

The achievements, challenges and opportunities in the development of public water supply systems in the South Region of the Republic of Moldova

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Abstract: Despite the lower provision of surface and groundwater resources, the population's access to public aqueducts is significantly higher than in the Northern and Central Development Regions. About ¾ of the population of the South Region has access to public waterworks, including around 90% in urban areas and 60% in the rural areas. The highest access rates are recorded in the administrative districts of Basarabeasca (95%), Căuşeni (87%), Ştefan Vodă (83%), Cimişlia and Autonomous Territorial Unit Găgăuzia (82% each), while the lowest rates are observed in the districts of Leova (51%) and Cantemir (57%). In the years 2014-2024, the total length of public aqueducts in the Southern Region increased by 1.5 times or with ≈1670 km, including in rural areas – by 1.5 times or with 1302 km and in urban areas – by 1.4 times or with 367 km. The total volume of water supplied in the study region increased by 1.8 times, including in rural areas by 2.1 times and in urban areas – by 1.5 times. The positive dynamics is manifested in all administrative districts of the Southern Region. At the same time, the quality of water captured from artesian wells frequently does not correspond to the physico-chemical and microbiological standards, and the technical and financial capacities for capturing and transporting water from the Dniester and Prut rivers are small. In this study were applied statistical and analytical methods, including systemic and SWOT analysis, cartographic and comparative methods.

1. Introduction

Providing the population with safe and high-quality drinking water is one of the main objectives of sustainable regional development. The Southern Region of the Republic of Moldova is characterized by an insufficient amount of atmospheric precipitation, very low flows of internal rivers, massive clogging of reservoirs (Jeleapov, 2024), and periods of dryness and drought are much more frequent and intense (Nedealcov et al., 2018; Cojocari et al., 2024). In addition, the pronounced rural and

agrarian character of the study region, supplemented by the lower paying capacity of the population compared to the other regions of the Republic of Moldova, has as a consequence, increased vulnerability and decreased sectoral and regional resilience to climate change and its effects, especially the reduction of available water resources. The increased vulnerability and decreased resilience to the action of these risk factors is determined, to a significant extent, by recent demographic changes, which are more intense in the Southern Region (Matei et al., 2024), especially the aging of the population, the massive exodus of the young population from villages and small towns.

The increasing impact of climate change on the vulnerability of the population and water supply sector is a topic frequently addressed both in scientific publications and in reports of international organizations. In this context, a significant importance are the recent researches focusing on: the evaluation of the impact of climate change on vulnerable population in the different states of the words (Josefs et al., 2023); climate change impacts on water management (Thebo, A. 2025); water use efficiency under climate change conditions (Fu et al., 2024); domestic water demand (Zhu et al, 2025) and water use efficiency of this sector (Mazzoni, 2023); sustainable water use (UN, 2023; Freitas, 2022; Sebusang et al., 2022).

The status and use of public systems of water supply from Republic of Moldova and its southern region are reflected in the recent analytical studies coordinated by OECD (2013, 2019), the Environmental Protection of International River Basins (EPIRB, 2016), European Union Initiative for Water (EUWI+, 2020), in the Management Plans of Danube river (2021), Dniester Hydrographic District, Cycles 1-II (GD No. 814/2017, GD 70/2025), of Danube-Prut and Black Sea Hydrographical District, Cycles I-II (2018, 2022), and of the Botna river basin (Bejan I. et al., 2020), as well as in the and regional sectorial program (South RDA, 2024). Also particularly valuable are studies on the assessment of vulnerability of population and water supply sector to climate changes (Sîrodoiev, 2008; Țăranu et al, 2018) and on current problem of operation and developing the water supply and sanitation infrastructure at the regional and local level, particularly in the Central (Dinet et al., 2017) and Southern Regions of the Republic of Moldova (GIZ, 2015, Chiurrciu, 2023; South RDA, 2025a).

The present study is a continuation of our previous researches about the status and use of water supply systems at the regional level, particularly in the Northern (Bacal, 2021, 2022a, 2023b; Burduja, 2022), the Central Development Region (Bacal, 2020) and on the South Region of the Republic of Moldova (Bacal, 2024). Also, some aspects of water use elucidated in the present study were previously analysed in our studies elaborated at the level of river basins (Bejan et al., 2017, 2020, 2023; Bacal, 2022b, 2023a; Burduja, 2024).

The purpose of the study is to identify the main achievements, challenges and opportunities in the development of public water supply systems in urban and rural localities from the Southern Region of the Republic of Moldova. The main objectives of the study are: 1) the regional geodemographic situation and its influence on the evolution of water demand; 2) evaluation of the status and use of the public water supply systems; 3) identification the key challenges of the public water supply sector; 4) assessment the access of the urban and rural population to the public supply system and intra-regional

differences in water consumption; 5) identification of achievements of the operation of public water supply systems; 6) developing recommendations to solve the problems identified in the water supply of the urban and rural population in the study region.

1. Data and Methods

The main statistical and analytics support of this research included:

- 1) Data from the National Bureau of Statistics (NBS) on the status and activity of the public systems of water supply (NBS, 2025b), on the number of present population (NBS, 2023), and according data of Population and Housing Census 2024 (NBS, 2025a). These data were used to evaluate the status and use of public water supply systems in the urban and rural localities form Southern Region, population access to public aqueducts and per capita water consumption. The study period covered the years 2014-2024 – the period of implementation of the National Water Supply and Sanitation Strategy (GD 119/2014).
- 2) Annual Reports „Financial and production indices of the activity of water supply and sewerage companies” of the Associations „Moldova Water-Chanel” (2014-2024) on the status and activity of water supply systems from urban area. Also, these reports were used for identifying the problems and opportunity in the water use and management.
- 3) Yearbooks of State Inspectorate for Environmental Protection (SIEP) on the quality of environmental factors and on the activity of Ecological Inspections (2014-2024), widely used for the identification of regional and local problems in the use and management of water;

The main methods used in this study are: statistical-mathematical, cartographical, including GIS techniques, analytical, deductive and comparative methods. Statistical-mathematical methods were used for data processing and the development of graphic support regarding the volume of abstracted and used water at the regional and local (districts) level and identifying the recent dynamics of the respective indicators. The cartographic methods, based on GIS techniques, were applied for the spatial representation of the administrative-territorial units (on the thirist and second level) of the South Region of Republic of Moldova, the volume of water captured on the sources of origin and on the main categories of use in the districts from South Development Region (SDR) and in the Autonomous Territorial Unit (ATU) of Găgăuzia. The implementation of GIS models in the assessment of the water supply sector contributes significantly to the validation and proper interpretation of data using advanced technologies, which can significantly improve work in the field of territorial planning of urban and rural settlements (Lateş et al., 2016).

The analytical methods were used for comprehensive analysis of indices regarding the volumes of abstracted and used water, per total, from surface and underground sources and by main usage categories. The SWOT analysis method was applied to identify problems and opportunities regarding the provision of water resources, status

and use of water supply systems in the Southern Region of the Republic of Moldova (Table 2). The comparative method was applied for assessment the dynamics of the volume of abstracted and used water and the status of water supply systems in the administrative districts from Southern Region.

3. The study area

The South Region occupies a total area of 9.2 thousand km² or 27% of total surface of Republic of Moldova (RM), including the South Development Region (DR) – 7.4 thousand km² (22%) and the Autonomous Territorial Unit (ATU) of Găgăuzia – 1.8 thousand km² (5.5%). According to the Law of RM No. 764-XV/2001 and Law No. 438/2006, the South DR includes 8 administrative districts (Căușeni, Ștefan Vodă, Cimișlia, Basarabeasca, Leova, Cantemir, Taraclia and Cahul) (Figure 1). The largest part of the Region's is located within the Danube-Black Sea Hydrographical Space (HS), including the Ialpuș river basin (ATU Găgăuzia, Taraclia, Cantemir and Cahul districts), Cogâlnic river basin (Cimișlia, Basarabeasca and Căușeni districts), the Sărata and Hadjider river basins (a small part of Căușeni and Ștefan-Vodă districts). In the Prut hydrographic basin (HB) are located the absolute majority of the localities from Leova district and of the localities from Cantemir and Cahul administrative districts located in the meadow of this river (Bacal, 2024). In the Dniester hydrographic basin, the localities in the Ștefan-Vodă district located in the valley of this river, as well as most of the localities in the Căușeni district located in the Botna river basin (Bacal, 2022b).

