. 656/2023) details the operational, monitoring and industrial acceptance requirements for sewage and WWTPs and GD No. 802/2013 governs direct discharges. Amendments in 2023 mandate the use of accredited laboratories and digital registers, allowing auditable evidence in line with EU formats. The SWC is required to maintain official and georeferenced records regarding agglomerations, collection systems, appropriate systems, WWTP inventories, influent and effluent results, sludge destinations, industrial discharges (contracts, pretreatment), sensitive areas and compliance assessments linked to the Association Agreement milestones and investment planning.[37, 38]

The new UWWTD (Directive (EU) 2024/3019) expands its scope to agglomerations of $\geqslant$1,000 p.e. and addresses micropollutants (such as PFAS), microplastics, antimicrobial resistance (AMR) monitoring and virus surveillance. It also requires monitoring of storm overflow and runoff as well as plant-level reporting of energy and greenhouse gas emissions under stringent transparency standards. Moldova will therefore need to adopt the SWC modules for these parameters and overflow event logs, track energy neutrality and publish a public dashboard compliant with Aarhus transparency requirements.

The immediate priorities for the period 2025–2029 are to:

- finalize the mapping of at least 1,000 p.e. agglomerations;
- link permits, monitoring plans and sampling points;
- stabilize API exchanges with the SWC;
- expand the capacity of accredited laboratories for micropollutants and microplastics;
- integrate AMR and virus surveillance with health partners;
- automate EU-style plant and agglomeration fact sheets and compliance time series.

Outcome: The SWC will demonstrate compliance with the legacy UWWTD and natively support the recast, streamlining approximation and donor-financed upgrades.

7.6 Conclusion of Chapter 7

The legal and regulatory framework seems to be progressing in the right direction. However, the diversity of regulatory texts and the absence of a clear, consolidated law or wastewater code that logically brings together all obligations related to wastewater management and treatment make it difficult to understand the current situation and to identify priorities for progress towards implementation of the UWWTD.

The fact it was not possible to establish a complete or accurate picture of the situation with wastewater management and treatment for this report indicates that the complete situation is not yet sufficiently understood. While several sections of this report conclude that all relevant data and information should be included in the State Water Cadastre, this does not appear to be the case in practice. The absence of a reliable central information system, supported by a common language and reporting framework, as well as clear obligations for operators to report

data on UWWTD implementation and progress and for authorities to regularly assess and publicly report on the situation, poses a significant threat to the effective implementation of national legislation and of the UWWTD.

8 Key Challenges and Strategic Recommendations

Quantitative and qualitative data on the volume and composition of wastewater discharges in the country remain severely limited. WWTPs demonstrate inconsistent reporting practices, highlighting systemic gaps in monitoring and data management. Furthermore, national-level databases on wastewater generation and treatment are not available. This deficiency is primarily attributed to limited institutional capacity for systematic monitoring and the absence of standardized reporting protocols among wastewater treatment facilities. In addition, routine monitoring of influent and effluent pollutant concentrations is not consistently conducted in most WWTPs. The lack of comprehensive baseline data significantly constrains effective infrastructure planning, performance evaluation and evidence-based policy development within the wastewater sector.

The data collected during this baseline assessment further indicate that the operational capacities of WWTPs are below the levels required to ensure effective wastewater treatment across the country. Consequently, treatment performance is often insufficient to meet applicable environmental standards, increasing the likelihood of untreated or inadequately treated effluent being discharged into receiving water bodies. This situation poses a considerable risk of surface water pollution and associated environmental impacts. Therefore, upgrading and modernizing existing WWTP infrastructure should be considered a key priority to enhance treatment efficiency and safeguard water quality.

Addressing these challenges will require a coordinated set of institutional, technical and regulatory measures. In particular, the establishment and enforcement of standardized monitoring and reporting protocols for wastewater treatment facilities is essential to improve data availability and reliability. Strengthening institutional capacities for data collection, management and analysis should be prioritized alongside the introduction of regular monitoring of influent and effluent quality parameters. At the same time, targeted investments in the rehabilitation and modernization of WWTP infrastructure, including improvements in treatment technologies, process optimization and operational management, are necessary to increase treatment capacity and performance.

