attached
to Government Decision no. _____
from ___________________________

THE PLAN
OF MANAGEMENT OF THE NISTRU HYDROGRAPHIC BASIN DISTRICT, CYCLE II (2024-2029)

1. Introduction

The elaboration of the II cycle of the Dniester River Basin District Management Plan (PGDBHN) for the period 2024-2029 (hereinafter the Plan) is carried out in accordance with the provisions of art. 19 of the Water Law no. 272/2011 regarding the revision of the Management Plans of the watershed districts every 6 years and point 9 of Government Decision no. 866/2013 for the approval of the Regulation on the procedure for the elaboration and revision of the Management Plan of the hydrographic basin district, which establishes that the central body of the public administration in the field of the environment prepares the announcement about the intention to initiate the elaboration of the Plan at least two years before the beginning of its reference period . With the entry into force of Government Decision no. 386/2020 with regard to the planning, elaboration, approval, implementation, monitoring and evaluation of public policy documents, the drafting of the Concept of the public policy document is foreseen, which contains: a) the name of the document; b) the type of public policy document that is proposed to be developed; c) the problem addressed; d) the purpose of drafting the public policy document; e) concordance with the National Development Strategy, the National Development Plan, the medium-term budgetary framework, etc.; f) the planned period for the elaboration of the public policy document; g) the parties involved.

Subsequently, the Concept regarding the development of the II cycle of the Dniester River Basin Management Plan (2024-2029) was developed, presented to the State Chancellery for approval and published on the ministry's website for information and consultation of the draft Government decision for the Plan's approval.

The revision of the Plan is carried out in accordance with the provisions of Chapter V of Government Decision no. 866/2013 for the approval of the Regulation on the procedure for drawing up and revising the Management Plan of the watershed district. The revision procedure is initiated one year before the expiration of the six years of validity of the first cycle of the Management Plan.

The new management plan, cycle II (2024 - 2029), completed and revised contains :

1) re-delimitation of surface water bodies in accordance with the methodology regarding the identification, delimitation and classification of water bodies (System A), approved by GD no. 881 of November 7, 2013;

2) the brief exposition of all additions and changes made since the beginning of the implementation of the previous Management Plan;

3) the evaluation of the progress made in the achievement of the environmental objectives with reference to the state of surface waters , underground waters and protected areas in the hydrographic basin district that it targets, in order to protect, improve and restore water bodies and to prevent the deterioration of the status of all water bodies, as well as the deadlines for achieving these objectives, including a cartographic representation of the monitoring results for the previous plan period, accompanied by explanations for any environmental objective that was not achieved;

4) the brief exposition of the measures that were included in the previous Management Plan, but were not fulfilled, with the exposition of the causes of their non-fulfillment, as well as the measures that were not included in the previous Management Plan, but were fulfilled in order to achieve the environmental objectives established in the plan.

If it is established that the environmental objectives for the water resources provided for in the plan have not been achieved, the new, completed or revised Management Plan will contain the exposition of the transitional measures applied since the publication date of the previous version of the plan, such as:

1) investigating the causes of possible failure ;

2) examination of permits and the relevant authorizations and , as the case may be, their revision;

3) revision of the monitoring programs and , if necessary, their modification.

When the non-achievement of the objectives is the result of natural causes or exceptional situations of force majeure or which could not have been foreseen, especially strong floods and periods of prolonged drought , the adoption of additional measures is not necessary.

I. Brief exposition of all additions and changes made since the beginning of the implementation of the previous Management Plan:

- Surface water bodies were re-delimited (90 river water bodies and 5 lake water bodies);
- The underground water bodies were re-delimited (8 bodies);
- The protected areas of water bodies have been demarcated in accordance with Article 19 [1] "Protected areas" of the Water Law no. 272/2011 - *areas intended for the capture of drinking water* , *areas intended for the protection of aquatic species of economic importance, water bodies intended for recreation* , *areas sensitive to nutrients* and *areas intended for the protection of habitats or species* .

II. Evaluation of the progress made in the achievement of environmental objectives with reference to the state of surface waters , underground waters and protected areas.

The monitoring of the quality of water resources carried out in the period 2017-2022 indicates that the quality class of the waters of the Dniester River and small and medium rivers is not improving. The quality class of fl . Dniester during this period varied from 3 (moderately polluted) to 4 (polluted). Monitored tributaries (Răut , Cubolta, Căinari, Ciuluc Mare, Ichel , Bîc , Botna , and occasionally Camenca, Cohâlnic , Cuşmirca, Ghidighici reservoir) have the general quality class 5 (highly polluted waters).

III. Brief exposition of the measures that have been fulfilled/not fulfilled/additional measures not included in the first cycle of the Plan/transitional measures.

The measures carried out (25 measures or 35% of the total) are mostly made up of those related to raising awareness, education, strengthening capacities, organizing scientific conferences, measures related to the management of natural hazards, monitoring programs, planting, rehabilitation of springs, delimitation of protected areas, climate change assessments, rehabilitation of sectors of the "Dniester Chior" bed, creation of the "Lower Dniester" National Park, activity of the Dniester River Basin District Committee, collaboration with the Ukrainian side in the field of protection and sustainable use of the Dniester River .

The partially implemented measures (25 measures or 35% of the total) are constituted in large numbers by those related to treatment plants (preparation of technical projects, construction/modernization of treatment plants). This category also includes some measures related to the monitoring and inventory of point sources of pollution, the improvement of the hydromorphological state of water bodies and the state of biodiversity, the operation and completion of the information system of water resources. Measures related to the hydrological monitoring of waters are also included in this group.

The unfulfilled measures refer to the identification of the reference water bodies and the heavily modified ones, the elaboration of various studies. Within this group are also included the measures related to the development of the Program for the planting and restoration of riparian sections for the protection of water bodies in DBHN , the Program for improving the situation of the ichthyofauna in the Dniester River.

Cycle II of the Management Plan will contribute to:

- achieving the objectives of the policy documents, which were included in the priority directions for the development of a healthy environment to improve the quality of life of the population and water ecosystems (Environmental Strategy for the years 2014-2023 and the Action Plan for its implementation, approved by the Decision Government No. 301/2014, Water Supply and Sanitation Strategy (2014-2030), approved by Government Decision No. 199/2014, Government Decision No. 1063/2016 regarding the approval of the National Program for the implementation of the Water and Health Protocol in the Republic of Moldova for the years 2016-2025, the European Moldova Strategy 2030, the National Development Plan 2023-2025);
- achieving the targets set in the Sustainable Development Goals (SDGs) regarding ensuring the availability and sustainable management of water resources, minimizing water resource pollution, increasing the efficiency of water use in all economic and social sectors, as well as increasing the protection of water-related ecosystems. The objectives also incorporate aspects related to the sustainable management of water resources, including through appropriate international cooperation and the involvement of local and regional communities in the management of water resources;

Transboundary Watercourses and International Lakes (Helsinki, March 17, 1992), which promotes the implementation of the integrated management of water resources, especially the watershed approach.

The parties involved in the development and realization of this Plan are the state institutions and those subordinate to them, the local public authorities, the NGOs in the respective fields, the management committee of the Dniester hydrographic district and the committees of its tributaries' sub-basins , civil society, external assistance.

2. Analysis of the situation

The territory of the Republic of Moldova is part of two eco -regions of European rivers and lakes: the Pontic Eco-region (12) and the Eastern Plains Eco-region (16). According to Government Decision no. 775 of October 4, 2013, the bodies of water in the territory of the Republic of Moldova are included in two hydrographic districts: the Danube-Prut and the Black Sea and the Dniester River Basin District. Within the Dniester River Basin District (DBHN), in turn , 15 sub-river basins were identified and delimited (fig. 1, tab. 1).

The Dniester River forms the border between the Republic of Moldova and Ukraine over a distance of 142.5 km.

Administratively DBHN fully occupies the districts: Drochia, Soroca, Balti, Sângerei, Floreşti, Soldăneşti, Teleneşti, Rezina, Călăraşi, Orhei, Dubăsari, Chişinău, Criuleni, Anenii Noi, Tighina and UTA Transnistria, and partially: Briceni, Edineț , Ocnița , Dondușeni, Râşcani, Glodeni, Făleşti, Ungheni, Nisporeni, Străşeni, Hânceşti, Ialoveni, Cimişlia, Căuşeni and Ştefan Vodă.

The DBHN population is approx. 2,635 thousand inhabitants, of which 1.4 million live in the urban environment. (53%). 713 thousand people or 1/3 of the current population of DBHN live in the riverside districts of the Dniester River . The average population density is 137 people/km ^{2}, higher (over 200 people/km ^{2}) in the central part of DBHN in the vicinity of Chisinau (Străseni, Orhei, Criuleni, Ialoveni, Anenii Noi and Chisinau districts), in the districts Nisporeni, Drochia, Sangerei, as well as in the south of Transnistria. Low population density values are recorded in central-northern Transnistria and the northern half of the Bessarabian part of the DBHN.

The surface of the Dniester basin (within the borders of the Republic of Moldova) is 19,232.79 km². The basin is distributed asymmetrically with respect to the main axis of the Dniester valley, so that the left surface of the basin (within the borders of the Republic of Moldova) is 3514.79 km² (18.27%), and the right one is 15718.0 km² (81.73%).

The hydrographic network of DBHN is represented by about 3000 surface water courses, of which 1591 rivers, including 5 with a length of about 100 km and others 153 rivers with a length of about 10 km, 51 reservoirs with a volume of about 1 million m ^{3} each and approx. 1700 small water reservoirs. The longest rivers in DBHN are Răut , Bâc and Botna .

The density of the hydrographic network in DBHN on the territory of the Republic of Moldova is uneven and is 0.56 km/km ^{2}, which attests a higher share compared to the average value in the Republic of Moldova (0.48 km/km ^{2}) (table 1).

The density of the hydrographic network of the right tributaries is higher and is 0.45 km/km ^{2}, while the density of the hydrographic network of the left tributaries is only 0.28 km/km ^{2}. Respectively, the length of the water courses of the right tributaries is clearly superior to the left tributaries.

Table 1.

Basic characteristics of rivers in DBHN

The river	The length the river, km	Surface basin, km ^{2}	number water courses _	The length total, km	The density the network km /km ^{2}
The right tributaries of the Dniester river					
Raut	286	7760	935	3720	0.48
Bic	155	2150	201	955	0.44
Botna	146	1540	231	884	0.57
Cainari	100	835	65	305	0.36
Cubolta	97	943	107	424	0.44
Ichel	98	814	83	294	0.36
Ciulucul Mic	64	1060	141	618	0.58
Ciorna	42	312	30	132	0.42
The left tributaries of the Dniester River					
Camenca	52	403	21	146	0.36
Beloci	40	237	13	90	0.38
Molochis	33	268	11	62	0.23
Râbnița	45	419	8	111	0.26
Iagorlic	73	1280	17	229	0.18

The State Hydrometeorological Service (SHS) performs state hydrological monitoring. In DBHN, the Hydrological Monitoring Network includes 30 hydrological stations, including flow and level measurements (fig. 1). SHS deals with the collection and processing of operational information, analyzes the conditions for the occurrence of natural and dangerous hydrometeorological phenomena. Since the main flood formation on the Dniester River takes place in Ukraine, between Ukraine and the Republic of Moldova there is an Agreement on the procedure for the transfer of daily operational information from water level monitoring stations, flood warnings. Hydrological warnings are prepared by the Center for Forecasts and Warnings of the SHS and transmitted to institutions and ministries at the national level with important support functions for the management of exceptional flood situations. The directing center in exceptional situations of the Commission for Extraordinary Situations of the Republic of Moldova, which operates under the General Inspectorate for Emergency Situations (IGSU), in accordance with its attributions and functional plans, is associated with the local emergency committees for carrying out standard activities.

The SHS information system presents the following functions:

a) data and information collection;
b) data and information transfer;
c) data and information processing;
d) data and information storage;
e) sharing of data and information.

The collection and transmission of data is ensured through the related communications infrastructure.

The water resources of the rivers were assessed based on the monitoring carried out by SHS. The multiannual average water volume of fl . Dniester is about 9.2 km ^{3} (tab. 2), varying between 6 km ^{3} in dry years with moisture deficit and 12 km ^{3} , values reached in years rich in water resources. The multiannual average for the period 1980-2022 is 288 m ^{3} /s (p/h Hruşca), with fluctuations between 174 (in 1987) and 500 m ^{3} /s (in 1980). In the last 10 years, however, there has been a decrease/increase in the average flows by 14 m ^{3} /s.

Table 2.

The regime of the annual liquid discharge on the Dniester River

basin	volume drains , km ^{3}	%
r. Dniester	9, 2	93.0
Right tributaries	0.61	6.0
Left tributaries	0.09	1.0
Total	**9, 9**	**100**

The multi-year average of the flow at p/h Bender in the years 1980-2022 is 272 m ^{3} /s, which falls within the limits of 4.68-6.49 l/s, and the runoff layer amounts to values of 148-205 mm . In the last 10 years, however, there has been a decrease in average flows by 17 m ^{3} /s, which can be explained by the consequences of climate change, damming of riverbeds. It is likely that the decrease in runoff in recent years is part of a new cycle of low water, which began in 2011.

The largest natural lakes in DBHN are Sălaş (3.72 km ^{2}), Roşu (1.6 km ^{2}) and Old Dniester (1.86 km ^{2}). The largest artificial lakes are Dubăsari on the Dniester River (67.5 km 2) and Ghidighici on the Bâc River (6.8 km ^{2}). The network of lakes provides regularization and responds to recreational requests, being also used for the supply of drinking and technical water, for irrigation, navigation and other purposes.

The multiannual average flow of the right tributaries of the Dniester varies from 0.54 m ^{3} /s (Ciorna - s. Mateuţi) to 10.66 m ^{3} /s (Răut - s. Jeloboc), and that of the left tributaries varies from at 0.16 m ^{3} /s (Rîbniţa - s. Andreevca) at 0.98 m ^{3} /s (Iagorlâc - s. Doibani). The leakage layer falls within the limits of 20.56mm (Botna - town of Căuşeni) and 65.51mm (Cubolta - village of Cubolta) (tab. 3). The largest volume of water is characteristic of the Răut river, which exceeds 300 million m ^{3} , and the smallest – 17 million m ^{3} – for the Ciorna river.

Table 3.

Water resources of the small rivers of the Dniester river basin

tributary	Length, km	Basin area, km ^{2}	Average annual flow, m ^{3} /s	average runoff, 10^6 m ^{3} /year

R. Camenca	50	403	0.95	29.87
r. Beloci	40	223	056	17.58
Molochiş	31	268	0.16	4.88
Andreevka	45	410	0.15	4.68
r. Ciorna	42	294	0.39	12.28
Iagorlîc	77	1590	0.93	29.35
r. Raut	286	7760	9.2	290
r. Cubolta	92	943	1.57	49.46
r. Cainari	95	385	1.25	39.30
r. Ciulucul Mic	61	1060	0.60	19.03
r. Ichel	102	814	0.43	13.55
r. Bac	155	2040	1.17	37.02
r. Botna	152	1540	0.79	25.13
Total		**17730**		**290**

The waters of fl . Dniester is the main source of water that can fully ensure the drinking water needs of the population, as well as the needs of the economy of the Republic of Moldova as a whole. The main sources of supply are snow and rain, the role of ground water being much reduced. Most of the precipitation falls in the form of rain showers and only 10% of it is in the form of snow.