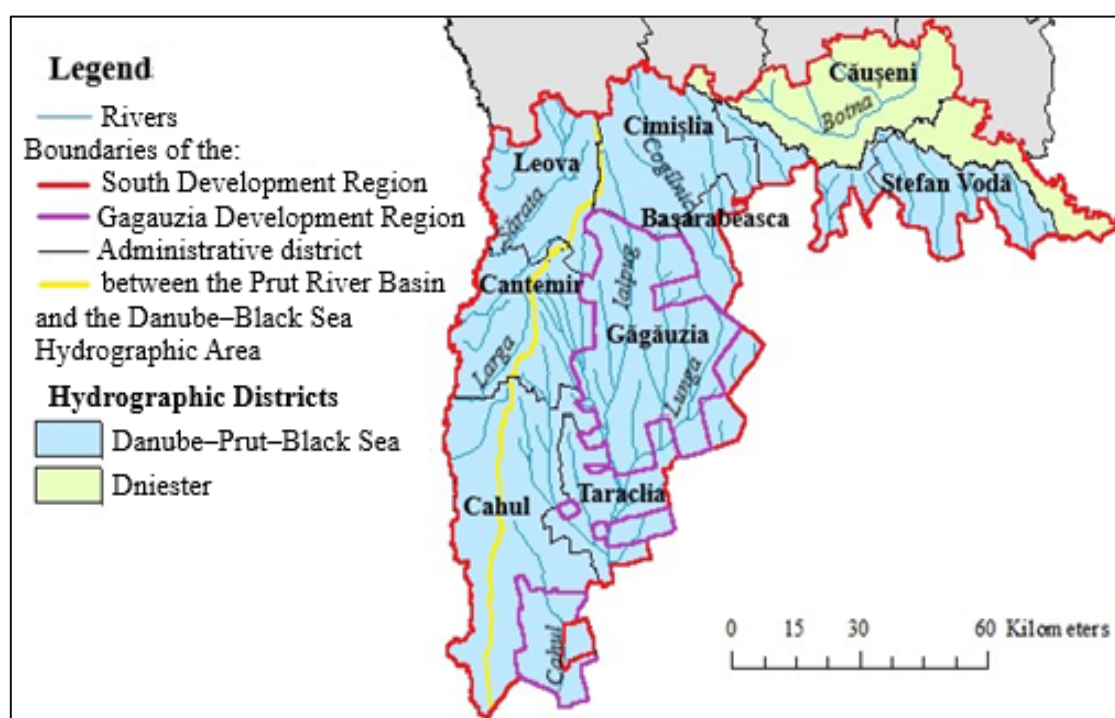


Figure 1. Southern Region of the Republic of Moldova. Administrative map and hydrographic network

The present population of the Southern Region is 626 thousand inhabitants or 19.3% from total number of populations from Republic of Moldova (NBS, 2023), including in the Southern Development Region – 479 thousand (15%) and in the ATU Găgăuzia – 148 thousand (4.6%). According to the Population and Housing Census (NBS, 2025), the number of the population is 439 thousand inhabitants (18%), including in the Southern DR – 324 thousand (13%) and in the ATU Găgăuzia – 115 thousand (4.7%). The rural population makes up about 70% of the total population, including 74% in the Southern DR and 61% in the ATU Găgăuzia. The urban localities are only small and medium-sized, including the municipalities of Cahul, Comrat and Ceadăr Lunga. The aging rate is lower than in the North and Center Development Regions, but the growth rates are more intense (Matei et al., 2024). The phenomenon of migration and depopulation are more pronounced. The predominance of the rural population, the high rate of aging, the massive exodus of the young people, the low incomes of the population and of the local public budgets represent the significant constraints for development of public water supply systems in the study region (Table 2).

4. Results and discussion:

4.1. Water resources

In the Southern Region of the Republic of Moldova, there are about 1170 rivers with a total length of 4125 km, of which 3 rivers have a length of over 100 km, 9 rivers – between 50 and 100 km, 52 rivers – between 10 and 50 km, 1106 streams with a total length of 2149 km. Therefore, small rivers and streams predominate, with minor importance in water supply.

The Prut and Dniester rivers form the western and eastern borders of the region and represent the main source of drinking and technological water, but insufficiently exploited (Bacal, 2022b). They have a significant contribution only for the water supply of the cities along the Prut River (Cahul, Cantemir and Leova). The density of the hydrographic network of the region is 0.44 km/km². In recent years, both at large rivers and small and medium-sized rivers have witnessed a significant reduction of its flow. The region also contains the largest natural lakes – Beleu, Manta, Dracele, Rotunda and Nistru Vechi (Old Dniester), with a total area of 17.35 km², which constitutes 78% of the total surface of natural lakes in the Republic of Moldova. In the ATU Găgăuzia, water is extracted, almost exclusively, from underground sources, with a total volume of 8-10 million m³. Surface sources are very limited (Table 2). There are 2 major water reservoirs: the Comrat reservoir, with an area of 1.7 km², and the Kongaz reservoir, with an area of 4.9 km², both of which are heavily affected by clogging and drying processes (SIEP, 2024).

Groundwater is the main source of water supply in the absolute majority of urban and rural localities. Of greater importance are the Badenian-Sarmatian, Middle Sarmatian, Pontian and Holocene-alluvial aquifer complexes. The Badenian-Sarmatian aquifer complex covers most of the study region, with the exception of Cahul district and part of Cantemir and Taraclia districts, and of ATU Găgăuzia. It contains rich reserves of good quality water. The thickness of the aquifer layers is 30-50 m, reaching up to

100-500 m (Jeleapov, 2024). After mineralization and hardness, it frequently meets the requirements for drinking water.

The Pontian aquifer horizon is widespread only in the southern part of the Republic outside the river valleys, where the Pontian deposits are washed out. The aquifer rocks are formed by clays and granular sands of a bluish-green color, and the thickness of the aquifer layers ranges from 7-40 m, reaching to 80-100 m. The waters are sulfate-chlorine-sodium with mineralization ranging from 0.5 to 1.7 g/l and hardness up to 4.3 mEq/l. The water quality usually complies with the requirements for drinking water, but there are sectors with high mineralization and hardness (Table 2). The waters are widely used for drinking or technical water supply.

The Holocene-Alluvial aquifer is spread throughout the region in river meadows, less in the districts of Ștefan Vodă, Căușeni, Cimișlia and in the ATU Găgăuzia. The aquifer rocks are formed by sands, sandy clays, pebbles. The thickness of the layers varies between 0.5 m -18 m, and the specific flow rate - up to 0.8 l/s. The waters of the alluvial horizon in the Dniester River valley are fresh, with mineralization of 0.7-1.0 g/l, and in the valleys and meadows of small rivers up to 3.0-7.0 g/l. They are used for technological and drinking purposes, and the water quality often does not comply with the requirements for drinking water.

Certainly, in the case of excessive water consumption, in the conditions of intensifying climate aridity, in the long term there is a risk of significant reduction in the available reserves of groundwater, but this problem manifests itself only in some specific areas. The significant decrease is much more pronounced in the reserves and level of groundwater extracted from wells and springs and insignificant (in the short and medium term) in deep groundwater. The amount of atmospheric precipitation and the annual and multiannual rainfall regime and accelerating of climate aridification have a predominant impact on the reserves of the Holocene-alluvial aquifer horizon and have an insignificant influence on the reserves of the Badenian-Sarmatian Aquifer Complex and other deep-water aquifer horizons, which are most frequently used by the public water supply systems. The much more acute problem is not so much the quantity of extracted water from underground sources, but its quality or very frequently it does not meet the requirements for the quality of drinking water in the most of rural localities, especially the high degree of mineralization and excessive concentration of nitrates (Bacal et al., 2024), more common in water extracted from wells and springs.