8.1 Process and Energy Optimization of WWTPs

Under Output 2.3 of the EU4GRE programme, the focus is on improving treatment performance and energy efficiency at WWTPs, along with the capacity-building initiatives for plant operators and decision-makers. The data collection process faced substantial challenges due to the absence of relevant operational information from most WWTPs in Moldova. From the limited available sources, basic operational data were obtained for 112 WWTPs, which were evaluated to identify facilities with optimal potential for implementing EE and ER interventions. The shortlisted candidates underwent consultation with Moldova's NFPs to ensure alignment with national priorities and programmatic coherence. Considering ongoing projects at various facilities, the strategic relevance of localities and treatment performance characteristics, as explained in Chapter 6.5, three pilot sites were selected for detailed feasibility studies and subsequent implementation of EE and ER activities, wherever possible.

Although three pilot sites have been selected, this does not imply that energy recovery technologies will be implemented at each site. The selection of three pilot plants was made to

increase the likelihood that at least one facility has the operational capacity and conditions required for the implementation of an energy recovery option. For the remaining plants, the assessment will primarily focus on identifying operational and energy efficiency improvement measures. Given the current operational conditions of WWTPs, the immediate implementation of energy recovery technologies such as biogas recovery may not be technically or economically feasible in many cases. However, if these facilities are modernized and restored to operate in accordance with their design capacity and intended treatment processes, the implementation of such energy recovery solutions could become viable in the future.

Conducting feasibility studies for these options can therefore provide important strategic value. In particular, these studies can support the mobilization of financing for modernization investments by demonstrating that improvements in WWTP performance would not only enhance wastewater treatment outcomes and thus reduce pollution in receiving waters, but also enable energy recovery for plant operations. In certain cases, recovered energy such as electricity or heat generated could potentially contribute to meeting the energy needs of nearby communities, further strengthening the economic and environmental benefits of infrastructure upgrades.

8.1.1 Pilot Sites

1. **Căușeni WWTP**

Căușeni WWTP represents a unique opportunity for integrated wastewater management demonstration. Although SEI is currently working at this facility, their intervention focuses exclusively on treated wastewater reuse for agricultural irrigation, with no activities related to energy consumption optimization or sludge management. Feasibility studies on energy optimization and by-product valorization at the WWTP will complement the existing assessment conducted by SEI. If the plant achieves improved energy efficiency while enabling the reuse of treated wastewater, its potential to serve as a demonstration site would be significantly strengthened. In this context, the facility could be positioned as a model for other wastewater treatment plants in Moldova, illustrating how integrated approaches combining treated water reuse with energy optimization measures can enhance both operational efficiency and environmental performance across the sector. In addition, the site presents strategic advantages, including its favourable location and its adequate treatment performance according to GD 950/2013.

2. **Ungheni WWTP**

Ungheni WWTP was selected based on its substantial treatment capacity of 15,000 m³/day, making it the third-largest facility in Moldova after Chișinău and Bălți. With Chișinău excluded due to ongoing EBRD support and Bălți disqualified due to private operation, Ungheni represents the largest municipally operated facility available for programme intervention. This high capacity shows a possible potential for generation of sufficient sludge volumes for energy recovery technologies. The facility's strategic relevance is further enhanced by its location in a city hosting an industrial park connected to the WWTP. Industrial wastewater contributions increase both treatment complexity and potential environmental impact, making process improvements at this site particularly valuable. The plant employs conventional biological treatment processes, which need to be further assessed to understand the opportunities for energy consumption optimization through process control improvements, equipment upgrades and operational adjustments. This WWTP is also not currently receiving support from other development programmes.

3. **Fălești WWTP**

The Fălești WWTP was selected based on the availability of more detailed operational data compared to other candidate facilities. Given the limited reliability of other data sources, information collected directly from the plant is considered the most dependable for evaluating operational performance and improvement opportunities. Current sludge management practices involving the storage of untreated sludge on plant premises represent a potential environmental risk. In this context, it would be valuable to assess the potential for energy recovery from sludge through a detailed evaluation of plant operations, including the characteristics and volumes of incoming wastewater and sludge generation. Such an assessment would also support the identification of opportunities for improving the energy efficiency of treatment processes and overall plant operations.