A high water level is recorded in the spring due to snowmelt (40-50% of the annual runoff). In the summer season, with torrential rains, river levels, especially small ones, can rise considerably, sometimes causing floods-of proportions.

The driest season for the southern region is autumn which provides only 15% of the annual water volume. In the northern region, 20% of the annual resources are provided uniformly during the seasons of summer, autumn, winter. Spring is characterized by maximum runoff values.

For the entire observation period, the most significant ***floods*** on the Dniester River were recorded in 1932 (flow 6.28 thousand m^3/s), 1941 (7.3 thousand m^3/s). The floods of spring 1969 caused the formation of ice dams, as a result the water level rose from 6 to 9 m. The floods of June 1969, with a flow of 5.5 thousand m^3/s, caused an increase in the water level from 7.5 to 9.0 m. In July 1974, due to the flood with a volume of 2.8 thousand $m^3/$ the water level rose to 6 m. In 1980, in June, 2 waves of floods with a flow rate of 2.52 thousand m^3/s, and in July the maximum flow was 3.6 thousand m^3/s.

In June 1998, a flood was recorded with a flow rate of 4.0 thousand m^3/s, the water level in the Otaci-Camenca sector recorded values of 4.0 m. In 2008, July-August, a flood occurred with a flow rate of 5.4 thousand m^3/s. The discharge volume from Lake Dnestrovsk was 3.33 thousand m^3/s, which caused the water level to rise in the Otaci-Dubăsari sector to 7 m, and downstream of Dubăsari to 9 m.

Since June 23, 2010, two flood waves were observed in the Dniester River (Ukraine). The increase in the flow of water discharged from the Dnestrovsk reservoir caused an increase in the water level on the territory of the Republic of Moldova: in the Otaci-Dubăsari sector, in June, following the first flood wave, by 1.5 –2,0 m and the maximum flow (p/h Hruşca) of 1410 m^3/s, and after the second flood wave - from 2.5 to3,4 m and the maximum flow of 1710 m^3/s. As a result of the increase in the flow of water discharged from the Dubăsari reservoir up to 1500 m^3/s, the increase in the water level constituted: on the urban sector. Dubăsari - the arm Turunciuc , in the case of the first flood wave, about 2,5 m, in the case of the second flood wave - 4,5 m, and on the sector arm Turunciuc - the mouth of the river, the water level did not rise after the first flood wave and the general increase in the level was about 2,0 m. The main cause that determined the reduction in the number of floods in recent years is the construction of the CHE-1 dam in Novodnestrovsk (Ukraine) in 1983, which reduced the flow, in some cases, even by 50%.

Severe floods on rivers and small streams were observed in 1948, 1956, 1963, 1973, 1984, 1989, 1991, 1994, 1998 and 1999. In the general context of the spatial distribution of precipitation, two foci of maximum intensity can be distinguished, one of which manifested itself within the limits of the DBHN, the rivers Ciuluc and Cula. During the years of instrumental observations and until this period, 19 cases of significant flooding were recorded on the tributaries of the Dniester River on the right bank, with an average frequency of every 5 years).

Atmospheric precipitation is unevenly distributed and subject to latitudinal and altitudinal laws. The largest amounts of precipitation fall in the northern part of the country, but also in the central part, in the regions with the highest altitudes. Mean annual precipitation shows a small overall decrease in DBHN from 544 mm in the reference period 1961–1990 to 528 mm in the years 1991–2020. So the precipitation in the environment decreased by 17 mm (tab. 4) or 7.2%.

It should be emphasized that the annual amounts of precipitation differ significantly in dry and rainy years. In years with insufficient moisture, the annual amounts of precipitation are limited to 300 - 400 mm, and in those with excess, the values reach up to 900 mm.

Table 4.

Average annual precipitation, mm, for reference years 1961-1990 and 1991-2020

The station	Annual average		
	1961-1990	1991-2020	Δh
Soroca	566	542	-25
Camenca	543	544	2
Râbnița	526	530	5
Balti	529	489	-40
Bravicea	610	573	-38
Dubasari	549	516	-33
Baltata	521	501	-20
Chisinau	548	554	6
Tiraspol	506	500	-6
Mediate	**544**	**528**	**-17**

The most precipitation was recorded at the Bravicea meteorological station, from the Codrilor Plateau with values of 610 and 573 mm for the periods 1961-1990 and 1991-2020 with a decrease of 38 mm or 6.5%. The least precipitation was recorded in the period 1961-1990 at the meteorological station Tiraspol (506 mm) and in Balti in the years 1991-2020 (489 mm). The biggest decrease in precipitation at present is manifested in the Balțului Plain (Bălți meteorological station) with a decrease of 8.2%, or 40 mm.

The changes in average monthly precipitation have a more variegated character and denote considerable changes in the DBHN's rainfall regime (tab. 5, fig. 2), which will certainly, with some inertia, also be reflected in the surface runoff regime.

Table 5.

Difference in mean monthly precipitation (mm) at weather stations, 1991–2020 vs. 1961–1990

The station	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Soroca	-8.1	-9.6	[illegible]	-3.5	-4.5	-16.7	-3.3	[illegible]	[illegible]	[illegible]	[illegible]	-7.7	-24.7
Camenca	[illegible]	[illegible]	[illegible]	-3.3	[illegible]	-8.7	-12.6	-4.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Râbnița	-0.2	-2.1	-0.4	-3.9	-1.3	-7.9	0.7	-5.7	[illegible]	[illegible]	[illegible]	-2.1	[illegible]
Balti	-6.0	-4.3	[illegible]	-8.8	-6.0	-17.9	-10.7	-0.9	[illegible]	[illegible]	-2.0	-2.4	-40.0

Bravicea	-7.2	-7.7		-7.6		-18.5	-4.9	-7.0	-3.6		-0.4	-0.1	-37.8
Dubasari	-8.2	-4.3		-11.1	-0.5	-20.2	-12.4	-4.0	-4.0				-35.4
Baltata	-4.9	-8.5		-9.1		-7.1	-8.1		-0.1				-19.7
Chisinau	-3.5	-7.4		-4.2		-10.9	-2.1						
Tiraspol		-8.7		-4.8	-4.6	-6.0	-6.5	-1.4				-4.6	-5.7
Mediate	-3.9	-5.6		-6.2	-0.8	-12.7	-6.7	-1.8				-1.3	-16.8

The air temperature , especially during the warm period of the year, influences the evaporation processes, which in its essence represent the loss of water resources from the basin, and the atmospheric precipitation contributes substantially to the formation of river runoff from the DBHN. Thus, evaporation and atmospheric precipitation represent key elements of the water balance in the studied territory. Air temperature is one of the key elements influencing climate conditions and is conditioned by solar radiation and atmospheric circulation. The annual, seasonal and monthly average values, as well as their spatial distribution, present particular information from the point of view of hydrological analysis.

It is certain that the global climate is in permanent transformation, which in recent decades has been accelerating, especially due to human impact. The Republic of Moldova is not an exception and climate changes can be detected even by analyzing average temperatures. Thus in tab. 6 shows the average annual temperature values of the coldest winter month - January and the warmest summer month - July, for the reference years 1961-1990 and 1991-2020.

Table 6.

Average annual winter and summer temperatures for reference years 1961-1990 and 1991-2020

The station	Year			Winter			Summer		
	61-90	91-20	Dt	61-90	91-20	Dt	61-90	91-20	Dt
Soroca	8.39	9.59	1.20	-4.6	-2.9	1.74	18.1	19.6	1.41
Camenca	8.72	9.86	1.14	-4.5	-2.7	1.84	18.7	19.9	1.26
Râbniţa	8.93	10.1	1.14	-3.8	-2.4	1.34	18.8	20.2	1.40
Bălţi	8.98	10.1	1.11	-4.1	-2.3	1.77	18.9	20.2	1.29
Bravicea	9.28	10.4	1.13	-3.6	-1.8	1.79	19.0	20.3	1.36
Dubăsari	9.69	11.0	1.28	-3.4	-1.7	1.75	19.7	21.2	1.51
Bălţata	9.36	10.4	1.08	-3.5	-1.8	1.75	19.2	20.3	1.10
Chişinău	9.62	10.8	1.13	-3.2	-1.8	1.46	19.4	20.7	1.35
Tiraspol	9.84	10.8	0.93	-2.9	-1.8	1.06	19.7	20.9	1.28
Mediate	**9.20**	**10.3**	**1.13**	**-3.75**	**-2.1**	**1.61**	**19.0**	**20.4**	**1.33**

Average annual temperatures are obviously dependent on latitude and altitude. Thus, the minimum values are observed in the northern part of the studied territory (Soroca, 9.59°C) and on the water basins, and the maximum values – in the southeast of DBHN (Tiraspol, 10.8°C) and the river valleys. The average annual temperature is currently 10.3°C and shows an increase of 1.13°C compared to the reference period 1961-1990 (tab. 6). Temperatures increased the most in Soroca (by 1.2°C) and the least in Tiraspol (by 0.93°C).

Average winter temperatures are -3.8°C, up 1.61°C from 1961-1990. The lowest values are recorded at the Soroca weather station (-2.9°C, with an increase of 1.74°C) and the highest at Tiraspol (-2.9°C, with an increase of 1.06°C). The geographical zonality in the distribution of winter temperatures is manifested by their increase from north to south and with low values on water scales.

Average summer temperatures are 20.4°C, 1.33°C higher than 1961-1990. The lowest values are recorded at the Soroca weather station (19.6°C, with an increase of 1.41°C) and the highest at Tiraspol

(20.9°C, with an increase of 1.28°C). The geographical zonality in the distribution of summer temperatures is manifested by their increase from north to south and with low values on water scales.

Thus, the average annual temperature changed the most in the winter period – with an increase of 1.61°C compared to the years 1961-1990.

The trends of changing the thermal regime, for the observation period 1961-2020, are increasing in Soroca by 0.04°C every year and by 0.03°C in Tiraspol. During the period 1961-1990, the average annual temperatures did not show obvious trends of change (Soroca - increase by 0.003°C annually, Tiraspol - decrease by 0.007°C annually). The last 30 years are manifested by sudden acceleration of temperature increase, in Soroca by 0.08°C and Tiraspol by 0.06°C annually.

Thus, on average for DBHN winter temperatures increased the most (50.4%) with the maximum in February – 77.9%. Temperatures rose the least in autumn (6.5%) with the minimum in September – 4.5%. In absolute terms, temperatures rose the least in May - only 4.0%.

The absolute thermal extremes recorded in DBHN are 41.5°C, at the Camenca weather station in July 2007 and -35.4°C, at the Bălți weather station, in January 1963.

In the 5th National Communication of the Republic of Moldova, the latest information on **climate change is provided** .

Annual changes for **temperatures** will be very homogeneous for DBHN. Thus, according to the SSP1-2.6 scenarios, the rate of increase in average annual temperatures towards the 2040s would be +1.2-1.4°C compared to the climatological reference period 1995-2014.

Seasonally, temperatures will be distributed as follows: In winter, temperatures will increase by 1.2-1.4°C, in spring - 0.9-1.0°C, in summer - 1.3-1.4°C, in autumn - 1.2-1.3°C.

All SSP scenarios anticipate a slight annual increase in the amount of **precipitation** in the north of the DBHN, from 2.9% compared to the climatological reference period 1995-2014, and up to 2.4% in the south of the study area towards the 2040s.

Seasonally, precipitation will be distributed as follows: Winter precipitation will increase by 6.7% in the north and 7.0% in the south of DBHN according to the SSP1-2.6 scenario towards the 2040s. Spring – by 7.2% in the north and 4 .2% in the south. Summer – by 2.9% in the north and 2.1% in the south. Autumn – will decrease by 1.1% in the north and by 2.7% in the south of DBHN.

Following the hydrogeological surveys, ***the total underground water reserves*** are estimated at 3478.9 m ^{3}/day, of which approx. 80% goes to DBHN .

The underground water bodies within the boundaries of the Dniester watershed district are presented by the following underground water bodies:

1) Alluvial-deluvial aquifer horizon a,adA3, Holocene
2) The aquifer complex of the Pliocene-Pleistocene aN2
2+3aAI+II
3) Upper Sarmatian-Meotian N1s3-m aquifer complex
4) Middle Sarmatian aquifer horizon N1s2 (sand)
5) Badenian -Sarmatian aquifer complex N1b-s
6) Silurian-Cretaceous K+S aquifer complex
7) Vendian-Rifeic VR aquifer complex

Practically all horizons and aquifer complexes can be classified as having a good qualitative state (except for the first two – alluvial-deluvil and Pliocene-Pleistocene).

The richest aquifer complex is the lower Badenian-Sarmatian complex , whose reserves make up 2306.8 thousand m ^{3}/day (84% of the total), which together with the Cretaceous-Silurian complex make up 90% of the exploitation resources of drinking water (tab. 7). In the central and southeastern regions of the Dniester hydrographic basin district, the Middle Sarmatian horizon and the Lower Badenian-Sarmatian complex are exploited . Last complex, thank you of good quality and considerable reserves, represents the main source of centralized water supply of the municipality of Chisinau and other localities in the central region of the basin.

The total number of natural mineral water deposits approved on the territory of the Republic of Moldova as of 01.01.2020, according to the data of the State Balance of Reserves, is 68 deposits , respectively 60 deposits of mineral water for internal use and 8 deposits for external use.

Table 7.

Groundwater reserves in the Republic of Moldova

Underground water bodies	**Reserves , thousand m ^{3} /24 hours**	**%**
Alluvial-deluvial, Holocene, adA $_3$	171.18	5.0
Upper Sarmatian - Meotian, $N_1 s_3$+m	1.50	0.0
Middle Sarmatian, $N_1 s_2$	10,12	0.3
Badenian – Lower Sarmatian, $N_1 bs_1$	2306.83	67.0
Silurian - Cretaceous, SK $_2$	174.35	5.1
Vendian - Rifean , VR	84.58	2.5
Total, Dniester River Basin	***2748.56***	***79.8***
Prut- Danube - Blak See River Basin	***694.08***	***20.2***
Total, Republic of Moldova	**3442.64**	**100.0**

The distribution of exploitable groundwater reserves is not uniform. Several operational underground water reserves are concentrated in the Dniester river valley (fig. 2) close to the big cities. Currently, this area is the most endowed with assessed groundwater reserves. The conditions of interaction of aquifers with rivers, which determine the amount of operational reserves, have been clarified so far with insufficient exhaustiveness. Exploitable reserves were calculated considering the boundaries as the central part of the Dniester river basin and river.

Operational underground water reserves have better quality for drinking water supply (according to HG 931 of 20.11.2013) near the fl meadow . Dniester The distribution of mineralization and groundwater quality is shown in table 8 and fig. 3.

Table 8.