Although it occupies 27% of the Republic's area, the South Region has only 14.5% of the groundwater reserves (Burduja, 2022). The richest groundwater reserves are located in the districts of Căușeni (57.9 thousand m³/day) and Ștefan Vodă (51.6 thousand m³/day), which have $\approx 1/2$ of the groundwater reserves of the region. The smallest groundwater reserves are registered in the districts of Taraclia (8 thousand m³/day) and Basarabeasca (6 thousand m³/day) with small dimensions. In the Basarabeasca district, a significant part of these reserves (34%) does not meet quality standards.

4.2. Dynamics and status of the water supply public systems.

In the period 2014-2024, the number of centralized public water supply systems in the Southern Region increased by 40% or 112 units, including in the Southern DR by 45% (108 units) and by only 11% (4 units) in the Găgăuzia ATU. The increase of the number of public aqueducts is due, almost exclusively, to the rural localities. The pace of expansion of the number and length of public water supply systems is slower compared to the other regions of the Republic [Bacal, 2020, 2021; Burduja, 2022], which is explained not so much by the lower scale of public aqueduct construction works, but by their construction in previous periods.

In 2024, in the Southern Region were operating 391 public water supply systems, including 18 in the urban areas and 373 units in the rural areas (Table 1). The maximum number of public water supply systems is recorded in the districts of Cimișlia (68), Cahul (67) and Căușeni (65), with a higher number of localities with access to public aqueducts. The lowest number of public water supply systems is recorded in the districts of Basarabeasca (16), Taraclia (19), Leova (22) and Cantemir (36) with a lower number of localities.

Table 1. Status and use of public water supply systems in the districts of South DR and ATUG (2024)

Administrative districts and regions	Number of units			Length of public aqueducts, km			Number of connected persons, thousands			Access of the current population to the public waterworks, in %		
	total	urban	rural	total	urban	rural	total	urban	rural	total	urban	rural
Căușeni	65	4	61	727	171	559	72,5	19,2	53,4	87	91	86
Ștefan Vodă	57	1	56	650	45,8	604	52,1	6,8	45,3	83	96	82
Cimișlia	68	2	66	431	67,6	364	43,3	11,8	31,6	82	98	77
Basarabeasca	16	2	14	222	59,1	163	24,7	10,2	14,4	95	98	93
Leova	22	2	20	418	158	260	24,5	10,5	14,0	51	76	41
Cantemir	36	1	35	506	82	424	31,4	4,8	26,7	57	98	53
Cahul	67	1	66	737	112	625	77,5	30,1	47,4	69	85	61
Taraclia	19	2	17	305	128	177	27,9	16,3	11,6	74	90	60
South DR	350	15	335	3999	824	3175	354	110	244	74	89	69
ATU Găgăuzia	41	3	38	1010	408	602	122	53,2	68,4	82	93	75
South Region	391	18	373	5008	1232	3776	476	163	313	76	91	70

Sources: elaborated by authors according data of National Bureau of Statistics (NBS, 2023, 2025a,b)

The total length of public aqueducts in the Southern Region is over 5000 km, including ≈ 4000 km (75%) in rural areas and 1232 km (25%) – in the urban areas (Figure 2). In 2014-2024, this indicator increased by 1.5 times or with ≈ 1670 km, including in the rural areas – by 1.5 times or with 1302 km and in the urban areas – by 1.4 times or with 367 km.

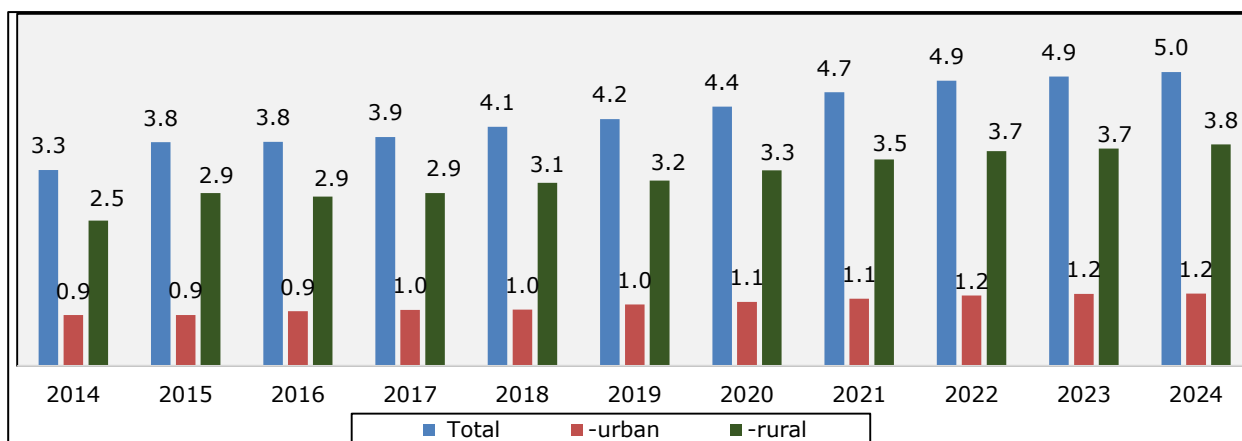


Fig. 2. Dynamics of the length of public water supply systems in the Southern Region, in thousands km

Source: elaborated by authors according data of National Bureau of Statistics (NBS, 2025b)

The positive dynamics is registered in the all districts of the South DR and in the ATU Găgăuzia. The maximum increase is attested in the districts with a lower level of access to public aqueducts, including Leova (by 4.0 times or with 314 km), Cantemir (by 2.9 times or with 334 km) and Cahul (by 2.0 times or with 361 km). The minimum increase is recorded in the districts of Căușeni (+11% or 74 km), Taraclia (+17%), Cimișlia (+21%) and Basarabeasca (26%), with a higher level of access ($\geq 80\%$) to public aqueducts (Table 1).

In 2024, the most extensive aqueducts were located in the districts of Cahul (737 km), Căușeni (730 km) and Ștefan Vodă (650 km), and the smallest ones in the districts of Basarabeasca (222 km), Taraclia (305 km) and Leova (418 km), with a smaller sizes and a minimum number of localities connected to public aqueducts. At the locality level, the most extensive urban public aqueducts are in the cities of Comrat (173 km), Ceadâr Lunga (162 km), Căușeni (133 km) and Cahul (112 km). The most extensive rural public aqueducts are in the communes of: Abaclia (53.0 km) in the district of Basarabeasca; Crihana Veche (48.0 km), Slobozia Mare (39.5 km) and Giurgiulești (35.0 km) from the district of Cahul; Gotești (92.0 km) from Cantemir district; Sălcuța (58.1 km), Cărnățeni (47.0 km) and Fârlădeni (38.0 km) from Căușeni district; Ciucur-Mingir (43.0 km) and Gura Galbenei (37.0 km) from Cimișlia district; Filipeni (54.1 km) and Borogani (41.0 km) from Leova district; Talmaza (73.7 km), Cioburciu (42.0 km) and Olănești (40.4 km) from Ștefan Vodă district; Congaz (65.0 km), Baurci (48 km), Avdarma (45 km) from ATU Găgăuzia (NBS, 2025b).

The artesian wells. During the analyzed period, the number of artesian wells in the Southern Region increased by 1.4 times or with 204 units, including in the urban areas - by 10% or with 15 units and in the rural areas - by 1.5 times or with 189 units (Figure 3). The highest growth rates are recorded in the districts of Leova (by 3.0 times), Cahul (by 2.4 times) and Cantemir (by 2.2 times), and the slowest rates - in the ATU Găgăuzia (by 1.2 times), as well as in the districts of Căușeni (+7%), Basarabeasca (+10%), Cimișlia (+13%) (table 3.4), with a higher level of access to public aqueducts at the beginning of the analyzed period.