Another key consideration in the selection of this facility is the need to broaden the focus of international support initiatives. Development projects often prioritize large-scale wastewater treatment plants, while small and medium-sized facilities receive comparatively limited attention. Including a medium-sized plant such as the one in Fălești helps demonstrate that significant opportunities for operational improvement and energy optimization also exist at facilities of this scale. Furthermore, the Fălești WWTP is currently not receiving support from other development programmes, allowing for a dedicated focus of activities under the EU4GRE initiative. The facility was also recommended by the Ministry of Environment of Moldova, indicating support at the national level for its inclusion as a pilot site.

8.1.2 Technology Selection for Feasibility Studies

The specific technologies and interventions appropriate for each site cannot be definitively determined at this preliminary assessment stage. Given the significant disparities observed between data from different sources and the limited availability of detailed operational parameters, technology selection for EE and ER requires comprehensive on-site evaluation by technical experts. Site visits will be essential to verify actual operational conditions and capacity, conduct detailed measurements of energy consumption, assess sludge production quantities and characteristics, evaluate existing infrastructure and potential integration points for new technologies and identify site-specific constraints and opportunities.

Energy efficiency improvements can be achieved through energy audits aimed at assessing current energy consumption patterns, identifying optimization opportunities and recommending operational modifications. Such audits provide a systematic basis for improving the overall energy performance of WWTPs. Potential energy optimization measures may include the following:

- **Upgrade or optimization of pumps and blowers:** Ageing equipment in small WWTPs often operates with low energy efficiency. Installing Variable Frequency Drives (VFDs) on blowers and main pumps can improve operational flexibility and reduce energy consumption. In addition, replacing oversized pumps with properly sized high-efficiency models and optimizing pump scheduling to avoid operating multiple pumps at low loads can further enhance efficiency. Regular maintenance, including cleaning pumps and removing clogging, is also essential to maintain optimal performance.
- **Optimization of aeration systems:** In most biological wastewater treatment processes, aeration accounts for approximately 50–70% of total electricity consumption. Even relatively simple improvements can therefore result in significant energy savings. These measures may include the installation of dissolved oxygen (DO) control systems, replacing coarse-bubble diffusers with fine-bubble diffusers where technically feasible,

implementing timers or simple programmable logic controller (PLC) systems to regulate blower operation and repairing air leaks in piping and diffuser systems.

- **Improved sludge management practices:** Where aerobic sludge stabilization is applied, energy demand can be reduced through process optimization. For example, sludge age (solids retention time, SRT) can be adjusted to optimized levels to avoid excessive aeration requirements.

In addition to energy efficiency measures, small-scale energy recovery options can also be implemented. Potential options include, but are not limited to:

- **Micro-turbines for hydropower generation:** If treated effluent is discharged with a significant elevation difference, the installation of a micro-turbine may allow for the generation of small amounts of electricity from the hydraulic head.
- **Co-treatment of sludge with agricultural waste:** In regions with significant agricultural activity, sludge from WWTPs could potentially be co-digested with agricultural waste in a regional anaerobic digestion facility. Such an approach could enable biogas production while simultaneously improving sludge management practices and supporting renewable energy generation.

Alternative sludge management strategies, such as agricultural application, composting or co-processing, can also be evaluated where energy recovery may not be technically or economically optimal. The feasibility studies will systematically evaluate site-specific technical, operational and institutional criteria, ultimately recommending tailored suggestions that maximize EE improvements and ER potential.

8.2 Policy and Regulations

New accomplishments in Moldova, including the recent update to the Water Law of 2023, the implementation of more stringent sewer acceptance rules, advanced standards on integrated industrial permitting and the formulation of basin plans, must now be converted into binding obligations, financed projects and verifiable impact over the 2025–2030 period. A national prioritization programme should be developed to gather priorities identified in RBMPs, aggregate them and define a phasing approach with key national priorities for wastewater collection and treatment. In particular, the expansion of collective sewer collection and treatment should be developed in order to provide a more significant share of the population with adequate wastewater collection and treatment of sewerage. This will lead to increased energy use and sludge production and will require further refinement of the legal framework.