The chemical composition of underground water reserves within the boundaries of the Dniester river basin

№	**The horizon (aquifer complex**	**Groundwater body code**	**pH**	**Mineralization, g/l**	**Hardness, degree germ.**	**Geochemical type of waters**	**Components that may exceed the supported level**
1	Alluvial aquifer horizon (a,adA $_3$)	**MDNSGWQ110**	7.0 - 8.5	0.6 -1.5	2.5-31.0	HCO_3 -SO_4 - Ca-Na-Mg	SO_4 up to 450 mg/l, NO_3, NO_2

2	The aquifer complex of the Upper Sarmatian-Meotian (N_1S_3+m)	**MDNSGWD410**	7.5 - 8.7	0.9 - 1.4	0.8-25.0	HCO_3 - Cup, SO_4-Cl-Na	mineralization, hardness, sulfates, chlorides (south) Fe, F, NH_4
3	The aquifer complex of the Middle Sarmatian (congerian sand) (N_1S_2)	**MDNSGWD610**	7.8 - 8.0	0.6 - 2.5	0.8-5.6	HCO_3-SO_4-Na; HCO_3-Cl-Na	mineralization, hardness, chlorides (south), NH_4 up to 9.8 mg/l, Mn, Sr, Fe, F, chromatic up to 70 degrees.
4	Badenian - Sarmatian aquifer complex (N_1 b+s_1)	**MDNSGWD710** **MDNSGWD720**	7.5 - 9.0	0.5 - 2.0	1.4-42.0	HCO_3-SO_4-Cl -Na-Ca-Mg	mineralization, hardness, Na, NH_4, NO_3, Fe; micro-components: Al, Sr, Mn, F,
5	Silurian-Cretaceous aquifer complex (K_2 +S)	**MDNSGWD810**	7.5 - 8.0	0.6 – 3.1	0.8-31.0	HCO_3-SO_4-Cl-Na-Ca-Mg	mineralization, hardness, Na up to 600 mg/l, NH_4, NO_3, micro-components: Al, Mn, F
6	Vendian-Rifeic aquifer complex (V_1 +R_3)	**MDNSGWD910**	7.7 - 8.7	0.7 - 1.5	17 - 25	SO_4 HCO_3 Cl-Na Ca	NO_3, F up to 7.5 mg/l

The specific feature of the regional climate is represented by periodic **droughts** , typical for the entire territory of the Republic of Moldova. Drought can be of several types, all of which have a major impact on the environment. One of the most important and acute types of drought is the hydrological drought , which represents the significant reduction of the water level in rivers , reservoirs or the level of groundwater compared to the normal level that is registered during a specific time period for each watershed .

The duration of summer low flows is highly uncertain and varies from year to year. The period of low discharge can be observed throughout the whole year, during the whole summer or all the time, interrupted by frequent rain floods, which in some years, following one after another, do not give the possibility of establishing for a longer period of low flows (1926, 1948, 1955, 1967, 1969, 1975, 1989, 2006, 2020). Minimum summer flows (open bed) are observed in any month after the end of spring high water until the ice bridge appears.

The minimum water flows of the Dniester River during the low water period (during the open bed), which are of practical interest, are presented in the Table below (tab. 9).

Table 10.

Monthly flow rates (average, maximum and minimum) at p/h Hruşca and Bender

The hydrometric post	Average flow, m^3/s	Maximum flow, m^3/s	

Hrusca	176	422	93.5
Bender	155	391	73.4

Ecological flows. Since the 90s of the last century, experts from the Republic of Moldova and Ukraine have been making efforts to plan and implement the ecological spring flood - the purpose of which is to provide the Dniester river bed with sufficient volumes of water to guarantee the reproduction of fish and the stability of the Dniester ecosystems.

Since the 1980s, ***droughts*** have increased in intensity and persistence, mostly due to rising temperatures and decreasing precipitation in the region. In particular, the south of Moldova is vulnerable to drought. The precipitation deficit is specific for the entire territory of the Republic of Moldova.

Droughts affect both the quantity of available water resources and their quality. The amount of precipitation equal to or less than 50% of the climatic norm of precipitation (in this case we can speak of severe drought) occurs on the territory of the country with a probability of 11 - 41%. Thus, based on this indicator, there have been droughts in the last three decades (1990-2020) in the years 1990, 1992, 1994, 1996, 1999, 2000, 2001, 2003, 2007, 2012, 2015, 2017 and 2020. The specificity of the last decades is also increasing the intensity of drought phenomena. Thus, only in the period 2000–2020 in the Republic of Moldova there were 7 severe droughts (2000, 2003, 2007, 2012, 2015, 2017 and 2020) affecting 75% of the country's territory . The most affected was the south of the country with 6 droughts recorded, 3 - 4 dry periods were recorded in the center of the country, while the northern region was the least affected . Of the series of droughts mentioned above, the most severe was the drought of 2007. This can be compared to the one of 1946, the most disastrous in the series of observations, when precipitation in the spring-summer period was well below 50% of the climatic norm.

According to the degree of aridity in accordance with indices used in international practice (the ratio of the amount of precipitation $\sum R$ and the potential evapotranspiration E_0), it shows that most of the RM is attributed to sub-humid and semi-arid regions with a high probability of droughts and development of desertification processes. The lack of precipitation and its uneven distribution cause frequent and intensive droughts.

SHS of the Republic of Moldova, based on the detailed analysis of the *hydrothermal coefficient* (*CHT*), established that the value of CHT $\geq$ 1.0 indicates *sufficient humidity* , CHT $\geq$ 0.7 - *dry climate* , CHT = 0.6 - *mild drought* , CHT $\leq$ 0 ,5 - *strong* and *very strong drought* .

The consequences of drought are determined both by the degree of intensity, duration and the affected area. Droughts covering an area of up to 10% of the country's territory are assessed as *local* ; 11-20% are considered - *vast* ; 21-30% – *very large* ; 31-50% – *extreme* , and above 50% are considered *catastrophic droughts* , because they cause great losses to the national economy.

The calculations were carried out for each season and year separately. For the territory of the Republic of Moldova, vast and catastrophic droughts predominate in spring, extreme droughts are more frequent in summer, and catastrophic droughts are more frequent in autumn (fig. 4).

The drought of 2020 was one of the most extensive in its period, affecting the entire territory of the country, and the damage caused to agriculture was approximately 6 billion . lei.

The likelihood of multi-year droughts is increasing and if they are not managed properly then the repercussions on the economy will be devastating. The average frequency of droughts is 1-2 episodes during a decade in the northern region, 2-3 – in the central region and 5-6 – in the southern region. Estimates show that the Republic of Moldova will face extensive and extremely extensive droughts once every two to three years.

Seasonal droughts can be recorded almost every year, which will influence the development of agricultural crops and their harvest. The drought approach focuses on risk management instead of crisis management.

The actual leakage was analyzed based on measurements made at the p/h of SHS. The real average runoff shows the same trends of decreasing values in the direction from northwest to southeast (fig. 5).

The average runoff decreased the most in the southern part of the country by more than 30 mm or more than 200% (fig. 6). In the central part of the country, a small area is observed with a slight increase in runoff up to 10 mm, which can only be explained by the influence of the human factor. Thus, the actual modeled runoff from the period 1961-1990 is on average 46 mm per country, and towards the period 1991-2020 the runoff decreases to 30 mm.

Even if the flow volume of the Dniester River is formed in other geographical areas, the reduction of the actual flow is also characteristic of this cross-border river.

Thus, the average annual flows of the Dniester river during the period 1961-1990 constitute 327 m^3/s at p/h Bender (volume of the average annual runoff – 10.3 km^3). For the years 1991-2020, these values constitute 278 m^3/s (8.8 km^3) (tab. 11 and fig. 7).

Table 11.

Change in actual water resources of rivers in DBHN

The river / p/h	1961-1990		1991-2020		The difference		
	Q, m^3/s	W, (km^3/year)	Q, m^3/s	W, (km^3/year)	Q	w	%
Dniester, Hrušca	309.8	9.8	294.7	9.3	15.2	0.5	4.9
Dniester, Bender	327	10.3	278	8.8	49	1.5	15
Dniester Olanesti	30	4.1	121	3.8	9.2	0.3	7.1
Turunciuc, Nezavertailovca	193	6.1	166	5.2	26.7	0.9	13.8
Olanesti, Nezavertailovca		10.2		9.0		1,2	11.8

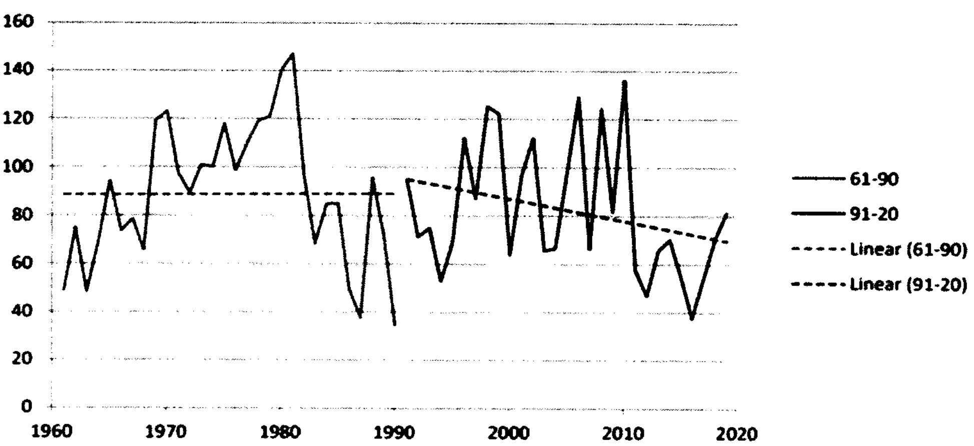


Figure 7. Flow dynamics of the Dniester River at the Bender hydrological station

The impact of climate change on water resources. Based on the analysis of the real average water resources and the climatic runoff, the essential **changes** in **the hydrological regime of the Dniester River** were highlighted .

Climatic runoff in its essence is determined as a difference between annual precipitation and evaporation, which in turn depends on the geographical position and orographic specifics of the studied territory and is calculated by applying the water balance model.

Thus, the maximum possible evaporation in the period 1961-1990 on the territory of the country was 902 mm, the maximum – 1076 mm in the southeast of the country and the minimum 773 mm in the north of the country. By the years 1991-2020, these values were already 993, 1152 and 868 mm, respectively. The increase in average, maximum possible evaporation values in accordance with climate change trends is evident.

The modeling of the climatic runoff (tab. 12) was also carried out by applying the multiple regression method, a function of the relief and the geographical position.

Table 12.

Statistical parameters with climate runoff changes in the period 1991-2022 compared to 1961-1990

[redacted]	[redacted]	[redacted]	[redacted]	
			MM	%
[redacted]	10	7	-3	-30.0
	111	79	-32	-28.8
	40	28	-12	-30.0

In accordance with the laws of the distribution of air temperatures and atmospheric precipitation, the climatic outflow decreases from the northwest to the south and southeast. The biggest decrease is seen in the southern part of the country - about 10 mm or 100%, i.e. double compared to the years 1961-2020. It should be noted that in the Răut river basin , the climatic runoff indicates a decrease in values of about 50%.

For the Dniester basin, the change in runoff volume and its seasonal distribution is identified as one of the critical consequences of climate change. According to the research data in accordance with some fixed scenarios of emission of greenhouse gases, in the lower course of the fl Dniester the average and minimum discharge will decrease towards the middle of the century. XXI by 10-20%.

In the upper part of the basin - on the contrary, an insignificant increase in the average runoff is expected. As a result, overall, the changes in average runoff will not be considerable. At the same time, an increase in the average annual temperature is expected, especially in the lower course.

It is also proven that climate change will lead to an increase in the intensity and unevenness of precipitation, especially heavy rains and increases in the water level in the Dniester.

It should be noted that the quantitative parameters of this analysis and the highlighted trends have a high degree of assessment uncertainty, long-term climate changes are now becoming a reality that must be taken into account in water management planning.

In particular, even in the absence of the total volume of runoff from the basin, the increase in average summer temperatures will inevitably be felt in the water demands of both natural ecosystems and water management, including agriculture and especially - irrigation.

Even though in the year with 75% insurance, the reserves to insure the increased requirements will be considerable, in a very dry year with 95% insurance, the situation may become more critical than in the past.

As the experience of real droughts indicates, overcoming them requires a severe water economy regime, with an undisputed priority in communal water provision and a strict coordination of water resources management in different sectors of the basin.

The expected increase in the unevenness of precipitation and surface runoff may complicate the accumulation of sufficient water reserves in reservoirs on the fl . Dniester, which will have to increase the discharge depth of the lakes in the period before the floods.

The reduction of the discharge in the lower course of the Dniester will further aggravate the problems of small rivers and create additional difficulties for water users, those who obtain it from tributaries, not from the river bed (including in the Răut, Bâc , Botna river basins). Here, it is particularly necessary to increase the security of water supply and, in the future, to increase the efficiency of water use.

The ecological problems in the Dniester delta will be exacerbated under the conditions of the reduction of the local runoff, which is to a greater extent dependent on the operating regime of the reservoirs on the Dniester. This, as well as the expected redistribution of runoff between the upper and lower reaches, emphasizes the importance of the ecological function of the Dniester reservoirs. Accordingly, it will be inevitable to review the priorities of their operation, with increased attention to the criteria, which will ensure the solution of the ecological problems in the lower course and the subjects of water provision in general under the conditions of climate change.

It is obvious that the possible changes in the drainage regime due to climate changes must already be considered in the new edition of the Rules for Exploitation of the Dniester Hydropower Complex node , as well as in the development of the Climate Change Adaptation Strategy in the Dniester Basin. In the practical activity, the Republic of Moldova and Ukraine must foresee and gradually start implementing measures of a strategic nature to maintain the sufficiency of the Dniester discharge in relation to the use of water from the basin, as well as for the early prevention and solution of possible problems.

At the same time, the further accumulation of data on the real parameters and perspectives of the water management balance in the Dniester basin, the growth rate of irrigated areas in the Republic of Moldova and Ukraine, the trends of climate change in the basin, will allow the application of corrections in terms of the current perception of water resources of the Dniester and, respectively, the perspectives and limits in the use of water in the water management of the entire river basin.

From the exposed one we deduce:

- The water resources in the Dniester basin are becoming more and more insufficient for the sustainable water supply of the economy and population of the Republic of Moldova and the Dniester basin as a whole, both now and in the next 35-50 years, under the conditions of climate change.
- The node of the Nistrean Hydropower Complex has a key role in regulating the flow of the Dniester river. In the conditions of climate change, this role is particularly important, including in the solution of common ecological problems with others, in the lower course of the river. This conditions the objective necessity of increasing attention to these problems when operating the hydrotechnical node.

As the research data in the field of climate change in the Dniester basin, the formation and use of the river flow accumulate, corrections will be applied in the management of water resources in the basin.

3. Sources of pollution

Pressure categories ***significant factors*** considered for the assessment of the anthropogenic impact and the risk of not reaching the environmental objectives are

- pollution with organic substances ;
- nutrient pollution ;
- pollution with dangerous substances ;
- hydromorphological alterations ,

In order to evaluate anthropogenic pressures and their impact on water bodies, the following important steps are carried out:

- Identification of the main activities and anthropogenic pressures;
- Identification of significant pressures;
- Evaluation of their impact;
- Identification of water bodies at risk of not reaching environmental objectives.