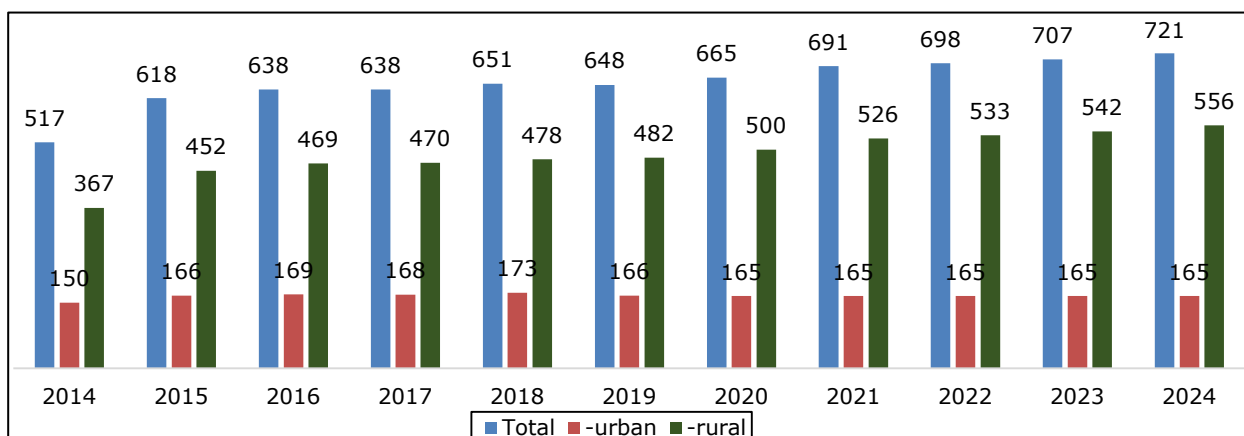


Figure 3. Dynamics of the number of artesian wells in the Southern Region

Source: elaborated by authors according data of National Bureau of Statistics (NBS, 2025c).

Table 2. SWOT analysis of the status and use of public water supply systems in the Southern Region

Strengths	Weaknesses
•The Dniester and Prut rivers on the borders of the Southern Region are main sources of quality water; •Water supply to the population is a main direction of regional and local programs; •Significant financial assistance from the National Ecological Fund and the Regional and Local Development Fund, as well as from external donors (GIZ, ADA, EU, TIKA, World Bank); •Significantly expanding the number and length of public water supply systems in rural areas; High level of access to public aqueducts in the most districts of the Southern DR and in the ATU Găgăuzia; Active implementation of projects for the regionalization of water supply services in Cahul and Leova districts, as well as their launch in Căușeni and Cantemir districts;	Insufficient atmospheric precipitation; Low flow of internal rivers and high degree of clogging of reservoirs; Large rivers flow at the borders of the region, which limits the supply of quality surface water; Lack of main aqueducts supplying water from the Dniester and Prut rivers to the central part of the study region; Insufficient groundwater reserves; Massive pollution of wells and springs; The predominantly agrarian and rural character of the region; Lower level of socio-economic development; The reduced capacity of LPAs to co-finance projects in the field; Superficial monitoring of groundwater flow and of the quality indices of water captured in rural areas.
Opportunities	Threats
• Regionalization and efficiency of water supply services;	Very intense manifestation of depopulation and population aging processes, especially in rural

•Expansion of the main aqueduct branches in the districts of Leova, Cahul, Cantemir and Căuşeni; •Start of construction projects of main aqueducts from the Nistru and Prut rivers towards the central part of the region; • Applying international good practices in the field; • Attracting foreign investment in the context of EU accession; • Optimized reporting, monitoring and evaluation systems for water resources and their use; • Implementation of alternative project co-financing models, including crowdfunding platforms.	areas and small towns; Massive exodus of the young population; Intensification of climate change and its associated effects; Significant increase in energy resource prices and operational expenses; Significant increase in tariffs for delivered water and reduction in the population's ability to pay; Political and economic instability at the macro-regional and national levels; Major investment risks.
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In 2024, in the Southern Region wells by public water supply systems were operated 721 artesian wells, including 165 (23%) in urban areas and 556 (77%) in rural areas (Figure 3). The number of artesian wells varies depending on the size of districts and of its localities with extensive aqueducts, which are supplied from underground sources. Thus, the maximum number of artesian wells is attested in the ATU Găgăuzia (172), as well as in the Cahul district (108). A minimal number of artesian wells were exploited in smaller districts, including Basarabeasca (32), Taraclia (63), but also with a lower level of access to public aqueducts – Leova (27) and Cantemir (51). In the Leova and Cahul towns, which are supplied exclusively from the Prut River, the public systems do not exploit artesian wells. The majority of artesian wells operated by public water supply system are in working condition, but some of the wells and distribution networks built several decades ago are in an advanced state of wear, which is significantly reflected in the large water losses and the quality of the delivered water.

At the same time, the quality of water captured from artesian wells frequently does not correspond to the physico-chemical and microbiological indicators, and the technical and financial capacities for capturing and transporting water from the Dniester and Prut rivers are small (Table 2). Also, the absolute majority of rural public water supply systems do not have functional water treatment stations or the existing facilities are used only episodically, usually before planned checks on the quality of the supplied water (Bacal et al., 2021). In additions, in the rural areas most of the monitoring and control systems are not functional. In addition, the water distributed by public water supply systems is used for irrigation or for frequent washing of vehicles, which generates increased risks in the operation of the respective systems, especially water shortages and its delivery for short periods of time, especially during droughts, increased unauthorized use and theft of water from the system etc (Bejan et al., 2020). Frequently, rural public supply system

operators prefer to focus exclusively on daily operational activities, while planning, monitoring, analysis and improvement activities are neglected.

4.3. Access to the public systems of water supply

Despite the lower provision of surface and groundwater resources, the population's access to public aqueducts is much higher than in the Northern and Central Development Regions. Over $\frac{3}{4}$ of the population of the South Region has access to public aqueducts, including 90% in urban areas and 70% in rural areas (Table 1, Figure 4).

The maximum access to public water supply systems is attested in the districts of Basarabasca (95%), Căușeni (87%), Ștefan Vodă (83%), Cimișlia and ATU Găgăuzia (82% each), and the minimum access – in the districts of Leova (51%) and Cantemir (57%). In rural areas, the highest level of access to public water supply is also observed in the districts of Basarabasca (93%), Căușeni (86%) and Ștefan Vodă (82%), an average level in ATU Găgăuzia (75%) and Cimișlia district (77%) and a minimum level in the districts of Leova (41%) and Cantemir (53%). In the district of Leova, a lower level of access to the public aqueducts is registered in the rural localities on the northern and south-eastern outskirts (in the Tigheci river basin), and in the Cantemir and Cahul districts – in the localities located outside the Prut river basin (Figure 4). Despite this fact, in the peri-urban areas of Cahul and Leova cities are being implemented successful projects regarding the expansion of main aqueducts to supply the population with quality water from the Prut River (South RDA, 2025 a, b; GIZ, 2015). Also, the construction of the planned connections of the main aqueducts Cioburciu-Căinari (GD No.23/2022), Cahul-Găvănoasa, Leova-Iargara-Borogani, Leova-Sărata Nouă-Cneazevca, Leova-Sărata-Răzeși-Tomai, Prut-Ceadîr Lunga and their branches will boost the development of public water supply systems and increase the demand for quality water from the Dniester and Prut rivers.