An effort is still necessary within the legal and regulatory framework to overcome the diversity of relevant texts and laws and to bring together in a logical way all obligations contributing to the wastewater management and treatment. This would provide a clear framework for all actors implementing this framework and involved in the management and prioritization of efforts necessary for wastewater infrastructure across the country, which serves as a key asset for environmental protection and the well-being of the population. Furthermore, this framework should also be supported by a well-organized and transparent data and information system, able to provide a clear picture of the current situation and of the effective application of the legal framework by those subject to it. This is all the more necessary as the country has entered an accession process and will need to define a clear and achievable roadmap towards UWWTD

compliance, which may also be linked to possible EU funding to finance part of the system upgrade.

Amendments to the Water Law should include a clear and explicit requirement reflecting that the recast Urban Wastewater Treatment Directive, including the treatment of agglomerations above 1,000 population equivalents and stricter tertiary treatment requirements in eutrophication-risk catchments. The introduction of quaternary treatment should be phased in at larger plants. The amendment should also establish a pathway towards energy neutrality including audits and annual reporting, standard definitions and progressive reduction targets for combined sewer overflows and public plant and agglomeration dashboards. This last element is of particular importance to regularly track progress and demonstrate to donors and EU authorities the status of implementation and its progress. As the legal framework and the reporting into the State Water Cadastre have already been established, it is now time to use the collected data to publicly present the situation and update it regularly. It is also crucial to have a legal framework for reclaimed water regulation and requirements for sludge end-of-waste standards.[13, 30]

Secondary acts will need to operationalize this change. The sewer acceptance regulation should include an annex for sector-specific pretreatment, clear sampling procedures and a digital chain of custody, risk-based surcharges, rapid suspension powers and mandatory digital reporting to the State Water Cadastre. Direct discharge rules must strengthen the derivation of emission limits from up-to-date environmental quality standards and status classes. They should also introduce proportionate micropollutant monitoring (including PFAS), drought and low-flow adaptations and safeguards for nature-based or infiltration systems. Updating surface and groundwater quality guidelines will allow the update of the Moldovan-relevant priority substances list, establish status classes and guide the transformation of ambient objectives into permit limits.

There should be two thematic regimes. First, a reclaimed water regulation should be transposed for agricultural irrigation including quality classes, risk management plans, responsibilities, monitoring and notification. This regime could later be expanded to other uses. Secondly, a consolidated sludge regulation should establish minimum treatment levels, pathogen and metal thresholds, agronomic criteria, crop restrictions, buffer zones, traceability and end-of-waste or product standards concerning digestate, compost and pyrolysis-derived outputs. A cadastre-based national sludge registry would guarantee complete traceability.

Ambition requires enforcement and evidence to back it up. Integrated permits should match industrial limits with sewer acceptance obligations and municipal protection plans. The inspectorate should be equipped with rapid response tools and an annual public scorecard. Compliance information must come from accredited laboratories with proficiency testing, supported by electronic chains of custody and digitally signed reports.[14]

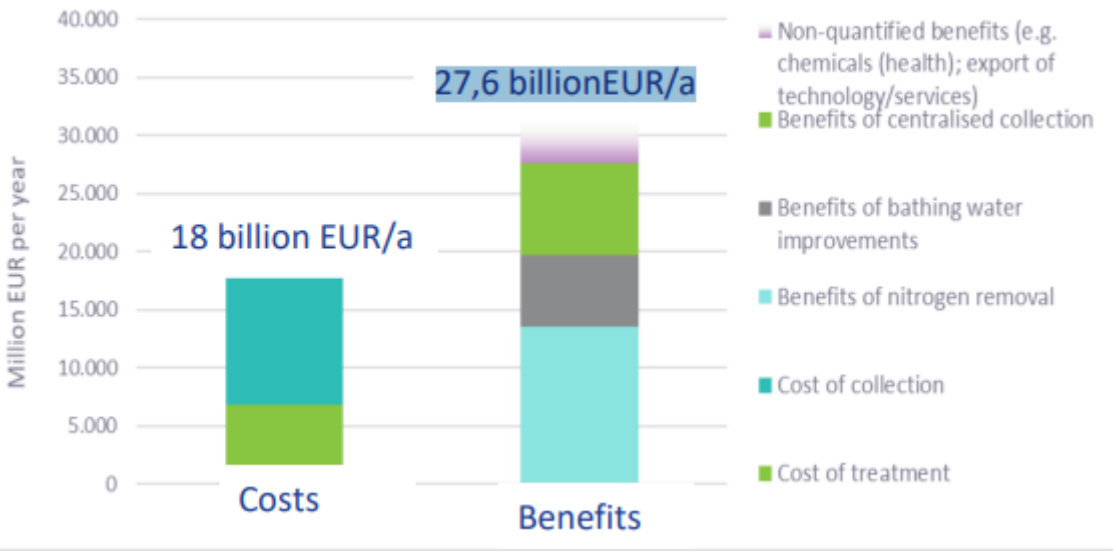
While the second-cycle RBMPs list a set of basic measures to be implemented for the management of wastewater (collection and treatment), their effective implementation should be tracked at national level. This is necessary in order to follow progress at least annually and verify that the implementation path follows the EU accession commitments and if not, to take the necessary corrective actions.