3.1. Sources of point pollution

3.1.1. Population and localities

About 2.6 million people live within the DBHN, of which 35.7% live in the Bâc basin and 26.5% in the Răut basin , another 8% live in the Botna basin . Based on the number of inhabitants and the surface area of water bodies, the average population density was calculated, which is about 103 people/km ^{2} . The maximum density is characteristic of the water body Bâc 4 that passes through Chisinau, with 1518 places/km ^{2} , followed by Răut 3 that crosses the municipality of Bălți, with 657 places/km ^{2} , Işnovăţ 3 that flows through the city. Ialoveni and Sîngera , with 311 places/km2, Răut 7 whose route is through the municipality of Orhei, with 255 places/km ^{2} , Botna 2 with 188 places/km ^{2} , Bâc 2 with 184 places/km ^{2} , Dniester 5 with 180 place/km ^{2} etc. For 21 bodies of water the density is 100-180 loc/km ^{2} , for 35 bodies of water this indicator decreases to 50-100 loc/km ^{2} , and for others 30 fall within the limits of 13.7-50 loc/km ^{2} . The lowest density, up to 20 places/km ^{2} , is estimated for Soloneţ 2, Larga, Ocnita water bodies.

Based on the number and density of the population (figs. 8 and 9), it can be deduced that the greatest anthropogenic impact on water resources is exerted in water bodies Bâc 4, Răut 3, Işnovăţ 3, Răut 7, Botna 2, Bâc 2 , Dniester 5, etc., and the smallest - in Soloneţ 2, Larga, Ocnița, Molochişil Mare, Valea Jidauca Beloci, Chiua , Ichel 1.

3.1.2. Population access to aqueduct and sewage systems

Of the 881 localities found within the DHBN limits, 546 are connected to the water supply system, and only 102 localities to the sewage system, a fact that significantly influences the quality of water resources. Within water bodies, the average share of the population connected to the water supply system is 46.4%, while that connected to the sewage system is only 7%. The highest number of inhabitants connected to both systems, about 99% and 92%, respectively, is characteristic only for Bâc 4, which passes through the municipality of Chisinau. In the other basins, a large number of localities are identified with water from the public system, but sewage is present only in a very small number of them. The share of the population connected to the two systems for the Bălţata water body is 95% and 43%, for Răut 7 – 94% and 46%, for Răut 3 – 80.3% and 57%, for Bîc 1 – 71% and 38 %. For 18 bodies of water, the number of the population connected to water supply systems exceeds 50%, and is equal to zero for the connection to the sewage systems (Botnişoara , Căinar, Ciulucul de Mijloc 1 and 2, Ciulucul Mic 1, Ciulucul Mare 2, Valea Jorei , Valea Socilor, etc.) (fig. 10 and 11).

In general, in 15 basins of water bodies the population is connected to aqueduct systems with a share of 80-99%, in 29 - 50-80%, in 24 – 20-50%, in 16 – 1-20%. The share of the population connected to sewage systems is small, for the basins of 2 water bodies the value increases to 50-92%, for another

12 – it decreases to 20-50% and for another 20 – it is only 0.1-20% . It should be noted that within the Căinari 1 water body basin, the population is not connected to the two systems. The spatial distribution of localities with inhabitants connected to the water supply and sewerage system is represented below.

3.1.3. Catchment, discharge, purification of water

According to the data of the Moldavian Water Agency, about 249 million m ^{3} of water are collected within the limits of the DBHN (without taking into account the CTE in the city of Dnestrovsk). Of these, 57% come from surface sources and 43% from underground sources. The main source of surface water is the Dniester river, from which about 134 million m ^{3} is captured . In the tributary basins, the main source of captured water comes from underground, where over 85% of the total is captured. Also, part of the volumes of water captured from the Dniester river are transferred to the Bâc and Răut river basins to provide resources to different cities, including Chisinau and Balti municipalities.

According to the statistical reports of the NBS and AAM, the volumes of water supplied amount to 186 million m ^{3} and are lower than those captured due to losses during water transportation, the share being about 20% of the total water captured. Within the tributary basins, the water volumes are 20.1 million m ^{3} (including 14.62 million m ^{3} local volumes) – the Răut basin , 24.47 million m ^{3} – the Botna basin . The largest volumes of water are supplied within the Bâc basin, in particular, for the needs of the municipality of Chisinau, the values being estimated at 48 million m ^{3} (fig. 12).

Of the total volume of water captured and transported to the consumer, 63% is discharged into the sewage system. The volumes of water discharged in the Bâc basin amount to 57 million m ^{3} , and in that of Răut - 13.4 million m ^{3} . Of the 132 million m ^{3} of discharged water, 127 million m ^{3} are discharged into surface waters, 4.58 million m ^{3} are accumulated in retention basins, infiltration beds, etc. a. Of the total discharged water, 121.4 million m ^{3} are declared normatively purified, 1.35 million m ^{3} are not purified, another 4.33 million m ^{3} are insufficiently purified. The waste water discharged within the limits of the Răut basin is about 13.38 million m ^{3} , of which 1.38 million m ^{3} are discharged into retention basins, and 12 million m ^{3} - into surface waters. About 11.33 million m ^{3} of water are considered normatively purified, another 0.1 million m ^{3} are polluted, and 0.51 million m ^{3} are insufficiently purified. Within the boundaries of the Bâc river basin, about 57 million m ^{3} of water are discharged, of which 56.16 million m ^{3} are legally treated and 0.23 million m ^{3} are untreated or insufficiently treated. Of the 2.69 million m ^{3} of captured water, only 0.36 million m ^{3} of water is discharged within the Botna basin , all being discharged with insufficient purification into surface waters.

According to the Environmental Protection Inspectorate (IPM), the number of sewage treatment plants (SE) within DBHN (right side) amounts to 156. 25 of them, or 16%, treat wastewater according to established standards, 92 or 59% evacuate water insufficiently purified and 39 or 25% are not functional (fig. 13). The treatment plants are located within the limits of 53 bodies of water, and the discharged water is mainly a source of river pollution. The largest number of treatment stations is located in the basin of the Ichel 3 water body, out of the 12 SEs, 1 is performing standard treatment, 8 – insufficient, 3 – not working. Within the basins of the Dniester 5 and Dniester 6 water bodies, 10 SEs are positioned each , of which 1 is purifying sufficiently, 15 – insufficiently and 4 are not working. Within the Dniester 1 and Dniester 4 water bodies, 7 stations are located in each of them, 4 of them discharge purified water according to the norm, 5 - insufficient and 5 do not work. Of the 6 treatment stations in the Botna 4 water body basin, 5 treat wastewater insufficiently, and one is non-functional. As many as 5 stations are located in the basins of water bodies Bâc 2 and Bâc 4, of which 3 work normally, 5 insufficiently and 2 do not work. Of the 5 treatment stations in the Cubolta 2 basin, 3 discharge insufficiently treated water, 2 do not work. In the basin of the Ciorna 2 water body, there are 2 stations with the discharge of insufficiently purified water and 2 non-functional ones, and in that of the Cula 2 water body, all 4 stations are insufficiently functioning. It should be noted that 4 treatment stations are also present in the Vatici water body, of which 3 treat the water according to standards and 1 insufficiently.

How many 3 treatment stations are located in the basins of 13 water bodies (Bâc 1, Botna 3, Bucovăţ, Ciulucul Mic 2, Copaceanca 1, Cubolta 3, Cula 1, Işnovăţ 1, Ivancea, Nistru 3, Răut 4, Răut 5 , Sesu Valley). Out of the 39 treatment stations, 5 work normally (Botna 3, Ciulucul Mic 2, Işnovăţ 1, Ivancea), 26 treat the water insufficiently and 13 do not work.

As many as 2 purification stations are found within 10 basins of water bodies (Balţata , Botna 2, Botna 5, Copăceanca 2, Higacea , Ichel 1, Ichel 2, Pojarna , Răuţel, Redi), the vast majority evacuating insufficiently purified water, 4 are not functional. Only in the Botna 2 water body are there water stations with normative treatment. Within 18 basins of water bodies, one treatment station is positioned each (Bâc 5, Bolata 1, Botnişoara , Camenca, Căinar, Căinari 4, Ciulucul Mare 1, Cogâlnic 3, Cuşmirca, Dobruşa, Draghinici , Işnovăţ 2, Molovateţ , Dniester 5, Răut 6, Răut 7, Stiubei , Valea Jidauca), of all these 4 purify the water according to the norm, 8 – insufficiently, 6 – not working.

Based on the analysis of information on the number and density of the population, the number of inhabitants connected to the aqueduct and sewerage systems, the volumes of captured, supplied and discharged water, including the purified water, the treatment plants and their efficiency, the anthropogenic impact on bodies of water. In particular, the effect of wastewater discharge into water bodies was evaluated. In this regard, two indicators were used, *the Indicator - Specific Wastewater Discharge (Dww)* and *the Indicator - Total Share of Wastewater (Sww).* The indicator - *Specific waste water discharge* (Dww) allows the identification of the most sensitive water bodies to the discharge of waste water, by evaluating the load of untreated residual water in relation to the minimum annual flow. The waste water load is expressed by the so-called waste water load equivalent, expressed by the number of inhabitants connected to sewage networks. In the case of the presence of information regarding the connection to treatment plants and their efficiency, the value of the waste water load equivalent decreases as a result of the correction coefficient (assessed as the difference between 1 and the efficiency of the treatment plants) assessed based on tab. 13.

Table 13.

The values of the treatment efficiency correction coefficient at different wastewater treatment plants [1]:

	Efficiency of sewage treatment plants		
	primary	**secondary**	**advance**
Biochemical consumption of oxygen	0.85	0.90	0.95
NH_4	<0.25	>0.90	
Not_{all}			0.75
P_{all}			0.80

The specific wastewater discharge (Dww) was calculated based on the number of inhabitants connected to the sewage systems / treatment plants, the application of the correction coefficient based on the evaluation of the treatment plants carried out using the IPM reports of the ~~Environmental Protection Inspectorate,~~ but also of the minimum flow determined based on the hydrological measurement data of the SHS or indirectly based on the methodology of the National Normative Document 2. In the result, the major impact was identified on 37 bodies of water or 39% with a length of 1076.5 km or 36.5%, another 9 bodies of water or 9.5% were included in the category without risk, these being mainly the water bodies of the Dniester river (fig. 14 and 15, tab. 14). The vast majority of water bodies are included in the possibly at risk category, the information presented being considered insufficient for a more in-depth analysis. It should be noted that the given indicator does not take into account the population not connected to the sewage system, whose number is much higher than that

[1] "Guidelines and comments from the EPIRB project expert group: Guidance document on hydromorphology and physico -chemical characterization for Pressures and Impact Analysis/Risk Assessment under the EU DCA"

[2] dETERMINATION characteristic features hydrological for conditions Republic of Moldova. Normative in the constructions CP D.01.05-2012, edition official _ Construction Agency and Development the territory Republic of Moldova. Chisinau , 2013. 155 p.

provided with such a service. If this number of the population is also considered, all water bodies will fall into the class with significant impact, including the Dniester river.

Table 14. Water bodies under the action of the impact of specific wastewater discharge Dww

	[redacted]
CAR number	[redacted]
Share, %	[redacted]
CAR length, km	[redacted]
Share, %	[redacted]

Indicator - *Indicator - Total share of wastewater (Sww)* is calculated as the ratio between the cumulative discharged volume of wastewater within the river and the multi-year average of the water body. Taking into account the small share of reported discharged water, compared to that provided, for the calculation of the indicator both quantitative characteristics were used by comparative analysis. As a result, it was assessed that the significant impact is attributed to 6 bodies of water or 6.3% with a length of 202.5 km or 6.87% (tab. 15). These water bodies are located in the Bâc basin: Bâc 4, Bâc 5, Işnovăţ 3, Bălţata, and Răut : Răut 3 and Răut 4. A number of 18 water bodies or 18.9% with a length of 458 km or 15 .5% are considered to be without associated risk, the population density being lower. 71 water bodies or 74.7% with a length of 2283.8 km or 77.5% are included in the medium impact or possible risk category. For these water bodies, the information is either incomplete or the impact is assigned as medium.

Table 15. Water bodies under the action of the impact of water supply and evacuation Sww

	[redacted]
CAR number	[redacted]
Share, %	[redacted]
CAR length, km	[redacted]
Share, %	[redacted]

Based on the data of the Moldavian Water Agency, the amount of pollutants contained in the waste water was determined (tab. 16). Thus, the biological consumption of oxygen is discharged in a volume of 3.35 thousand t. for the entire DBHN, the largest amount being formed within the bed and, respectively, the Bâc river basin - about 2.47 thousand t, few amounts are reported for the Răut basin - 0.2 thousand t (including 0.17 thousand t - formed within the limits of the Răut river bed). Among nutrients, within DBHN, the volumes of waste water contain about 877 t phosphorus, 241 t nitrogen, 377 t ammonium nitrate, 299 t nitrates, 12.2 t nitrites. The maximum amounts of total phosphorus are formed within the limits of the Bâc river basin - 767 t, the rest, 101 t - in the Dniester river bed. The origin of the total nitrogen is the Dniester river bed, the localities in this sector being the source of the discharge of 239 t of nitrogen, small amounts being also discharged into the Bâc river bed - 2.41 t. Of the total amount of ammonium nitrogen, about 221 t are discharged with residual waters in the Bâc river bed and basin, about 80 t - in the Răut river basin (including 71.8 t from the Răut river bed), 61 t - in the Dniester river bed. Of the total volumes of nitrates, about 69.8 t come from the Răut basin and 9.28 t from that of the Bâc river. The 12.2 t of nitrites add up to 5.48 t from the Răut basin and 2.72 t from the Bâc basin. Also, 17.8 thousand t of sulfates are discharged into DBHN, including 7.3 thousand t from the localities in the Dniester river bed, 2.57 thousand t from the Răut basin , 6.15 thousand t from the Bâc basin. Chloride pollution amounts to 70.9 thousand t, about 58.9 t being from the bed and basin of the Bâc river, 9.07 thousand t from the limits of the Dniester river bed. The volumes of bichloroethane and honeoethanolamide amount to 97.1 t and 299 t, most of which are formed within the limits of the Dniester river bed - 79.9 t and 205 t, smaller amounts being from the basins of its tributaries. Mercury is estimated to be at 74.4 t, of which the vast majority is formed within the limits of the Bâc basin, and nickel – at 12.2 t, the volumes of this metal coming from the Răut basin – 5.48 t, Bâc – 2.72 t , the bed of the Dniester river – 3.02 t. The quantities of fats and oils discharged with the waste water are 97.1 t, about 17.2 t being from the Bâc basin. Detergents from waste water amount to 74.4 t, including 71.6 t from the Bâc basin. Quantities of petroleum products were also identified - 0.04 thousand t, the largest volumes coming from the Bâc bed and basin. The suspensions formed amount to 6.45 thousand t, the main source being the localities in the Bâc basin - 5.41 thousand t. The volume of the fixed residue equals 93.5 thousand t, of which 45.2 t are formed within the localities of the basin the Dniester river and 34.7 thousand t from that of the Bac river.

Table 16.