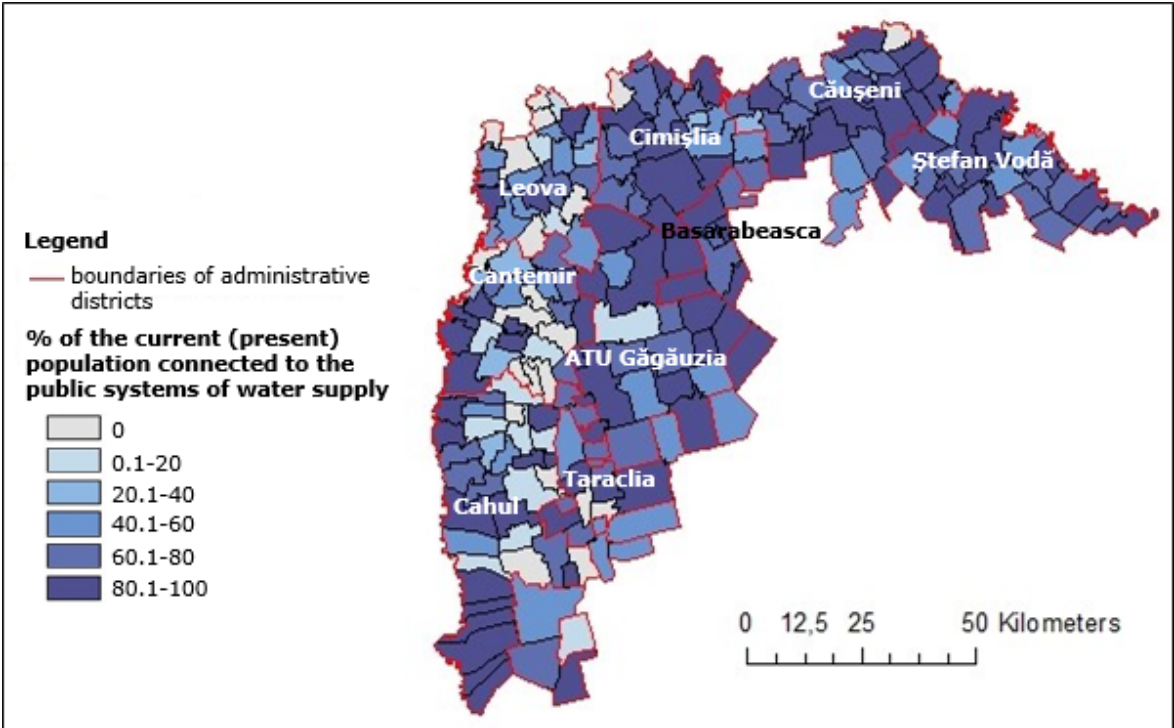


Figure 4. Access of the current population to the public aqueducts in the municipalities from the South Region of Republic of Moldova

Sources: elaborated by authors according data of National Bureau of Statistics (NBS, 2025b).

4.4. Dynamics and sources of the abstracted water

In the 2014-2024 years, in the Southern Region, the total volume of water abstracted in the study region increased by 1.7 times, including in the rural areas by 2.0 times and in the urban areas – by 1.5 times (Figure 5).

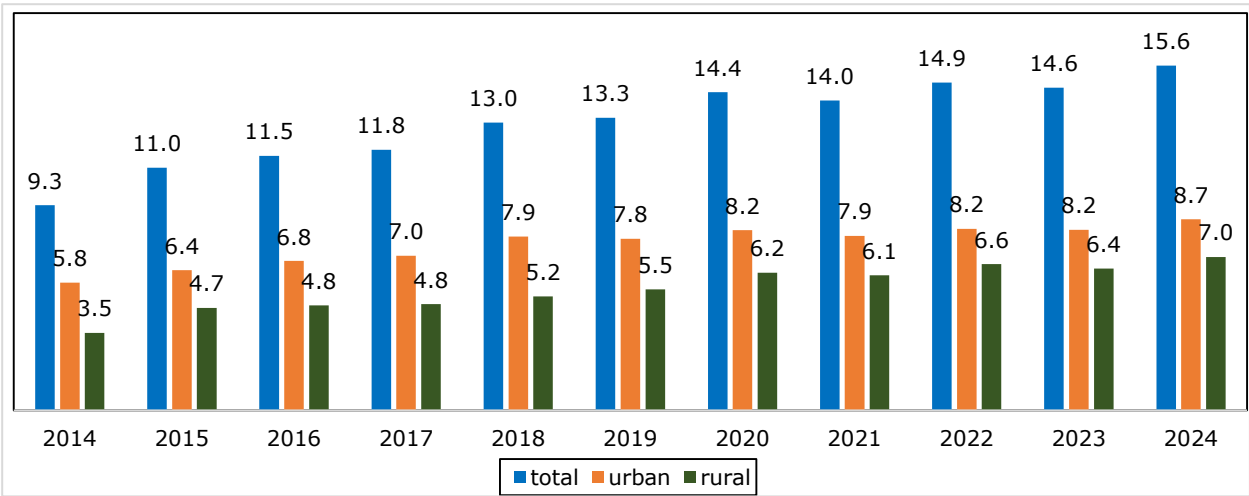


Figure 5. Dynamics of volume (million m³) of the abstracted water in the Southern Region, per total and in the urban and rural areas

Sources: elaborated by authors according data of National Bureau of Statistics (NBS, 2025 b,c)

The positive dynamics are observed in all districts of the Southern DR and in the ATU of Găgăuzia. The maximum increase is also observed in districts with a lower level of access to public water supply, including Leova (by 3.0 times), Cantemir (by 2.5 times). The minimum increase is recorded in the Găgăuzia ATU (by 1.4 times) and in the Basarabeasca (by 1.5 times) and Căușeni (by 1.6 times) districts, with a higher level of access in the 2014 and which also a higher rate of population decline (NBS, 2025 a,b). The share of urban space decreased from 62% to 55%, and the share of rural areas increased from 38% to 45%.

In 2024, the total volume of water abstracted in the Southern Region was 15.6 million m³, including 8.7 million m³ (55%) in the urban areas and 7.0 million m³ (45%) in the rural areas. The maximum volume of water was abstracted in Cahul district (4.1 million m³), as well as in Găgăuzia ATU (3.9 million m³), with a larger sizes and an urban centers (Table 3.). An average amount of water was abstracted in district of Căușeni (1.8 million m³), Ștefan Vodă and Cimișlia (1.3 million m³ each), with a higher level of access to public aqueducts (Bacal, 2024). The minimum volume was delivered in the Cantemir (662 thousand m³) and Basarabeasca (604 thousand m³) districts, with smaller sizes and urban centers. The maximum share of urban space is attested in the districts of Leova (81%), Cahul (68%) and ATU Găgăuzia (63%), and the minimum share is attested in the districts of Ștefan Vodă (17%) and Căușeni (37%), with a higher level of access to aqueducts in rural areas.

The total volume of water abstracted from surface sources increased by 1.5 times, and water abstracted from underground sources increased by 1.7 times (Figure 6).

The maximum increase of water extracted from underground sources is recorded in the districts with a lower level of access to public aqueducts in 2014, including Cantemir (by 4.8 times), Cahul (by 2.8 times), Leova (by 2.4 times). The minimum increase is attested in the ATU Găgăuzia (by 1.4 times), as well as in the Basarabeasca (by 1.5 times) and Căușeni (1.7 times) districts, with a higher level of access to aqueducts in 2014. The share of urban space decreased from 50% in 2014 to 42% in 2024, and of rural areas increased from 50% to 58%.

Table 3. Volume of the abstracted water in the districts of South DR and ATU of Găgăuzia (2024)

Administrative districts and regions	Total			From surface sources						From underground sources					
	total	rural	urban	total		rural		urban		total		rural		urban	
	thousand c.m.			%	thou-sand c.m.	%	thou-sand c.m.	%	thou-sand c.m.	%	thou-sand c.m.	%	thou-sand c.m.	%	thou-sand c.m.
Căușeni	1786	1118	668	37	0	0	0	0	0	0	1786	100	1118	63	668
Ștefan Vodă	1316	1094	223	17	0	0	0	0	0	0	1316	100	1094	83	223
Cimișlia	1267	683	585	46	0	0	0	0	0	0	1267	100	683	54	585
Basarabeasca	604	249	355	59	0	0	0	0	0	0	604	100	249	41	355
Leova	911	170	741	81	741	81	0	0	741	100	170	19	170	100	0
Cantemir	662	414	248	37	248	37	0	0	248	100	414	63	414	100	0
Cahul	4083	1316	2767	68	2920	72	152	5,2	2767	95	1163	28	1163	100	0
Taraclia	1050	436	614	58	19	2	19,1	100	0	0	1022	97	408	40	614
South DR	11680	5479	6201	53	3928	34	171	4,4	3757	96	7743	66	5298	68	2445
Gagauzia ATU	3948	1480	2468	63	1,8	0	1,8	100	0	0	3946	100	1478	37	2468
South Region	15628	6958	8669	55	3930	25	173	4,4	3757	96	11689	75	6776	58	4913

Sources: elaborated by authors according data of National Bureau of Statistics (NBS, 2025b,c)