9 Conclusion

This baseline assessment of wastewater management in the Republic of Moldova reveals that the sector is at a critical juncture, positioned between historical infrastructure deficits and emerging opportunities for transformation toward EU-aligned, sustainable practices. While significant progress has been achieved through recent legislative reforms and institutional strengthening, substantial gaps remain in wastewater collection, infrastructure coverage, operational performance, data availability and financial sustainability.

It is clear that the identified lack of comprehensive wastewater collection and proper treatment in Moldova leads to major direct and indirect economic damage to public health and the environment. The Government should be aware about the EU-wide experience with the implementation of the 1991 UWWTD: it has shown 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 Annualized Benefits and Costs at Current Implementation Levels (source: COMMISSION STAFF WORKING DOCUMENT, Brussels, 13 Dec. 2019)



9.1 Current State and Critical Gaps

The assessment has identified several fundamental challenges that constrain Moldova's wastewater sector. Only 10% of localities benefit from centralized sewerage services, with a strong rural-urban divide where less than 1% of rural residents have access to adequate sanitation infrastructure. Among the 271 documented WWTPs nationwide, merely 11% achieve normative treatment standards, while the majority operate with insufficient treatment efficiency either due to outdated infrastructure or inadequate treatment processes. This operational deficit is compounded by severe data gaps, critical parameters including pollutant concentrations,

energy consumption profiles and sludge production volumes are either not monitored or inadequately reported across most facilities.

The infrastructure challenges extend beyond treatment performance. Ageing collection networks, limited industrial pretreatment and accumulation of untreated sludge at many sites pose environmental and public health risks. These conditions represent both immediate liabilities and unrealized opportunities for resource recovery and energy generation.

The fact that it was not possible to gather a complete or accurate picture of the situation with wastewater management and treatment in the current document demonstrates that the situation is not well known. While several investigations throughout this document concluded that all data and information should be included in the State Water Cadastre, this does not seem to effectively be the case. The absence of a reliable central information system backed by a common reporting framework and obligations for operators to report data on UWWTD implementation and progress and for authorities to regularly assess and publicly report on the situation, represents a significant threat to the correct implementation and the economic and environmental effectiveness of national legislation and the UWWTD.

9.2 Policy Framework and EU Alignment

Moldova has demonstrated strong commitment to wastewater sector reform, particularly through the November 2023 amendments to Water Law No. 272/2011 and the development of second-cycle River Basin Management Plans. These reforms strengthen permitting procedures, clarify institutional responsibilities and align monitoring requirements with WFD principles. The establishment of ANRE's tariff approval authority and the development of a national water and sanitation information system represent important governance advances.

However, alignment with the recast UWWTD (EU) 2024/3019 will require additional legislative and regulatory measures. The expanded scope to agglomerations above 1,000 population equivalents, requirements for tertiary nutrient removal in sensitive areas, quaternary treatment for micropollutants, energy neutrality pathways and enhanced transparency obligations necessitate substantial regulatory amendments. Moldova currently lacks explicit national frameworks for agglomeration mapping, reclaimed water classification and reuse standards, comprehensive sludge management regulations with end-of-waste criteria and mandatory connection obligations for households and businesses.