Evacuation into surface water bodies of polluting substances contained in waste water (source: developed based on the reports of the Moldavian Water Agency, 2021)

	The volume of water residual mil.m. _ c.	**The amount of polluting substances discharged**																		
		Biological consumption of oxygen, thousands of tons	Petroleum products, thousand t,	Suspensions, thousands of tons	Fixed residue, thousand t,	Sulfates, thousands of tons	Chlorine, thousands of tons	Total phosphorus, tons	Total nitrogen, tons	Ammonium nitrogen, tons	Bichloroethane , t,	Honeoethanolamide , t,	Nickel, t,	mercury, t,	Fats , oils, etc	Nitrates _	Nitrites t,	Under, active agents are detergents ,
b,h , Dniester	127.3	3.35	0.04	6.45	93.5	17.8	70.9	877	241	377	97.1	299	12.2	74.4	97.1	299	12.2	74.4
r, Dniester (bed)	52.8	0.5	0.01	0.63	45.2	7.36	9.07	101	239	61	79.9	205	3.02	1.83	-	-	-	-
b,h , Bad	12.1	0.2	0	0.22	8.67	2.57	1.38	0	0	79.7	17.2	69.8	5.48	0.25	17.2	69.8	5.48	0.25
r, Bad (bed)	11.2	0.17	0	0.2	8.15	2.45	1.27	0	0	71.8	17.2	68.1	5.33	0.25	-	-	-	-
b, h , Bic	56.7	2.47	0.03	5.41	34.7	6.15	58.9	767	2.41	221	0	9.28	2.72	71.5		9.28	2.72	71.6
r, Bic (bed)	56.7	2.47	0.03	5.41	34.7	6.15	58.9	767	2.41	221	0	9.28	2.72	71.5	-	-	-	-
b,h , Botna	0.26	0	0	0.01	0.15	0.73	0.64	0.85	0	0.43	0	0.01	0.09	0	-	0.01	0.09	-
r, Botna (bed)	0.2	0	0	0	0.14	0	0.02	0.78	0	0.19	0	0	0.09	0	-	-	-	-

- there are no data

3.2 . Diffuse pollution sources

Sources of pollution they can be diffused classify in the three categories main : a) nitrates coming FROM mineralization manure _ _ and droppings _ HOUSEHOLD LIQUID and semi-liquids ; b) nitrates coming FROM mineralization products vegetable , waste , residues and WATER PLANT FROM FROM SECTOR animal husbandry ; c) nitrates coming FROM the use intensive use of fertilizers chemical (nitrogen and phosphorus).

These sources of pollution, reaching water bodies directly through stormwater runoff, can lead to their pollution and affect aquatic biodiversity. The main effect of nitrate pollution of underground and surface waters is the reduction of water potability and the eutrophication of water bodies. Agricultural lands, including arable lands, pastures, perennial plantations hold about 74% of the total surface of the country. The livestock sector is also of relevant importance, with the annual amount of manure representing about 4 million tons annually. Thus, the input of nutrients from agricultural lands and livestock holdings that reach surface and underground waters is essential, negatively influencing the quality of aquatic resources.

In order to protect water resources in the context of nitrate pollution, the application of organic and/or mineral fertilizers is prohibited during the periods when the demands of the agricultural crop towards nutrients are reduced, namely when the time interval in which the average air temperature is lower of +5 ° C. This interval corresponds to the period when the demands of the agricultural crop towards nutrients are reduced or when the risk of percolation/runoff to the surface is high; in general, the prohibition period for the application of nitrogen fertilizers is recommended from November 1 to March 15.

3.2.1. Agricultural activities

The main sources of diffuse pollution within DBHN are agricultural lands and livestock complexes. The impact of agricultural activities on arable land is expressed through the use of mineral fertilizers, pesticides and many other crop maintenance products and as a result the pollution of surface and underground water with nutrients (N, P and K) but also, in certain periods, with dangerous substances.

According to the National Bureau of Statistics, in 2021, the volumes of chemical fertilizers , used by agricultural enterprises and peasant households in 18 territorial administrative units within the DBHN, amount to 53.5 thousand t, or about 51% of the total used at country level . The largest quantities are reported for Criuleni district, 10.4 thousand t., Floreşti 9.4 thousand t., Drochia 6.3 thousand t., and the smallest for the municipality of Balti 27 t., Străşeni 353 t., Ialoveni 630 t., Chisinau municipality 762 t.

The volumes of chemical fertilizers per 1 hectare of sowing amount to 400-500 kg/ha in Criuleni and Călăraşi districts, 100-200 kg/ha in Donduşeni, Drochia, Floreşti, Chişinău, Şoldăneşti municipalities. The lowest values are assessed for Teleneşti, Străseni, Sângerei, Balti municipality – up to 50 kg/ha.

Compared to chemical fertilizers, natural ones are used in smaller volumes. About 33.7 thousand t of this type of fertilizer were applied to fields with sowing in 2021. Of the total volume used at the country level, the indicated value is only 26%.

The largest amounts of natural fertilizers are used in Drochia district, about 11.9 thousand t, followed by Orhei - with 7.7 thousand t., Dubăsari and Soroca - with about 5 thousand t.. In Bălţi municipality, This type of fertilizer is not used in Chisinau, Străseni, Soldăneşti, Căuşeni. The volumes of natural fertilizers used per 1 hectare of sowing amount to only 0.48 kg/ha in Dubăsari district, 0.34 kg/ha in Orhei, 0.24 ha in Drochia and Călăraşi.

For agricultural needs, significant volumes of pesticides continue to be used. Of these, the volumes of insecticides amount to 346.5 t, or about 63% of the total for the country in 2022. The highest volumes are applied to the lands in Floreşti - 127.8 t, Rezina - 55.1 t, Donduşeni - 35, t. Soroca – 20.3 t., and the smallest in the municipality of Balti 195 kg, Călăraşi - 860 kg. Volumes of insecticides applied per hectare are 2.5-5.3 kg/ha in Rezina and Floreşti, and 1.1-1.7 kg/ha in Străseni, Orhei, Ialoveni, Donduşeni, Chisinau municipality. The lowest values, of 0.6-0.7 kg/ha, are reported in the districts of Soldăneşti, Criuleni, Sângerei, Drochia, Balti municipality.

The volumes of fungicides used in 2022 amount to 653.5 t or about 48% of the total used per country. The largest quantities are reported for Floreşti, about 142 t, and Soroca with 73.5 t, followed by Căuşeni, Străseni, Anenii Noi, Donduşeni with about 50-60 t. The smallest volumes are used in the districts of Ialoveni, Călăraşi with about 10 - 12 tons and the municipality of Balti - 802 kg. Relative to 1 ha, the volume of fungicides is maximum, of 13-15 kg/ha in Soldăneşti, Călăraşi, followed by the municipality of Chisinau with 5.3 kg/ha and Anenii Noi with 4.3 kg/ha, in the other districts the volumes are of 1-3 kg/ha.

The herbicides used in 2022 amount to 846.6 t, of which 242.2 t were applied on lands in Floreşti, 103.2 t in Căuşeni, 70-75 t each in Rezina, and Drochia. The smallest volumes were reported for Balti, Călăraşi, Chişinău municipalities of 3-10 t. The amount of herbicides used per hectare is estimated at 3-4.4 kg/ha in Floreşti, Străseni, Rezina, the minimums of approx. 0.8-1 kg/ha are utilized in Balti, Telenesti municipalities, in the other districts the values are between 1 and 2.6 kg/ha.

About 80% of biological products for phytosanitary use or 535.1 t were applied to agricultural lands within the districts located within the DBHN limits in 2022. Of these, about 110-180 t were used in Străseni, Rezina, Floreşti. The smallest volumes are specific to the municipalities of Chisinau, Donduşeni, Ialoveni, around 100-400 kg, and in the municipality of Balti, these types of products were not used. Volumes used per hectare are around 203 kg/ha in Străseni, 20-45 kg/ha in Rezina, Orhei , Sângerei. The smallest quantities being used in Donduşeni, Drochia, Chişinău municipality, Soroca - about 0.6-2 kg/ha.

The assessment of the impact of agricultural activity is carried out conventionally, by estimating the share of arable areas in relation to the total area. In this regard, arable land covers more than 30% of the total basins in the case of 82 water bodies or 86.3% with a length of 2634.98 km or 89.5%. 11 bodies of water: Cula 1, Cula 2, Ichel 1, Pojarna , Bâc 1, Bâc 2, Bâc 3, Bucovăţ, Botna 1, Vatici, Molovateţ are included in the category of water bodies with medium impact, they being located in the area of plateau, with a greater share of forestation. Only 2 water bodies are classified as having no associated risk: Işnovăţ 1 and Işnovăţ 2. This fact is due to the greater share of forested areas (tab. 17, figs. 16 and 17).

Table 17.

Water bodies under the action of the impact of agricultural activities

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	11	[redacted]
Share, %	[redacted]	11.6	[redacted]
CAR length, km	[redacted]	277.62	[redacted]
Share, %	[redacted]	9.42	[redacted]

The impact of agricultural activities on the water resources of surface water bodies was also estimated. The decrease in water runoff under the influence of this pressure factor, as a function of the weight of the arable surface, amounts to 4-6%.

3.2.2. Livestock

The zootechnical branch imposes pollution with animal waste. Accumulation of these at livestock farms or redistribution on agricultural land is the main cause of water pollution by organic waste.

According to the National Bureau of Statistics, within the limits of the DBHN (without the left side of the Dniester), towards the beginning of 2023, the total number of cattle, sheep, pigs and goats constituted 296,513 heads, of which 42,827 were cattle (14.4%). 118,834 sheep (40%), 75,392 pigs (25.4%) and 59,460 goats (20%). About 10-14 thousand animals are found within the limits of water bodies Botna 4, Răut 4, about 5-10 thousand are kept in 14 water corrals (Botna 5, Ichle 3, Cula 1, Bâc

4, Bâc 5, Răutel, Sagala etc.). Within 58 water basins the number of heads is around 1000-5000, and below 1000 in the other basins. Relative to the surface of the water basins, a more consistent livestock is registered in the water bodies Valea Nicorenior , Sagala , Chiua , Ciulucul Mic 1, Botna 4, Şiubei, Răut 6, Ciorna, Ciulucul de Mijloc1, Solonet 1, Botna 5 (about 30-45 heads/km ^{2}), and quite small for Botna 1, Ivancea, Valea Şesu , Işnovăţ 1, Bâc 2, Redi (2.5-7 heads/km ^{2}). The largest number of cattle (1000-1350 heads) is found in the water bodies in the upper part of the Răut basin and the lower part of the Ichel , Bâc and Botna rivers , and the smallest is identified for those in the upper part of the Bâc and Botna rivers , as well as for the small tributaries of the Răut river : Vatici, Ivancea, Valea Şăbana , Higacea , Chiua , Redi (1-250). The highest concentration of sheep (over 2000 heads) was assessed for the water bodies in the middle part of the Răut river , including the Ciulucul Mic basin, as well as for those in the lower part of the Ichel , Bâc and Botna rivers , and the lowest for the upper part of the Ichel , Bâc and Botna rivers (under 250 heads). The maximum number of goats (1000-3000 heads) was estimated for the water bodies in the Cula basin, the lower part of the rivers Ichel , Bac and Botna , Cubolta, and minimum for Pojarna , Işnovăt 1 and 2, Botna 1, Ivancea, Valea Socilor , Redi, Ciorna, Popornita (under 200). In the basins of water bodies Botna 4 and 5, Bâc 4, Bucovăţ, Cula 1, Ichel 3, Răut 4, there is a large number of pigs (2-4 thousand heads), and their small number (100-200 heads) is specific for Valea Jorei , Căinari 3, Valea Şesu , Ichel 1, Işnovăţ 2, Larga.

As a result, it was estimated that the largest amount of nitrogen and phosphorus formed by livestock is for Botna 4 and 5, Dniester 3 and 4, Cubolta 4, Răut 4, Ichel 3, Cula 1, the volumes being about 70- 100 t/year of nitrogen and 10-15 t/year of phosphorus. The smallest amounts are specific for the basins of water bodies Botna 1, Işnovăţ 1 and 2, Redi, Ivancea, Ichel 1, Larga, alea Jorei and Valea Şesu , of about 3-10 t/year of nitrogen and 0.5-1 .3 t/year of phosphorus.

The livestock impact was carried out on the basis of information on the number of cattle, sheep, pigs and goats at the commune level. The impact proved to be minor in most of the water bodies' watersheds (fig. 17-19).

3.3. Hydromorphological changes

hydromorphological changes of the rivers within the Dniester DBH are caused by the construction of dams and reservoirs on the watercourses, which disrupt the longitudinal connection of the rivers, by the protective dikes and irrigation canals, which influence the transverse connection between the river and the meadow. The development of rivers within localities and the regularization of their bed is part of the series of factors that determine the hydromorphological changes of rivers. Also, the impact of the Dniester Hydropower Complex on the Dniester River was analyzed, in particular, the pulsating effect of the water discharge waves from CHE-2 and the change in the dynamics of solid material through the river bed as a result of its damming. The changes of 4 bodies of water transformed into reservoirs as well as of the natural lake Dniester Vechi were evaluated.

3.3.1. Regulation of water flow through dams and reservoirs

One of the main factors of hydromorphological changes is the construction of dams and, as a result, water accumulations on the water course. The main effect caused by their construction is considered to be the interruption of the longitudinal connectivity of the river, which in turn limits the connection between the upstream and downstream parts, as well as causes the modification of the upstream part of the river in water accumulation, and towards the downstream part the regime hydrological is controlled by the operators of the hydrotechnical constructions of the dams.

The water flows of the Dniester River are regulated by three reservoirs and one lateral one. The dams of the reservoirs are equipped with turbines that produce electricity. Two reservoirs built on the course and the lateral one form the Nistrean Hydropower Complex (CHN) located on the border between Ukraine and the Republic of Moldova. The Dnestrovsk reservoir with CHE-1 has a length of 194 km, a volume of 2.6 km^3, a dam height of 54 m, equipped with 6 turbines with a capacity of 702 MW. The stilling reservoir of CHE-2 is much smaller and has a length of 19.8 km, a volume of 37 million m^3, being the intention to increase its value to 58 million m^3, the dam is equipped with 3 turbines with a capacity of 40.8 MW. The artificial storage lake with the hydroelectric plant for water storage by pumping (CHEAP) is built next to the Dniester river, 9 km downstream of CHE-1, on the upper part of the slope on the right side of the river at approx. 150 m above the Dniester water level. CHEAP has a water volume of 41.43 million m^3, the dam is equipped with 3 turbines that were installed between 2013-2016, the capacity of 972 MW in turbine mode and 1263 MW in pumping mode, recently the fourth turbine was installed (324 MW in turbine mode and 421 MW in pumping mode). Within the borders of the Republic of Moldova, on the course of the Dniester river, the Dubăsari reservoir is being built with a length of 130.5 km, the current volume being about 194 million m^3, the dam being equipped with 4 turbines with a capacity of 48 MW. Summary the Dniester river is transformed into reservoirs with a weight of about 26%. Within the borders of the Republic of Moldova, the length of the Dniester river is transformed into a reservoir with a weight of about 21.2%. It should be mentioned that the Dubăsari reservoir was delimited as a separate body of water, being considered heavily modified.

The number of water reservoirs built on the tributaries of the Dniester River is variable. Most reservoirs are built on the rivers Cubolta - 19 and Căinari - 10. A number of 8-9 reservoirs are found on the course of the river Ichel and Ciulucul Mic. 5 reservoirs are built on the Bâc river, 4 on the Botna and 3 on the Răut . Water bodies are also affected by the construction of reservoirs. 30% or 27 bodies of water do not contain water accumulations per course. 1 reservoir is built on 7 water bodies, on 16 – 2-3 reservoirs, on 12 – 4-5 reservoirs, on 14 – 6-8 reservoirs, on 11 – 9-11 lakes accumulation. On the course of the Răutel and Soloneţ 1 rivers there are 14 water accumulations, and on Botnişoara – 15 water accumulations (fig. 20).