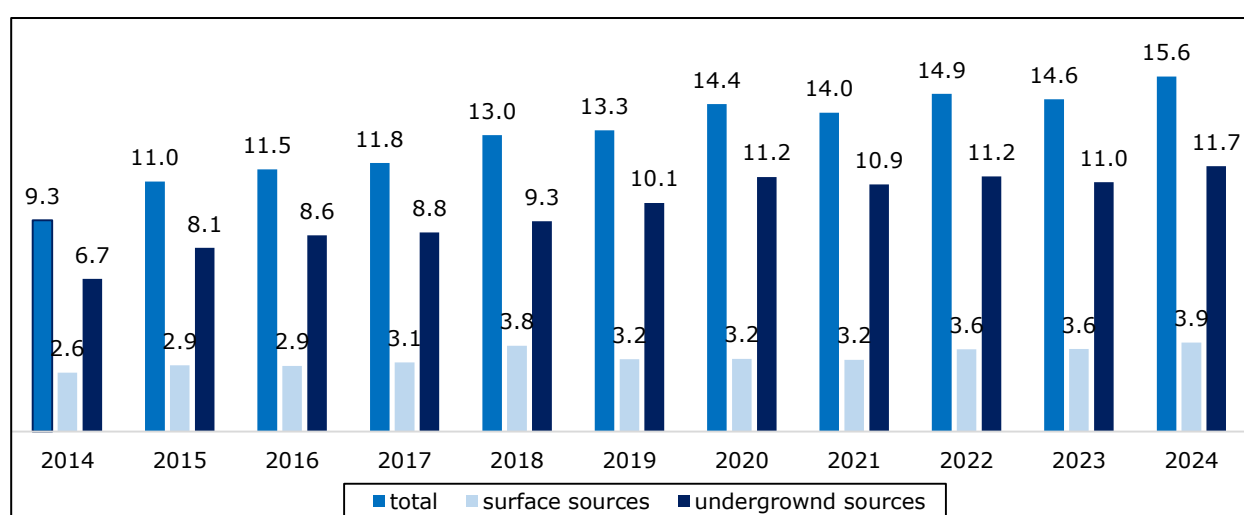


Figure 6. Dynamics of volume (million m³) of the abstracted water in the Southern Region, per total and by surface and underground sources

Source: elaborated by authors according data of National Bureau of Statistics (NBS, 2025c)

In 2024, the volume of water abstracted from groundwater sources was 11.7 million m³ or 75% of the total volume of abstracted water in the Southern Region, including 4.9 million m³ (42%) in the urban areas and 6.8 million m³ (58%) in the rural areas (Table 2). The maximum volume of water abstracted from is registered in the ATU Găgăuzia (3.9 million m³), with a larger surface, a higher level of urbanization and access to public aqueducts, a big rural localities supplied exclusively from groundwater sources. An average amount of water was abstracted in the Căușeni (1.8 million m³), Ștefan Vodă and Cimișlia districts (1.3 million m³ each), with medium dimensions and a high level of access to public aqueducts. The minimum volume of water was captured from underground sources in the districts of Leova (170 thousand m³) and Cantemir (414 thousand m³), with small dimensions and a lower level of access to public aqueducts. The

maximum share ($\leq 60\%$) of urban space is attested in the Gagauzia ATU and in the Taraclia and Basarabeasca districts, which have a higher level of urbanization and are supplied exclusively from underground sources. An average share is observed in the Cimişlia (46%) and Căuşeni (37%) districts, with medium-sized urban centers and extensive rural aqueducts, and the minimum share (0%) is observed in the Cahul, Cantemir and Leova districts, with the exclusive supply of urban areas from Prut riverbed.

From surface sources were abstracted about 25% of the total volume of captured water. They prevail only in the Cahul and Leova districts and in the city of Cantemir, being captured for the water supply of the respective urban centers and of some rural localities in their proximity. The water source is the Prut River, which corresponds, according to the absolute majority of indicators, to the requirements of Law 182 on drinking water.

In the case of public water supply systems, surface sources are used exclusively by urban enterprises in the field and can ensure high water consumption, at low costs, for both household and non-household consumers from this area. At the same time, in the rural areas, surface waters are massively abstracted from both the Dniester and Prut rivers, as well as from reservoirs and used for various agricultural purposes, especially for irrigation (Bacal et al, 2024), but this topic is not addressed in the present study, which focuses on the public water supply systems intended mainly to serve the households and public institutions.

In 2024, the volume of water abstracted from surface sources in the Southern Region was 3.9 million m^3 or 75% of the total volume of abstracted water, including 3.8 million m^3 (96%) in the urban areas and 173 thousand m^3 (4.4%) in the rural areas (Table 3). The maximum volume of water from surface sources was captured in the Cahul district, with 2.9 million m^3 or 74% of the total volume of water captured from surface sources in the Southern Region. In the Leova district, from surface sources of water was captured 741 thousand m^3 , and in Cantemir district – 248 thousand m^3 of abstracted water. In the other districts and in the ATU Găgăuzia, the volume of water captured from surface sources by public water supply systems did not exceed 20 thousand m^3 annually. Surface sources predominated only in the districts of Leova (81%) and Cahul (72%). In the Cantemir district, the share of surface sources was 37%, and in the other districts and in the ATU Găgăuzia – 0-2%. The urban space absolutely predominates, with 96%, in the total volume of water captured from surface sources in the Southern Region, which is due exclusively to the cities of Cahul, Leova and Cantemir and a few localities from their proximity served by urban water supply enterprises.

The highest increase of volume of water abstracted from surface sources is recorded in Leova district (by 3.1 times or 500 thousand m^3), as a result of the construction of the main aqueducts Leova-Filipeni-Romanovca, Leova-Sărată Nouă-Iargara and their subsequent extensions (South RDA, 2025b). In Leova and Cantemir districts, the positive dynamics is due exclusively to the increase of capacities of urban water supply enterprises. In addition, an increasing share of the volume of water captured by urban water supply service enterprises is also distributed to an increasing number of localities in the vicinity of urban centers connected to the main aqueducts, which significantly contributes to the efficiency and regionalization of those services, increasing the rural population's access to quality water and low tariffs, and eliminating

intra-regional discrepancies and those between urban and rural areas. Also, the significant elimination of intra-regional discrepancies regarding the access of an increasing number of urban and rural localities to quality water sources from the Dniester and Prut rivers is on the current agenda of government policies, but these main projects have been at the stage of discussions and of feasibility studies.

A great perspective in this regard has the construction of the main aqueduct Stefan Vodă (Cioburciu)-Căinari, which will distribute water captured from the Dniester River and connect the adjacent localities from the Stefan Vodă and Căușeni districts and will ensure the quality water needs of both the population and agricultural enterprises in the respective area. Other large-scale projects provide for the connection of urban centers from the Gagauzia Autonomous Region to the Prut riverbed. In the case of the city of Vulcănești, the construction works of the main aqueduct began in December 2025 (South RDA, 2025), and in the cities of Comrat and Ceadir Lunga, they have been at the level of discussions since the 1980s.

4.5 Dynamics of the volume of the used water by the main usage categories

The total volume of used water in the study region increased during the analyzed period by 1.8 times, including in rural areas by 2.1 times, and in urban areas – by 1.5 times (Figure 7). The positive dynamics is manifested in all administrative districts of the Southern DR and in the ATU Găgăuzia. The maximum increase is also attested in the districts with a lower level of access to public aqueducts, including in Leova (by 3.1 times) and Cantemir (by 2.8 times). The minimum increase is recorded in the districts of Basarabeasca (1.1 times), Căușeni and Cimișlia (1.6 times), which have high access to public aqueducts, but also higher rates of population decline in the years 2014-2024. In the rural areas, the higher rates of increase in the volume of water used are also recorded in the districts of Leova (5.6 times), Cantemir (4.6 times) and Cahul (2.9 times). The slowest growth rates are attested in the districts of Basarabeasca, Căușeni (1.6 times) and Cimișlia (1.7 times), with high access to public aqueducts, but with slower rates of its expansion in 2014-2024 years. The positive dynamics will be maintained, depending on the financing of the National Strategy of Water Supply and Sanitation (GD No. 199/2014), National Programs for the implementation of the Protocol on Water and Health (GD No. 1063/2016) and of the Regional Sectorial Programs in the water supply and sanitation sector (South RDA, 2025a; Găgăuzia RDA, 2025).