The legal and regulatory framework seems to be progressing in the right direction. However, the diversity of texts and the absence of a clear and single law or wastewater code that gathers in a logical way all the obligations contributing to the wastewater management and treatment makes it difficult to understand the current effective situation and to establish priorities for progress towards UWWTD implementation.

The basic measures listed in the RBMPs should help improve the situation, but it will be necessary to follow their implementation to ensure that engagements are met. In addition, the accession process will require to implement an effective EU reporting process, which can only be done with a reliable national information system gathering data at each agglomeration covered by UWWTD requirements (i.e. under the new UWWTD, agglomerations larger than 1,000 population equivalents).

9.3 Strategic Opportunities and Pilot Interventions

The assessment highlights both the opportunities and the practical constraints associated with improving the treatment performance and energy performance of WWTPs in Moldova. Despite the challenges in data collection and analysis, the assessment enabled the identification of a preliminary pool of facilities and the subsequent selection of three pilot sites through a process that considered data availability, operational relevance and alignment with national priorities. The selected facilities in Căușeni, Ungheni and Fălești represent different operational contexts and scales, providing a practical basis for testing approaches to energy efficiency improvement and by-product valorization within the country's wastewater sector.

The selected pilot plants were chosen based on specific considerations for their representativeness and suitability for demonstrating EU4GRE interventions when compared with the other WWTPs:

- **Căușeni WWTP** was selected to complement existing work on treated wastewater reuse conducted by SEI. Its relatively stable operational performance and favourable location make it suitable for integrating energy optimization measures alongside reuse activities, illustrating a holistic approach to wastewater management.
- **Ungheni WWTP** was selected for its substantial treatment capacity of 15,000 m^3/day and its connection to an industrial park. The facility is not receiving external support, allowing for focused implementation under EU4GRE.
- **Fălești WWTP** was selected because of its medium-scale nature, which allows demonstration that energy optimization and operational improvements are feasible even at smaller facilities. The site is not currently supported by other development programmes, ensuring exclusive attention under EU4GRE.

The findings also indicate that, under current operational conditions, the immediate deployment of advanced energy recovery technologies may be limited at the plants. However, opportunities exist to improve the energy performance of WWTPs through targeted operational and technological measures. In particular, energy audits, process optimization, equipment upgrades and improvements in sludge management practices can contribute to more efficient plant operation. In parallel, site-specific assessments may identify opportunities for small-scale energy recovery or alternative sludge valorization options where technically feasible. The feasibility studies to be conducted at the selected pilot plants will therefore play an important role in verifying operational conditions, identifying realistic intervention options and developing tailored recommendations based on local technical and institutional circumstances.

9.4 The Path Forward

The transformation of Moldova's wastewater sector from its current state to one aligned with EU standards and circular economy principles is a long-term endeavour requiring sustained commitment and substantial investment. However, the foundation has been established through recent legal reforms, basin planning frameworks and governance improvements. The pilot interventions proposed under EU4Green Recovery East will provide demonstrations of what is achievable, generating evidence and building capacity for broader replication.

Success will depend on sustained commitment, securing adequate and sustainable financing, strengthening institutional capacity at all levels from utilities to regulatory agencies, ensuring

transparent monitoring and public accountability and fostering cross-sectoral coordination among environment, infrastructure, agriculture and health authorities. Moldova stands at a pivotal moment. With candidate status for EU accession and growing recognition of water security challenges, the country has both motivation and opportunity to accelerate its wastewater sector development.