The density of dams built on water bodies falls within the limits of 0-0.55 dam/km. For 33 water bodies with a length of 905.4 km, the density of dams is 0.02-0.2 dam/km, for another 23 water bodies with a length of 585.1 km, this parameter is 0, 2-0.4 dam/km of river and for other 7 water bodies with 165.8 km it is 0.4-0.56 dam/km of river. The highest density of dams is specific to the Popornița , Căinar, Işnovăţ 3, Valea Jidauca , Răuţel, Botnişoara , Soloneţ 1 water bodies. Thus, the smallest rivers and water bodies are subject to the significant impact attributed to the construction of dams on the course of small rivers, smaller impact is specific to medium rivers and much smaller to large ones.

The course of a significant number of water bodies is transformed into water accumulations. Within the Răut basin , there are no water accumulations on 10 water bodies, another 13 water bodies are changed into accumulations in a proportion of up to 10%, another 20 in a proportion of 10-30%. The course of 5 cups of water is transformed with a weight of 30-40%. Of the 9 bodies of water in the Bâc river basin, only 2 bodies of water are moderately influenced by the pressure of water accumulations, the others being without impact. Water bodies in the Botna river basin fall into the category of no impact – 4 water bodies, medium impact – 3 water bodies and 1 water body is significantly influenced. The water bodies of fl . Dniester are not transformed into reservoirs, with the exception of the Dniester 4 water body – the Dubăsari reservoir.

Finally, the course of 27 water bodies or 30%, with a total length of 1084.8 km or 39.6%, is not regulated by water accumulations, another 27 water bodies with a length of 706.6 km or 25.8% are modified up to 10% and are not at risk of achieving the environmental objectives. 29 bodies of water or 32.2% with a length of 779.3 km or 28.4% fall into the category possibly at risk, their course being transformed into water accumulation with a weight of 10 to 30%. 7 bodies of water or 7.8% with a length of 170.4 km or 6.21% are considered to be at risk. These bodies are Copăceanca 2, Cubolta 2, Ichel 1, Larga, Popornița , Răutel, Soloneț 1 (fig. 21 and tab. 18).

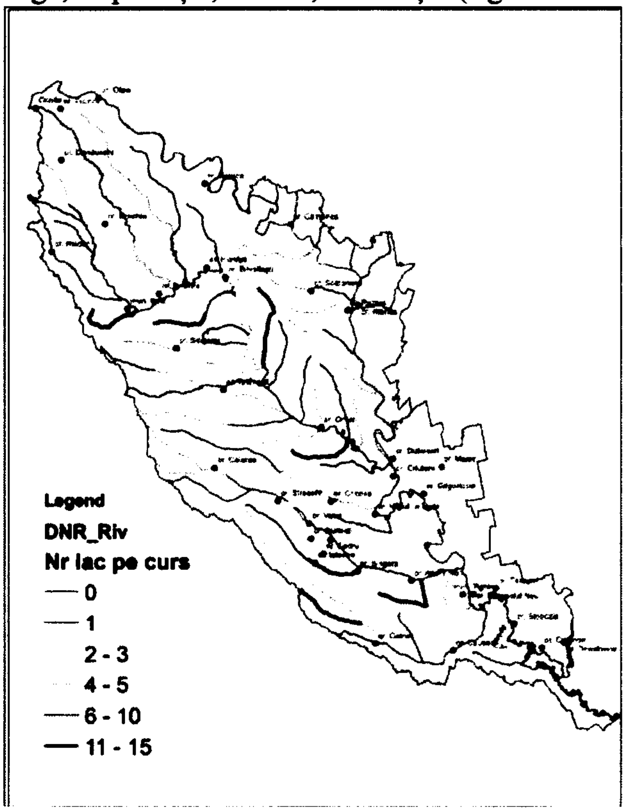


Figure 20. The number of reservoirs built along the rivers

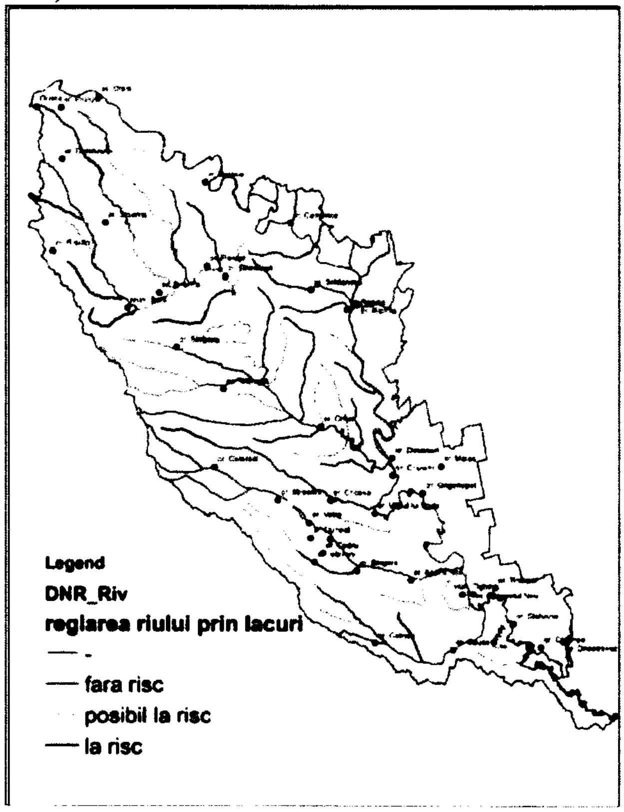


Figure 21. The impact of reservoirs built on the course of rivers

Table 18.

Water bodies under the action of the impact of the regulation of the water course by water accumulations

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	29	[redacted]
Share, %	[redacted]	32.2	[redacted]
CAR length, km	[redacted]	779.3	[redacted]
Share, %	[redacted]	28.4	[redacted]

3.3.2. The impact of the Dniester Hydropower Complex

3.3.2.1. Modification of suspended alluvium flows

The specificity of river water dynamics is the erosion, transport and accumulation of alluvial material. Under the action of the dams built on the course of the Dniester river, alluvium transport processes are limited. The Dubăsari reservoir as well as those of the Nistrean Hydropower Complex (CHN) have caused a decrease in the transport of alluvium.

On the middle sector of the Dniester river, the highest values of suspended alluvium flows are observed during the period before the construction of the CHN. The average of this characteristic is approx. 100 kg/s in Zalesciki (upstream CHN), 160 kg/s in Moghilev Podolsk and 230 kg/s in Hrušca. In the post CHN period, the flows of suspended alluvium are evaluated at 59 kg/s at Zaleşciki , decreasing compared to the previous period by 40%, the change being caused by natural factors. At the stations downstream of CHN, the values are significantly reduced compared to the previous period. To Mogilev In Podolsk, the average value of suspended alluvium flows is 2.8 kg/s, and in Hruşca - 19.6 kg/s, the decrease being by 92-98% (fig. 22-23) .

On a monthly basis, in a natural regime (at the Zalesciki post), most of the sediment volume is formed during the production of large spring waters and pluvial floods (fig. 24). Thus, it can be seen that the largest amounts of sediments are recorded in March-April and June-July, respectively, when large volumes of water are formed and spread through the meadow. After CHN, in a natural regime, the amount of sediments decreases by approx. 40-50% in the spring-summer months, the biggest decrease being specific to February, increases in the amount of sediments are observed for the autumn months. This fact is due to the natural conditions of the formation of the drain, without the influence of reservoirs.

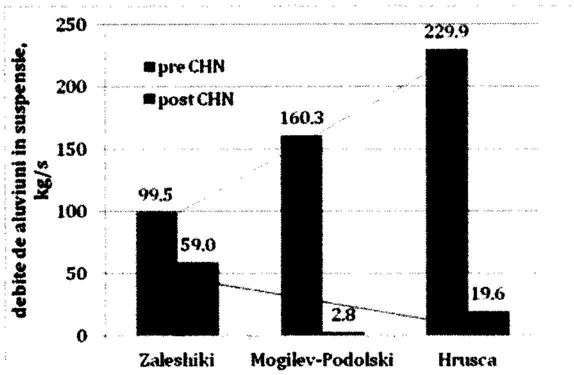


Figure 22. Average flows of suspended alluvium

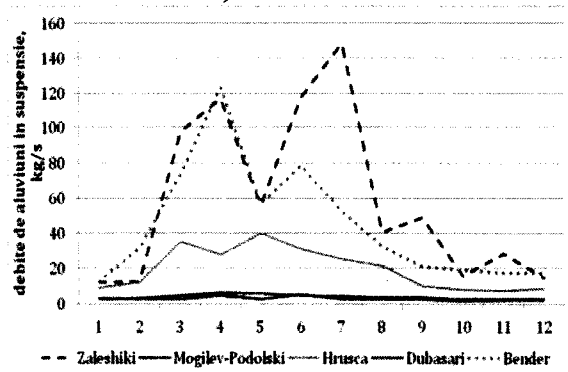


Figure 23. Solid flows of suspended alluvium (after the construction of the CHE-1 and Dubăsari dams)

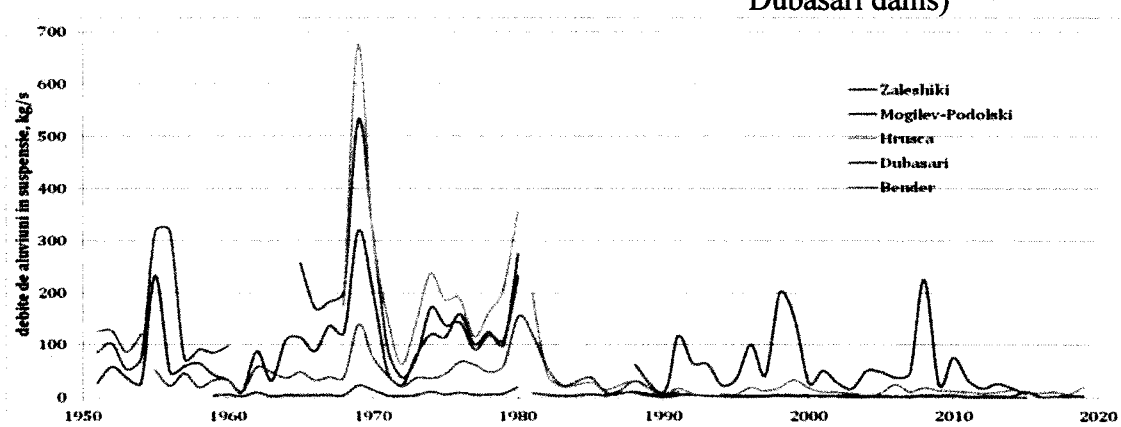


Figure 24. Average annual flows of suspended alluvium

In the period after the construction of the CHN, there is a decrease in the flow of suspended alluvium, a fact caused by the retention of sediments in the basin of the Novodnestrovsk reservoir . The significant decrease in sediment volumes is specific for all months of the year, thus, average monthly values higher than 5 kg/s are not recorded. The impact is registered on the entire sector of the Dniester river from the Novodnestrovsk dam to the Dubăsari dam and below it. Although a cumulative impact of the dams is observed, a reappearance of solid flows of suspended alluvium downstream of the reservoirs, at the Bender station, is highlighted. The reduction of sediment transport has determined the increase of water transparency, which consequently influences the development of aquatic ecosystems.

3.3.2.2. Pulsating effect of water waves ejected from CHN-2

One of the direct effects of CHN operation is the pulsating effect of the waves determined by the operation of the turbines at CHE–2 or the so-called hydropeaking effect . It is manifested by rapid rises and falls in the water level caused by the operation of the CHE-1 and CHE-2 turbines and influences the river ecosystem downstream.

As a result of the measurements , it was found that the intra-daily level amplitude downstream of CHN is 52 cm (5 km downstream, post Naslavcea). With increasing distance from CHE–2, the level variation decreases to 44 cm at 30 km downstream and only towards or. In Soroca, the fluctuation of the water level reaches values of 20 cm, and to Sănătăuca at 14 cm. In spatial profile, the hydropeaking effect , in general terms, manifests itself, downstream, in the first 100 km from CHE-2, in certain periods, however, the impact of this phenomenon extends and can be felt even 180 km downstream of the hydropower plant . On average, the water level rise/fall rate is 0.31 cm/min and –0.17 cm/min near CHN, respectively. The values are reduced 2 times 30 km downstream and 5 times towards Soroca and Sănătăuca. Thus, the greatest effect of the rate of increase and decrease is felt in Naslavcea and Unguri, sometimes in Soroca and rarely in Sănătăuca.

At the annual level, the highest **amplitudes of the water level** (difference between the maximum and minimum water level) are estimated for the first years of monitoring, 2013, 2014, the values decrease in 2015, 2016, increase in 2020, 2021. At the stations in near CHE-2 the average annual values are approx. 30 cm – in 2016, 2022, approx. 40 cm – in 2017-2019, and over 50 cm – in 2013, 2014, 2020, 2021 (fig. 25). At the Soroca and Sănătăuca stations, the amplitude values are close to 20 cm and 13 cm. At the monthly level, the biggest fluctuations are recorded in the warm period of the year (fig. 26). The months of April, May, June, July, August and December are highlighted , where the multi-year monthly average at the station near CHE-2 exceeds 50 cm. The lowest values of the level amplitude (of 30 cm) are observed for February, and in January, March, September, October and November the values approach 40 cm. In Hungary, the level variation is slightly reduced, by about 5-10 cm. In the months of May and June, the 50 cm threshold was estimated to be exceeded, by about 4-10 cm. The lowest values of the water amplitude are estimated for September and October - approx. 30 cm, and during the other months the value approaches 40 cm. Significant reductions in water amplitude are observed at stations located much further from CHE-2. At Soroca, the average daily water fluctuation is maximum, approx. 30 cm, in January, April, June, December, and minimum, of 12-15 cm, in June, August and September, and in the other months - approx. 20 cm. At Sănătăuca, the average value of the water level amplitude slightly exceeds the value of 20 cm only in March. In the autumn months, low values of up to 10 cm are recorded, and in winter, spring and summer they are 10-15 and sometimes 20-25 cm (June and March).