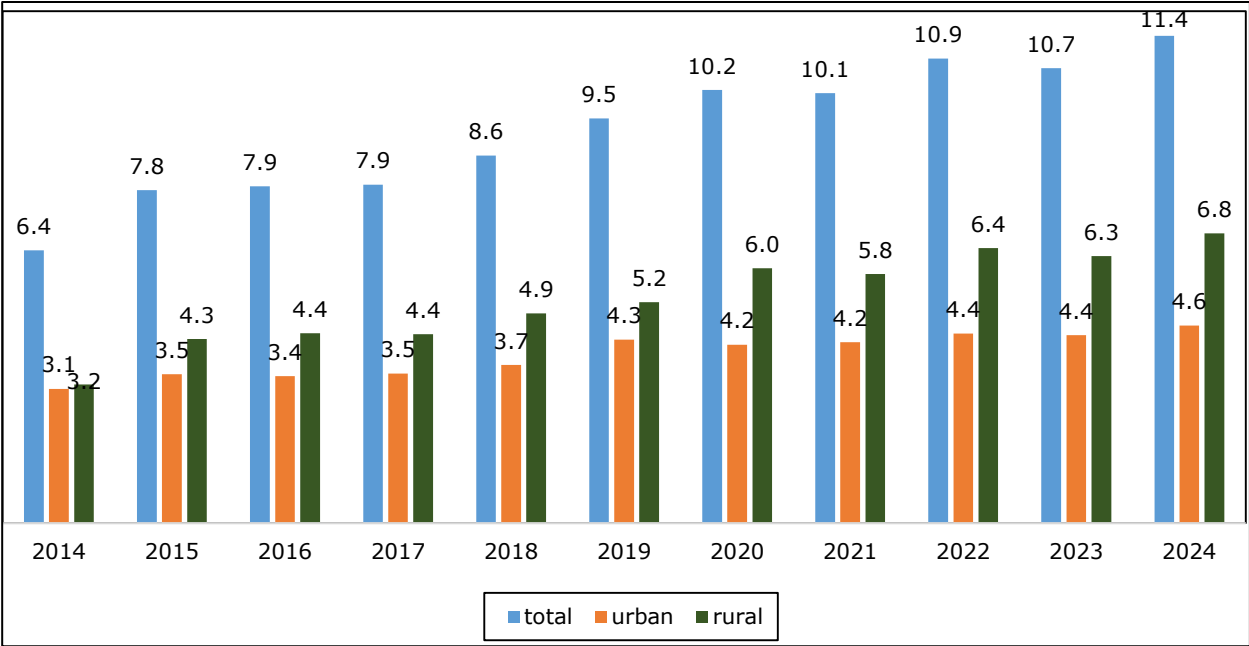


Figure 7. Dynamics of the total volume of water supplied by public systems of water supply in the Southern Region, per total and on the residential areas, in million m³.

Source: elaborated by authors according data of National Bureau of Statistics (NBS, 2025 b)

In 2024, the total volume of water used in the Southern Region was 11.4 million m³, including 4.6 million m³ (41%) in the urban areas and 6.8 million m³ (59%) in the rural areas. The maximum volume of water was delivered in the Găgăuzia ATU (2.7 million m³), with larger dimensions, a higher level of urbanization and access to public aqueducts, as well as in the Cahul district (2.5 million m³), with a larger area and a biggest urban center (Table 3). An average amount of water was used in the Căușeni (1.6 million m³) and Ștefan Vodă (1.2 million m³) districts, with medium dimensions and a higher level of access to public aqueducts. The minimum volume was delivered in the districts with a smaller sizes and urban centers and with a low level of access to public aqueducts, including the districts of Cantemir (577 thousand m³), Leova (676 thousand m³) and Basarabeasca (415 thousand m³).

Table 4. Volume of water delivered (thousand m³) by public water supply systems in South DR and ATU of Găgăuzia in 2024, by consumer categories and residential areas

Administrative districts and regions	The water users categories													Water use per capita, liters/day		
	Total			Households			%	Budgetary institutions			Other categories					
	total	urban	rural	total	urban	rural		total	urban	rural	total	urban	rural	total	urban	rural
Căușeni	1568	472	1096	1458	413	1044	93	63,8	23,7	40,1	54,9	37,0	1084	59	67	56
Ștefan Vodă	1229	171	1058	1127	150	977	92	65,7	10,6	55,1	30,4	10,9	1032	65	69	64
Cimișlia	966	350	617	882	286	596	91	32,4	18,0	14,4	58,4	45,5	610	61	81	54
Basarabasca	415	172	244	378	152	226	91	24,3	9,0	15,3	15,4	10,2	241	46	46	46
Leova	676	369	307	564	278	286	83	64,7	51,6	13,1	53,2	39,6	300	76	97	60
Cantemir	577	120	456	517	88	429	90	41,9	19,3	22,6	26,3	13,6	452	50	69	47
Cahul	2524	1142	1381	2222	895	1326	88	149	102,3	46,8	154	145	1373	89	104	80
Taraclia	767	438	330	634	340	293	83	86,1	60,5	25,6	47,6	36,8	319	75	74	78
South DR	8723	3234	5489	7780	2602	5178	89	528	295	233	440	338	5411	68	81	62
Gagauzia ATU	2700	1395	1305	2463	1231	1231	91	115	57,2	57,6	165	137	1289	61	72	52
South Region	11423	4629	6794	10243	3834	6409	90	643	352	291	605	475	6700	66	78	60

Source: elaborated by authors according data of National Bureau of Statistics (NBS, 2025b)

In the urban areas, the maximum volume of water was delivered to larger cities, including Cahul (1.1 million m³) and Comrat (701 thousand m³). An average amount of water was supplied to medium-sized cities – Ceadăr Lunga (456 thousand m³), Căușeni (407 thousand m³), Cimișlia (350 thousand m³) and Taraclia (323 thousand m³), and the minimum volume – in the small cities, such as Iargara (53.8 thousand m³), Căinari (65.3 thousand m³), Cantemir (120 thousand m³), Tvardița (115 thousand m³) and Ștefan Vodă (171 thousand m³). The maximum share of urban areas is observed in the Găgăuzia ATU (52%), as well as in the Taraclia (57%), Leova (55%) districts. The minimum share is attested in the districts of Ștefan Vodă (14%) and Cantemir (21%), with a smaller urban centers.

In the rural areas, the maximum volume of water supplied by public aqueducts is registered in the villages: Sadaclia (72.7 thousand m³) and Abaclia (70.2 thousand m³) from Basarabasca district; Slobozia Mare (172 thousand m³), Colibași (124 thousand m³), Burlacu (121 thousand m³), Crihana Veche (99.3 thousand m³) and Giurgiulesti (84 thousand m³) from Cahul district; Gotești (50 thousand m³) and Cania (41 thousand m³) in Cantemir district; Fârlădeni (102 thousand m³), Zaim (90 thousand m³), Chircăiești (87 thousand m³) and Sălcuța (75 thousand m³) from Căușeni district; Gura Galbenei (95 thousand m³) and Mihailovca (52.4 thousand m³) from Cimișlia district; Borogani (62.3 thousand m³) and Filipeni (42.6 thousand m³) from Leova district; Talmaza (125 thousand m³), Olănești (105 thousand m³), Ermoclia (71 thousand m³), Crocmaz (70 thousand m³) and Răscăiești (59 thousand m³) from Ștefan Vodă district; Corten (99 thousand m³) and Valea Perjei (60 thousand m³) from Taraclia district; Congaz (195 thousand m³), Cazaclia (96 thousand m³), Tomai (84 thousand m³), Copceac (85 thousand m³) and Dezghingea (77 thousand m³) from Găgăuzia ATU (NBS, 2025b). These are usually large villages, located near cities, and a good part of the water delivered by public aqueducts is used to irrigate land near the house for the purpose of growing vegetables that are freshly delivered daily to urban markets (Bejan et al, 2020).