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11 Annex

Wastewater treatment plant data collected from Environmental Protection Inspectorate (2025)

WWTP	Capacity (m^3/day)	Treatment Performance	Process Line	Requirement for repair
Telenești	29-17	Insufficient	MBBR	
Dănceni	0.5-10,000		Vavibloc, biological treatment	Commissioned in 2021
Chișinău	137,546	Insufficient	Biological treatment	Requires repair
Bălți	60,000	Insufficient	Biological treatment	Requires repair
Valea Mare Commune	15,000	Insufficient	WWTP biological treatment	Require repair
Fălești	10,000	Insufficient	Biological treatment	
V.Cupcea street, 2A, Orhei municipality	10,000	Insufficient	PUR Biological treatment	Require repair
Glodeni	8,000	Non-functional	Biological treatment	
Anenii Noi	7,500	Insufficient	Biological treatment	Requires repair. it is more appropriate to redesign and reconstruct the SEB in order to minimize maintenance and activity costs.
Ceadîr-Lunga	6,900	Purification degree according to AMFSA		
Comrat City	5,700	Insufficient	Mechanical purification	require repair
Edineț	5,300	Insufficient	Biofilter, biological treatment	Require repair
Căușeni	4,800	Sufficient	Biotal, Biological treatment	
Seliste	4,600	Sufficient	ZUC Biological treatment	
Hîncești	3,700	Insufficient	Biological treatment	require repair

Cahul Municipality	3,200	Insufficient	mechanical/biological treatment	Currently, on the territory of the existing treatment plant, a new mechanical/biological plant is under construction, which according to the project will have a capacity of 6,500 cubic metres/day
Călărași, Moldova	2,400	Insufficient	BBR biological and chemical treatment	routine repairs.
Riscani Riscani district	2,400	Insufficient	Soviet Type (1979) Biological treatment	Require repair
Vadului lui Vodă town, Balabanesti village	2,125.3	Insufficient	Biological treatment	Requires repair
Cricova	2,000	Insufficient	Biological treatment	Requires repair
Florești District	1,500	Insufficient	Biological treatment	
Vulcănești	1,500	Purification degree according to AMFSA	Mechanical purification	
Nisporeni	1,500	Insufficient	FLEXIDIBLOK	require repair
Basarabeasca	1,200	Insufficient	Biological treatment	
Cimișlia	1,200	Insufficient	Topaz biological treatment	Requires partial repair to sedimentation tanks
Briceni	1,020	Sufficient	Topaz biological treatment	
Cantemir, Moldova	740		Mechano-biological treatment	
Băcioi	700	Insufficient	Biological treatment	Requires repair
Porumbeni-Pașcani village Criuleni district	700	Insufficient	Biologicla treatment, aeration tank	Required repairs
Magdacești village, Criuleni district	700	Insufficient	MBBR	
Dondușeni	700	Sufficient	Biological treatment, Flexibloc	
The city Rezin	700		MBBR, biological treatment	

Drochia	653.4	Sufficient	Mechanical/biological treatment	Routine repairs
Peresecina	600	Test Status	Compact WWW, biological treatment	
Gura Căinarului	450	Sufficient	Biological treatment	
Ciorescu	400	Insufficient	MBBR	Requires repair
Drochia	400	Non-functional	Intelli BIO MBR-7700 Biological treatment	
Leova District	399	Insufficient	BIO-399	requires major repairs to the sand removers, primary and secondary decanters
Sadovoe	380	Non-functional	Biological treatment	
Sîngerei	350	Insufficient	Oxide 800, biological treatment	
Sipoteni	320	Insufficient	Intelli BIO MBBR Biological treatment	Current repair
Micleşti, Criuleni	300	Sufficient	Topaz biological treatment	
Merenii Noi	300	Insufficient	Biological treatment	Requires repair. it is more appropriate to redesign and reconstruct the SEB in order to minimize maintenance and activity costs.
Ivancea	300	Test Status	MBBA, biological treatment	
Costeşti, Rîşcani	300	Insufficient	MBBM-300 (Moving Bed Biofilm Reactor) biological treatment	
Cornești (town), Ungheni	300		BIOTAL-300 type	
S. Hirjeuca	280	Sufficient	Biological treatment	
Mingir	250	Insufficient	Biological treatment	Partial repair
Fundul Galbenei	250	Insufficient	Biological treatment	Partial repair
Ştefan Vodă	250	Insufficient	Monobloc, biological treatment	require ca[acity expansion
Glodeni	240	Test Status	Biological treatment	
Pelinia	200	Non-functional	Mechanical/biological treatment	
Avdarma	200	Insufficient	Biological treatment	