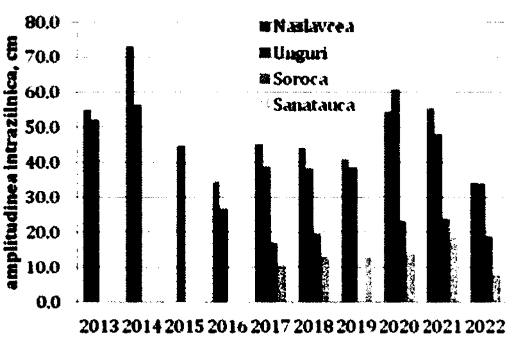


Figure 25. Average annual water level amplitude

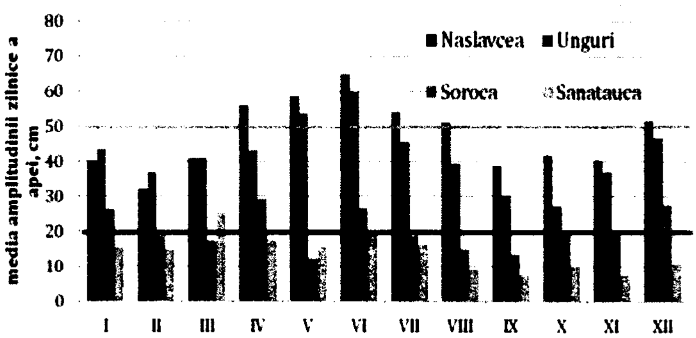


Figure 26. Average daily water amplitude at hydrological stations, by months of the year for the entire observation period

The rate of rise and fall describes the rapidity of the rise or fall of the water level in the Dniester riverbed due to the operation of the CHE-2 turbines and is considered to significantly influence aquatic biodiversity, as the risk of death increases with the shutdown of turbines and water flow. On a general level, the average growth and decrease rates in Naslavcea are 0.31 cm/min and -17 cm/min, in Hungary the values are between 0.15 cm/min and -0.12 cm/min. At the Soroca and Sănătăuca stations - the rates are 0.04 cm/min and -0.03 cm/min. On an annual level, in Naslavcea the growth rate is higher in the years 2013, 2014, 2018, 2020, the values reaching 0.35-0.45 cm/min, in other years they are 0.20-0, 30 cm/min. In Hungary, maximum average values are recorded in 2021 - 0.3 cm/min, and minimum values (of 0.09 cm/min) in 2016, 2018, 2019. In Hungary and Sănătăuca, the average rates of water level rise are 0 .03-0.05 cm/min and 0.02-0.03 cm/min for all years. The rate of decrease at these 2 stations is -0.03 cm/min and -0.02 cm/min during all monitoring years. At the upstream station, the variation in the values of the decrease rate between years is not large, being within the limits of -0.13 and -0.08 cm/min. In Naslavcea, this indicator is a maximum of -0.25 cm/min in 2014 and 2018, and a minimum in the last two years, in the other years it is -0.14 and -0.19 cm/min (fig. 27 and 28).

Based on the analysis of the monthly averages, both the increase and decrease rates, it can be concluded that the values at the Naslavcea station far exceed the threshold value of 0.08 cm/min, the limits being 0.25-0.5 cm/min and -0.15 - -0.26 cm/min. In Hungary, the situation changes, the rates mentioned by decrease twice compared to the post upstream. At the Soroca and Sănătăuca stations, the rate of increase and decrease does not exceed 0.04 cm/min and -0.04 cm/min (figs. 29 and 30).

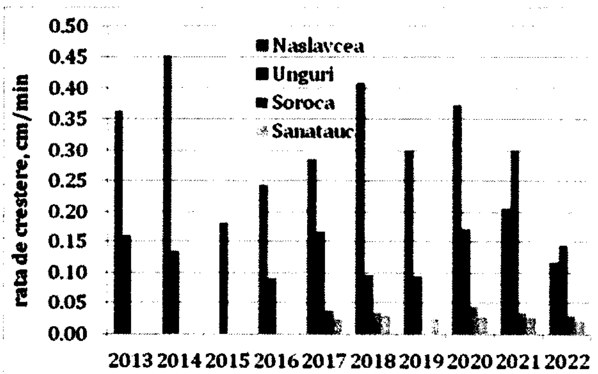


Figure 27. Average growth rate per year

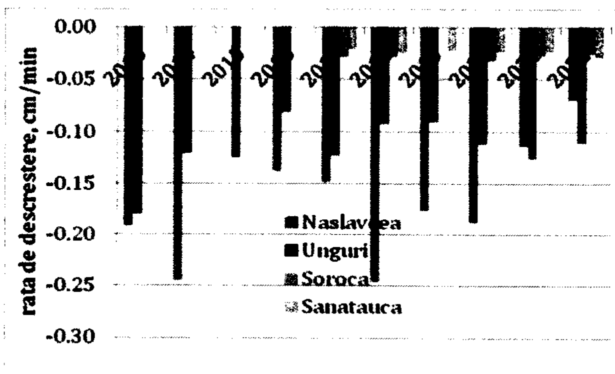
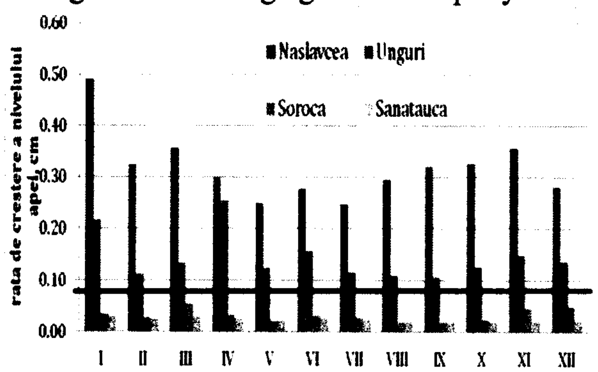
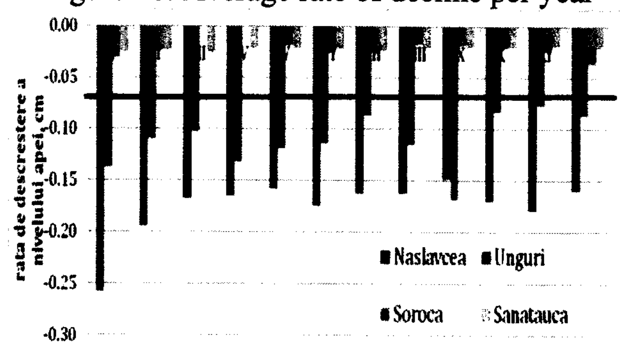


Figure 28. Average rate of decline per year





As a result of the analysis of the basic characteristics of the hydropeaking effect , it was found that the Dniester 1 and Dniester 2 water bodies are subject to a significant impact, which is reduced to the Dniester 3 water body. Thus, in the category of water bodies at risk were included Dniester 1 and Dniester 2, and in the possible risk - Dniester 3.

3.3.3. Development of rivers within localities

Most of the country's settlements are located in river meadows. As a result of the development of urbanization, the watercourses were also subject to development. The basic objectives of the arrangement of the watercourses were the strengthening of the banks, recreation, reducing the vulnerability to floods, making the use of water resources more efficient, etc. There is no consolidated database on the management of rivers within localities. The banks of the Dniester river are mostly laid out by concreting within the limits of big cities such as Soroca, Tiraspol, Tighina, etc. Among the tributaries, the bed of the Bac river within the limits of the municipality of Chisinau was subjected to development works.

The water bodies that pass through localities with a 30-80% share are 10 in number and include those on the left of the Dniester, as well as Ciorna 2, Cuşmirca, Căinar and Bâc 4. The course of another 24 water bodies passes through localities with a share from 10-20%, the share of the others falls within the limits of the localities with up to 10%.

As a result of the analysis of the impact of localities on the hydromorphological state of the rivers, 3 bodies of water were included in the category of those with a significant impact: Bâc 4, which passes through Chisinau, Căinari and Ciorna 2, in the class of those with medium impact 35 bodies of water and the others in the low impact class.

3.3.4. Regularization of riverbeds

Intensive regularization of the water course was carried out in the 50s-60s of the last century in order to expand the arable land in the meadows with fertile soil. The regularization of rivers determined the rectification, consolidation and re-profiling of minor riverbeds. The information regarding the modification of the riverbeds is not systematized in databases, also there is no clarity regarding the spatial representations of the natural courses of the rivers. In order to identify the bed sectors subject to changes, the areas with the extension of the canals, as well as those located within the localities, were analyzed. In the end, 16 bodies of water with a significant impact were identified, including all the water bodies of the Bâc and Cula rivers, 4 of the 5 bodies of the Botna river , Ciulucul Mic 2, Ichel 2, Răut 3, 4, 6, 7 In the category of those with medium anthropogenic impact, 14 water bodies are included, including Botnişoara , Bucovăţ, Ciulucul Mare 2, Ciulucul Mic 1, Ciulucul de Mijlocul 2, Cogâlnic 2, Cubolta 3, Ichel 1 and 3, Işnovăţ 3, Pojarna , Vatici, Bad 5, 8. The other bodies of water are included in the category without risk, apparently being little affected by the regularization, but also highlighting a lack of information regarding this type of work.

3.3.5. Anti-flood protection dykes

In order to protect the towns and agricultural lands from flooding, dyke systems were built in the river meadows. In the Republic of Moldova, damming works were carried out during the 50s-70s of the last century and resulted in the protection of 93 localities and 87.5 thousand ha of meadow land from floods. At the present time, the period of exploitation of hydrotechnical constructions has exceeded 50 years and, respectively, their protection capacity has essentially decreased.

In the Dniester river meadow, protective dikes are built in the lower part of the river, being positioned at a distance of 20-100 m from the minor bed, their height being up to 4 m. The dimensions of the existing protective structures in the Dniester river meadow are designed to withstand the maximum flow equal to 2600 m^3/sec. The protective dams are also built in the meadows of the main tributaries: Răut , Bâc, Botna , Ichel , Ciulucul Mic, Cula, Cubolta, Căinari, etc., these being located at an approximate distance of 30-60 m from one side to the other of the minor river bed, with heights of ~2-3 m, and widths of 1.5-2 m. According to HG 728/08.09.2014 , the total length of the protective dikes within the DBHN is 524 km, of which 237 km are built along the banks of the Dniester riverbed, 90.5 km along the Botna river , 79.4 km - Răut , 78.6 km - Bâc, etc. In total, the dikes provide flood protection for 82 localities, including 15 on Bac, 16 on Răut , 9 on Botna , 30 on Dniester.

The main purpose of dams is flood protection, however, hydrotechnical constructions also have a negative effect on the hydromorphological state of rivers by breaking the connection between the river and its meadow. Meadow ecosystems adapted to its periodic flooding are subject to degradation and extinction. The protection dams built in the immediate vicinity of the rivers cause the narrowing of the meadow, and as a result, the increase in the speed and flow of water during floods.

The impact of this type of pressure is, broadly speaking, average within the basin, the upper courses of the rivers being mostly unaffected and the lower ones being strongly influenced. In this way, the Dniester river (water bodies Dniester 5 and Dniester 6) is subject to a significant impact caused by dams in its lower part, downstream from the Dubăsari dam, where the water course is practically dammed on the right and left sides. Water bodies within the Răut basin undammed are 14 in number, and those with small lengths of dykes – 9. There are 8 bodies of water under medium human impact, of which Răut 3, Răut 8, Răutel, Cula 1, Ciulucul Mic 1, Ciulucul Mare 2, Ciulucul de Mijloc 2, Cubolta 3. Bodies subject to a significant impact determined by dams are 6 within the limits of the mentioned basin. These are mainly those of Răut: Răut 4, Răut 6, Răut 7, but also Cogâlnic 2, Ciulucul Mic 2, Cula 2. Of the three water bodies of the Ichel river , the first 2 are not subject to impact, and Ichel 3 is at risk. Within the Bâc basin, the Calintir , Pojarna and Işnovăţ 1 bodies are outside the pressure of the dikes, the Bucovăţ, Işnovăţ 3 and Bâc 3 bodies fall into the medium affected category, and Bâc 2 and Bâc 5 into those with a significant impact. The Botna River is dammed to the extent of 53% on the right side and 68% on the left side , all 5 water bodies of this river being at risk. The tributaries of Botna are not influenced by the impact of dams (fig. 31).

Water bodies without dams and without risk caused by dams are 66 in number or 69.4%, the length of the water bodies being 1815 km or 61.6%. The category of water bodies possibly at risk includes 11 water bodies or 11.5% with a length of 348 km or 11.8%. Water bodies at risk of not reaching the environmental objectives are 18 or 18.9% with a total length of 780 km or 26.5% (tab. 19).

Table 19.

Bodies of water under the action of flood protection dykes

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	11	[redacted]
Share, %	[redacted]	11.5	[redacted]
CAR length, km	[redacted]	348	[redacted]
Share, %	[redacted]	11.8	[redacted]

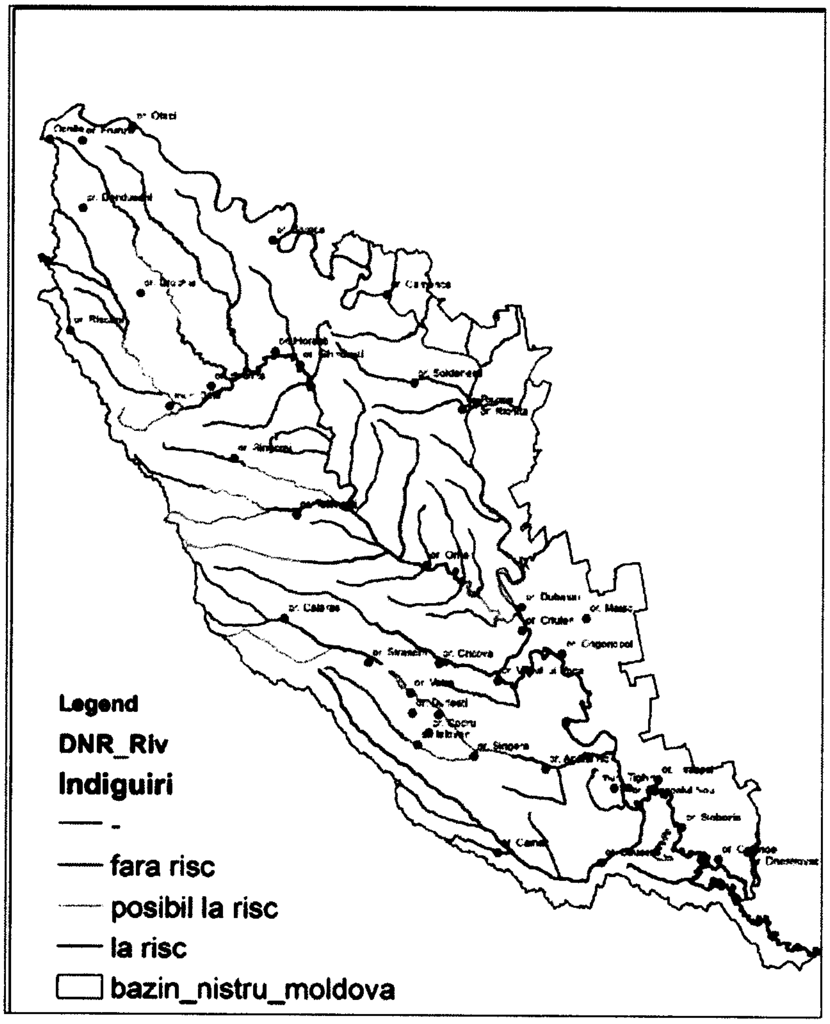


Figure 31. The impact of dams

3.3.6. Irrigation canal systems

During the 1960s-1980s, a large number of canal systems were built in the DBHN riverbeds, the main purpose of which was the development of irrigation. However, their high density and the transfer of water from rivers for irrigation negatively influence the hydromorphological state of water bodies. The quantities of water used for irrigation are not fully monitored and known. Large water users consistently report the volumes of water withdrawn, however, there are also a large number of users who are not included in the general statistics. The length of the canals within the DBHN exceeds 4200 km. The largest system of canals, about 1700 km, is located in the meadow of the Dniester river, the lower part. Of these, about 740 km are positioned in the basin of the Dniester 5 water body, and another 950 km of canals in the Dniester 6, a fact that includes them in the class of water bodies with a significant impact. About 1000 km of canals are located in the Răut basin , of which about 50% are built in the Răut river meadow , the most affected being the water bodies Răut 4, Răut 6 and Răut 7. About 237 km of canals have been identified in the Ciulucul basin Small, unaffected being the water bodies in the upper part of Ciulucul Mare and de Mijloc, medium affected being the water bodies Ciulucul Mic 1, Ciulucul de Mijloc 2, Ciulucul Mare 2, and strongly affected being Ciulucul Mic 2. Another 155 km of canals are positioned in the meadow of the Cula river, a fact that negatively influences the hydrological and hydromorphological state of the water bodies of this river. In the meadows of the bigger tributaries of the Răut, such as Cubolta and Căinari, but also smaller ones such as Bolata , Răuţel, Soloneţ, Dobruşa, Sagala , Ivancea and others. the presence of canals does not significantly influence the state of water bodies. About 160 km of canals were built in the Ichel river basin , a fact that determined an average impact on the water bodies Ichel 1 and Ichel 3 and significant for Ichel 2. Within the Bâc river basin, 484 km were identified, the impact being estimated for the entire river and its tributaries. Of the 11 water bodies, 2 water bodies are not negatively influenced, 3 are identified as having medium impact and 4 bodies – Bâc 1, Bâc 2, Bâc 5 and Bucovăţ are under significant impact. The vast majority of water bodies of the Botna River are negatively influenced by the presence of canals, which total about 642 km. Out of the 8 water bodies, the tributaries of the Botna are moderately affected , but also the upper course of the river, and the water bodies Botna 2, Botna 3, Botna 4, Botna 5 are strongly affected (fig. 32).