The **total volume of water delivered to the population** (households) in the Southern Region constituted 10.2 million m³ or about 90% of the total volume of water supplied by the public water supply systems (Table 4). In the all-administrative districts

and in ATU Găgăuzia, the share of the households is over 80%. The total volume of water supplied to the population increased by 1.8 times, including in the rural areas – by 2.2 times (from 2.9 million m³ to 6.4 million m³), and in urban areas – by 1.5 times (from 2.6 million m³ to 3.8 million m³). The multiple increase is observed in the districts of Leova (by 3.2 times), Cantemir (by 3.0 times), Ștefan Vodă (by 2.2 times) and Cahul (by 2.1 times), which recorded the highest rates of expansion of aqueducts, especially in peri-urban localities. In the ATU Găgăuzia the volume of water supplied to the population increased by 1.7 times, in the districts of Căușeni, Cimișlia and Taraclia – by 1.6 times, and in Basarabeasca it did not change.

In 2024, to the population were delivered 10.2 million m³ of water, including 6.4 million m³ (63%) in rural areas and 3.8 million m³ in urban areas (Table 4). Maximum water volumes were supplied in the Găgăuzia ATU (2.5 million m³) and in the Cahul district (2.2 million m³). An average volume of water was delivered in the Căușeni (1.5 million m³) and Ștefan Vodă (1.1 million m³) districts, with higher access to public aqueducts. The minimum volume was also supplied in the smaller districts, including the Cantemir (517 thousand m³), Leova (564 thousand m³) and Basarabeasca (378 thousand m³) districts. In the rural areas, the maximum volume of water delivered to the population is found in Cahul district (1.3 million m³) and in Găgăuzia ATU (1.2 million m³), Căușeni and Ștefan Vodă (1.0 million m³ each), with a larger sizes and higher level of access to public aqueducts. The minimum volume was delivered in Basarabeasca (226 thousand m³) and Taraclia (293 thousand m³) districts, with smaller urban centers, and in Leova district (286 thousand m³), due to lowest access to rural aqueducts.

The dynamics of the **volume of water supplied to budgetary organizations** reflects an oscillating evolution, being caused by the expansion of public aqueducts, by the territorial reorganization of public institutions, but also by the COVID-19 pandemic (Bacal et al., 2021). Thus, during the period 2014-2019, there was a constant and pronounced trend of increasing the volume of water supplied to budgetary organizations, which is due to the expansion of public aqueducts and the priority connection of this category of users to public water supply systems. Subsequently, in 2020-2021, as a result of the COVID 19 pandemic and the transition the activity of several budgetary organizations to the online regime, the volume of water supplied to this category of consumers decreased significantly. In 2022-2024, is observed a positive dynamic. The increase is recorded in the all districts and, including in the Taraclia (by 4.4 times), Ștefan Vodă (by 3.5 times), Basarabeasca (by 3.2 times) and Cahul (by 2.6 times), but the amount of water is small (up to 50 thousand m³).

In 2024, to budgetary organizations were delivered 643 thousand m³ of water or about 5% of total water delivered by the public systems of water supply in the Southern Region, including 291 thousand m³ (45%) in the rural areas and 352 thousand m³ (55%) in the urban areas (Table 3). The maximum volume of water delivered to this category of users is attested in the Găgăuzia ATU (115 thousand m³), as well as in the Cahul district (149 thousand m³), with larger urban centers. The minimum volume was delivered in the Basarabeasca (24.3 thousand m³) and Cantemir (41 thousand m³) districts, with smaller sizes and urban centers.

The **volume of water delivered to other categories of consumers** was, on average, 480 thousand m³ or about 5% of the total volume of water supplied by public water supply systems, of which 368 thousand m³ or about ¾ in the urban areas, where are concentrated most industrial and service enterprises (Bacal, 2018), and 120 thousand m³ in the rural areas.

The volume of water supplied to other categories of consumers registered an increase of about 1.8 times, including in the urban areas – by 2.0 times and in the rural areas – by 1.3 times. In addition, unlike budgetary organizations, the decrease of the volume of water supplied to other categories of users in the pandemic years (2020-2021) was insignificant. The positive dynamics are recorded in the all districts, except of the Basarabeasca district, where the volume delivered to enterprises decreased by 2 times, which is due to the bankruptcy of industrial enterprises in this districts center.

In 2024, the volume of water delivered to other categories of consumers in the Southern Region was 605 thousand m³, of which 475 thousand m³ (78%) in the urban areas and 130 thousand m³ in the rural areas. The volume of water delivered to these categories of consumers through public aqueducts is conditioned by the number and production capacity of enterprises that do not have their own water supply sources, especially agricultural and complex markets, technical service stations, car washes, etc. (Bejan et al, 2017). Thus, the maximum volume of water delivered to enterprises is observed in the Găgăuzia ATU (165 thousand m³), as well as in the Cahul district (154 thousand m³), with a larger urban centers and a minimum volume – in the Basarabeasca (15.4 thousand m³) and Cantemir (26.3 thousand m³) districts, with smaller urban centers. The maximum use is attested in the cities of Cahul (145 thousand m³) and Comrat (100 thousand m³). In the rural area of the districts of study region, the amount of water delivered to other categories of consumers did not exceed 20 thousand m³, and in the ATU of Găgăuzia – 30 thousand m³.

Despite the rapid expansion of water supply networks, water consumption per capita is low and constitutes 66 liters/day, including 78 liters/day in the urban areas and 60 liters/day in the rural areas (Table 4), which is about 2 times less than the water consumption norm for the population. Overall, the maximum daily water consumption per capita is recorded in the districts of Cahul (89 l/day), Leova (76 l/day) and Taraclia (75 l/day), an average consumption (about 60 l/day) is attested in the districts of Căușeni, Ștefan Vodă, Cimișlia, and the minimum consumption (up to 50 l/day) is in the districts of Basarabeasca and Cantemir.

5. Conclusions:

- Compared to the other regions of the Republic of Moldova, the Southern Region has a much more pronounced rural character, is less well provided with surface and groundwater resources, and the rivers within the region have very low flow and are heavily polluted.
- Underground sources are used for water supply the population and public institutions in most localities of the Southern Region, with the exception of the cities of Cahul, Leova and Cantemir and some of their suburbs. At the same time, the quality of the abstracted

groundwater, especially in rural areas, does not meet to the requirements and is not treated.

- As a result of significant support from the National Environmental Fund and from external sources (GIZ, ADA, EU, World Bank), the length of public aqueducts increased by 1.5 times. The total volume of water abstracted in the study region increased by 1.7 times, including in the rural areas by 2.0 times and in the urban areas – by 1.5 times. The total volume of used water increased by 1.8 times, including in the rural areas – by 2.1 times, and in the urban areas – by 1.5 times. The positive dynamics is manifested in the all administrative districts.
- Despite the lower provision of surface and groundwater resources, the population's access to public aqueducts is much higher than in the North and Center Development Regions. Over $\frac{3}{4}$ of the population of the South Region has access to public aqueducts, including 90% in urban areas and 60% in rural areas. The highest access is in the ATU Gagauzia and in the Basarabeasca, Căușeni and Ștefan Vodă districts. The lowest access is in Leova and Cantemir districts, especially in the small and medium-sized peripheral villages.
- The maximum volume of water captured and used is recorded in the larger districts with direct access to the Prut and Dniester rivers (Cahul, Căușeni), as well as in the ATU Găgăuzia, with a higher level of urbanization and of access to public aqueducts. Over 90% of the captured water is delivered to the population for various household needs.
- Despite the rapid expansion of water supply networks, water consumption per capita is low and constitutes ≈ 70 liters/day, including ≈ 80 liters/day in urban areas and 60 liters/day in rural areas, which is about 2 times less than the normative consumption.
- In the Southern Region are being successfully implemented the projects to expand the main aqueducts of the Prut river for water supply the population in the peri-urban areas of Cahul and Leova cities with quality water. The construction and expansion of the planned connections of the main aqueducts Cioburciu-Căinari, Cahul-Găvănoasa, Leova-Iargara, Prut-Ceadâr Lunga and their branches will boost the development of public water supply systems in the region and increase the demand for quality water from the Prut and Dniester rivers.

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