Peresecina	180	Insufficient	Monobloc-T Biological treatment	
Romanesti village	170	Insufficient	compact type	Commissioned in 2024
Iordanovca	151		Biological treatment	newly built
Bașcalia	150	Insufficient	Biological treatment	The works are not fully completed, the final acceptance certificate of the works is not signed and it is not put into operation.
Lipcani	120	Sufficient	Monoblock biological treatment	
Petrunea Village	120	Test Status	Biological treatment	
Svetlîi	110		Topaz biological treatment	
Crihana Veche	100		Topaz biological treatment	
Cociulia	100		Topaz biological treatment	
Ecaterinovca	100		Biological treatment, phytofilter	
Corjova, Criuleni	100	Sufficient	SBR Biological treatment	
Işnoveț village Criuleni district	100	Insufficient	Topaz biological treatment	
village of Rîșcova Criuleni district	100	Sufficient	Biological treatment, Clipper Austria	
Budești	100	Insufficient	Biological treatment (Topas 2x300S)	Requires repair
Speia, Anenii Noi	100	Insufficient	Biological treatment	Station recently rebuilt and adjusted from capacity of 1400 m3/d
Budva Municipality	100		Topaz biological treatment	
Copceac, Gagauzia	100	Insufficient	Topaz biological treatment	
Bolohan	100	Test Status	Topaz 150, biological treatment	
Chetrosu, Anenii Noi	98	Insufficient	Biological treatment	New station
Baimaclia, Căușeni	90	Insufficient	Topaz Biological treatment	

Valatie, New York	90		Topaz biological treatment	Commissioned in 2024
Gura Camencii	90	Insufficient	Biological treatment Topaz	require repair
Șoldănești	90	Sufficient	Biological treatment - Topas 300	Require repair
Popeasca	90	Insufficient	Topas-300PF", biological treatment	
Branesti village, Ivancea commune, Orhei district	72	Insufficient	Biological treatment plant	Require repair
Onișcani	70	Insufficient	ZUC biological treatment	routine repairs.
Ermoclia	70	Insufficient	"Biofix-U35", biological treatment	Partial repair
Cneazevca	60		Criber SBR60	
Bucovăț Town	60	Insufficient	2- Topaz type stations, biological treatment	Require repair
Iurceni	50		ZUC	
Dobrușa, Șoldănești	50	Sufficient	Topaz, biological treatment	
Chirileni	48		Cribrnet" type	
Vatici	45	Insufficient	Topaz- 300 biological treatment	Under developed
Cruzești	45	Insufficient	Biological treatment (Topas-150)	Requires repair
Frumușica, Florești	40		Topaz biological treatment	
Ghetlova	35	Sufficient	TOPAZ 75, biological treatment	
Village Goianul Nou, Chisinau	31.5	Insufficient	Monoblock T	Requires repair
Seliște, Nisporeni	30	Sufficient	Closed type - Vodaland SBR	
Cristești, Nisporeni	30		ZUC	require repair
Hulboaca village, Orhei district	25	Sufficient	TOPAZ 75 type, biological treatment	
Ciocîlteni	25	Insufficient	Topaz, biological treatment	Partially working
Sinești	25		Compact WW 25	
Vatici	23	Sufficient	Laiola IntellIBIO, biological purification	Under developed

Olănești	20	Insufficient	Bio-disc JB", biological treatment	
Frumușica, Florești	15		Closed type - Topas-100 PF	
Village of Valcinet	12	Insufficient	Biological treatment	Current repair
Șoldănești	11.5	Insufficient	Biological treatment - Topas 75	Require repair
Șoldănești	11.5	Sufficient	Biological treatment - Topas 76	Require repair
Temeleuți, Călărași	10	Insufficient	Biological treatment	Requires repair
Cotovscoe	10		Topaz biological treatment	
Cneazevca	10		Criber SBR10	
Budai, Chiayi	10		Criber Full Control	
Șoldănești	7.5	Sufficient	Biological treatment - Topas 50	Require repair
Novosiolovca	5.3	Non-functional	SBR Screen	
Marcăuți, Briceni		Non-functional		
Ocnița		Sufficient	Biological treatment	
Otaci City		Sufficient	Biological treatment	
Or.Frunza		Sufficient	Biological treatment	
Taraclia		Partially functional		

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