Finally, out of the 95 water bodies in the risk-free category (including no channels within the basin), 54 water bodies or 56.8% are included with a total length of 1492.7 km or 50.7%. The category of water bodies possibly at risk includes 18 water bodies or 18.9% with a length of 531.4 km or 18%. Water bodies at risk of not reaching the environmental objectives are 23 or 24.2% with a total length of 920 km or 31.2% (tab. 20).

Table 20.

Bodies of water under the action of the impact of irrigation canals

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	18	[redacted]
Share, %	[redacted]	18.9	[redacted]
CAR length, km	[redacted]	531.4	[redacted]
Share, %	[redacted]	18	[redacted]

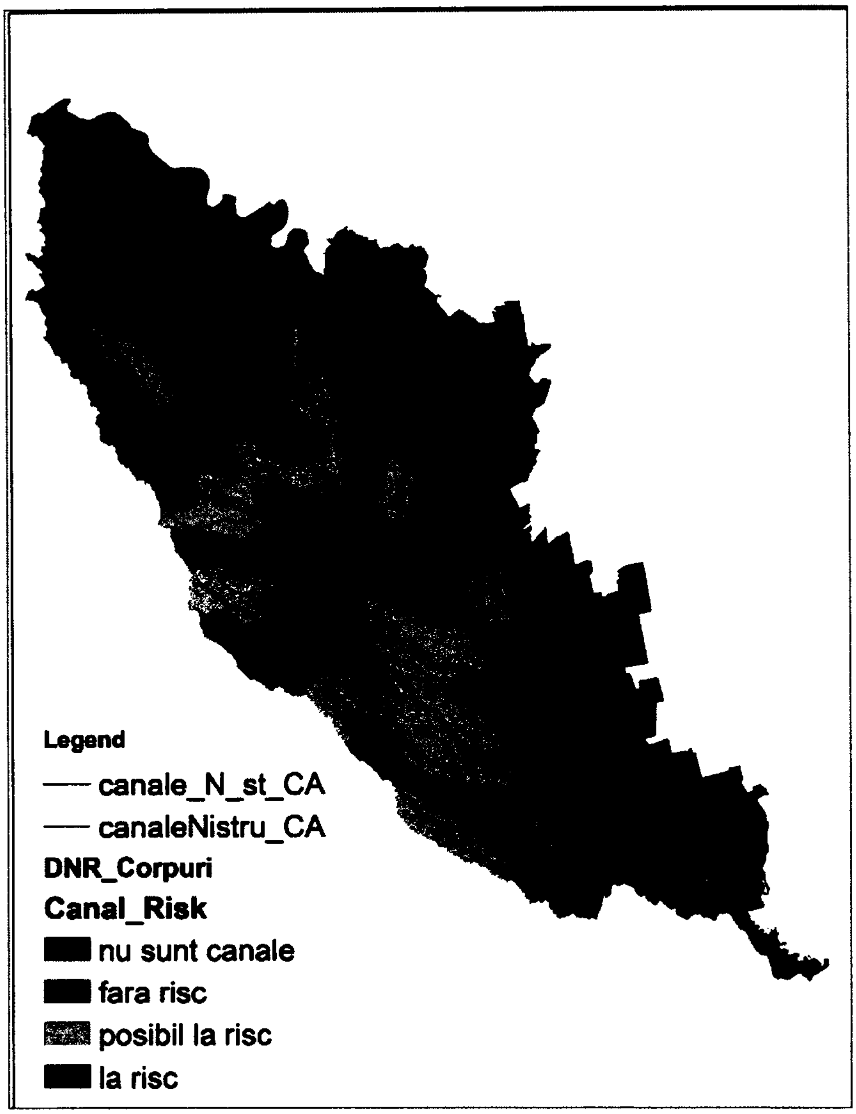


Figure 32. Impact of irrigation canals

3.3.7. modifying, hydromorphological of water bodies lakes

Within the DBHN, 5 bodies of water are delimited, which represent water accumulations. One of these – the Old Nistru Vechi water body also called Nistru Orb or Nistru Chior – is of natural origin, and the others are reservoirs: Ialoveni, Ghidighici, Cuciurgan and Dubăsari.

Nistru Vechi is a natural lake formed in the old bed of the Dniester river, a small gorge formed in the 19th century following a strong earthquake, in the meadow between the villages of Copanca, Talmaza and Leuntea in Căuşeni and Ştefan Vodă districts. The Old Dniester has the configuration of a horseshoe with several bends, and a length of 42 km, being an important natural monument. The Old Dniester has an important role for the bordering natural territories of the National Ecological Network - the core areas of local importance: "Copanca- Leuntea - Talmaza " and "Turkish Garden". For a long time, the water volumes of the Old Dniester were extremely low, the bed being dry. Recently, works were carried out to rehabilitate the bed of the Old Dniester, as well as sluices were built to improve the hydrological connection between the old and current bed of the river . Dniester At the present moment, the surface of the Old Dniester is about 1.8 km ^{2}, the average depth is 1.3 m, and the estimated volume of 2.37 million m ^{3}. Although the works carried out improved the sectors of the Old Dniester, the evaluations show that the rehabilitation has been carried out for about 10-15% of it, many sectors require restoration action.

The Dubăsari reservoir was put into operation in 1956, being the first reservoir built along the Dniester river. The basic destination is the production of electricity, fish farming, river transport, recreation, water supply. The length of the reservoir is about 130 km, the average width - 540 m, the surface of the water mirror - 64.7 km ^{2}. According to the project data, the volume of the Dubăsari reservoir is 485 m il. m³; useful - 213 million m³, the average depth - of 7.2 m. The current evaluations show a high degree of clogging, the estimated total volume of water being about 194 million m³, the clogging amounting to 60%, the average depth decreasing se at 3 m. The most significant clogging processes of the Dubăsari reservoir took place before the construction of CHN. After 1980, the clogging processes of the Dubăsari reservoir decreased, so that sediment transport as well as bottom and bank erosion decreased, its bed being relatively stable.

The Ghidighici reservoir was built in the 60s of the last century on the middle course of the Bâc river. Its basic purpose was flood protection of the municipality of Chisinau, as well as irrigation, fish farming, recreation. According to the project data, the length of the reservoir is about 8.5 km, the surface of the water mirror - 9.0 km ^{2}, the average depth - 4.4 m, the total volume - 40 million m ^{3}. Current data show that the length of the reservoir has decreased to 6 km, the surface of the water mirror - to 6.71 km ^{2}, the average depth - 3.5 m, the total volume - 23.5 million m ^{3}. The degree of clogging of the Ghidighici reservoir is quite high and reaches 41.2%, the surface of the water mirror has decreased by 25%.

Dănceni / Ialoveni reservoir is located on the Işnovăţ river, being put into operation in 1978. The basic destination is irrigation, fish farming, recreation. The initial parameters of the lake are the length – 6.15 km, the average depth 4.9 m, the surface of the water mirror – 4.43 km ^{2}, the total volume 21.73 million m ^{3}. Current estimates show that the length decreased to 5.89 km, the average depth 4 m, the surface of the water mirror – 3.86 km ^{2}, the total volume 15.4 million m ^{3}. Thus, as in the case of other reservoirs, this body of water was clogged, the clogging being 29%.

Cuciurgan reservoir was built on the Cuciurgan River on the basis of a natural lake (the surface of which was 17.6 km ^{2}) and was put into operation in 1980. The source of the reservoir's supply is the Turunciuc branch with a weight of 90- 98% (by pumping) and the Cuciurgan River 2-10%. The reservoir is shared between the Republic of Moldova and Ukraine. Within the borders of the country, the management of the reservoir takes place by the authorities on the left side of the Dniester. The main destination is ensuring the production of thermal energy, irrigation, fish farming, recreation. On the shore of the reservoir, on the border with Ukraine, is located the thermal power plant from Cuciurgan , being the largest plant of this type in the Republic of Moldova. The thermal complex was put into operation in 1964. The installed capacity of the plant is 2520 MW, being powered by natural gas, fuel oil and coal. The activity of the thermal power plant determined the modification of the thermal regime of the lake, the average values of the water temperature reaching 19.6 °C in the 80s and 14.8 °C in the 90s of the last century. The reservoir was built in 1967, and the volume of water at the normal retention level was reached in 1980. According to the data from 1980, the length of the Cuciurgan reservoir is 18.5 km, the average depth – 3.22 m, the surface water mirror – 27.3 km ^{2}, total volume 88 million m ^{3}. The current data show a reduction of some characteristics of this accumulation: the average depth has decreased to 2.8 m, the surface of the water mirror - to about 24 km ^{2} (within the country's borders - 12 km ^{2}), the volume of water - to 70.8 mil m ^{3}. The degree of clogging is 20.4%.

Water bodies - water accumulations are subject to clogging processes, the reservoirs being clogging with a weight of 20-60% (tab. 21). Works are needed to rehabilitate them, as well as the bed of the Old Dniester – an important area for the development of aquatic and meadow ecosystems.

Table 21.

The basic characteristics of water bodies - reservoirs

Bodies of water - reservoirs	The river	Year of commissioning	Surface of the current water mirror, km ^{2}	Share of the normal retention level, m	Current average depth, m	Project volume, million m ^{3}	Estimated current volume*, million m ^{3}	Estimated clogged volume, million m ^{3}	Weight of clogging, %
DUBASARI	Dniester	1956	64.7	28	3	485	194	291	60
Ghidighici	Bic	1962	6.71	56.2	3.5	40	23.5	16.5	41.2

Dănceni/Ialoveni	Isnovat	1978	3.86	83.5	4	21.7	15.4	6.3	29.0
Cuciurgan	Cuciurgan	1980	12/24*	3.5	2.8	88	70	18	20.4

* Within the limits of the Republic of Moldova, estimated by the author

It should be noted that rivers and water bodies are also subject to silting processes, but the impact of these processes needs to be extensively studied and evaluated.

3.4. Hydrological changes

In the category of anthropogenic factors that quantitatively influence water resources, human economic activities such as agricultural activities, which cause a decrease in water volumes, urbanization that causes an increase in surface runoff, as a result of the increase in impervious surfaces, the capture of fresh water, are usually attributed and the discharge of waste / purified water, the transfer of river water from one basin to another, the regulation of river flow, but also the water accumulations whose impact is expressed by the reduction of water volumes caused by additional evaporation from the water table , etc.

3.4.1. Water intake and discharge

In the year 2021, the volumes of water captured within the DBHN amount to 249 million m^3 (without taking into account the CTE in the city of Dnestrovsk). According to HG 728/08.09.2014, of the 39 largest water catchment systems within DBHN 31 are located on the banks of the Dniester river, 5 in the Răut river basin , and 3 in the Bâc river basin. The water bodies, within the basins of which the largest amounts of water are captured, are Dniester 5 - 125 million m^3, Dniester 3 - 143 million m^3, Dniester 4 -13.1 million m^3, Răut 3 - 11 mil. m^3, Ichel 3 – 2.3 mil. m^3, Răut 7 – 1.6 mil. m^3, Işnovăt 3 – 1.14 mil. m^3, Bac 4 – 1 mil. m^3. Within 73 water bodies, water volumes of up to 1 million m^3 are captured , and for 11 water bodies there are no data. The volumes of captured water are present in figure 33 .

Part of the volumes of water captured from the Dniester river are transferred to other basins, such as Răut and Bâc, in order to provide water resources to the country's largest localities: Chisinau municipality, Balti municipality, etc. In this sense, within the Răut river basin , the fresh water received is 11.54 million m^3, in that of the Bâc river, this is 67.9 million m^3 - mostly distributed in the municipality of Chisinau.

As a result of the analysis of the information on water capture, no significant impact on the resources of surface water bodies was identified. However, it should be noted that some of the water volumes are not reflected in the official statistics, as the captures and discharges are carried out illegally.

The evacuation of water volumes equals 132 million m^3, of which 127 million m^3 are discharged into surface waters, very small volumes being accumulated in retention basins, infiltration beds, etc. The quantities of water discharged from the hydrographic basins of the tributaries are about 13.38 million m^3 – bh . Bad , 57 million m^3 – bh . Băc and 0.36 million m^3 – bh . Botna , of which the volumes of water accumulated in various basins are small, most of them being discharged into rivers. The volumes of water transferred from fl . Dniester and discharged into the bed of its tributaries contribute to the increase of their water volumes. In this sense, it was identified that the water flows of the Bâc river practically double, as a result of the transfer of water from the Dniester and the evacuation of water from the municipality of Chisinau, and those of the Răut river increase by about ¼.

Information on water discharge is only available for 42 water bodies. The impact of this pressure factor was carried out cumulatively, by adding up the volumes of water that are discharged from the upstream part of the water body. Using this method, the water volumes on the water resources of the given body are fully evaluated. In this way, the largest volumes of water are discharged cumulatively into the fl . Dniester, in particular, in Dniester 6, which collects the waters from all DBHN, with about 100 million m^3 of discharged water, followed by Dniester 4 with 10 million m^3 of discharged water. From all water bodies of the Bâc river, maximum volumes are discharged into Bâc 4 and cumulatively transported through Bâc 5, the other water bodies receive about 0.1-0.3 million m^3 of water. Out of the 3 bodies of water of the Işnovăţ river, only in Işnovăţ 3 are evacuated 0.8 million m^3 of water. From the water bodies of the Răut river , the cumulative discharges are estimated from 10 million m^3 for Răut 3, Răut 4, Răut 5 to 11.1 million m ^{3} for Răut 6 and 12.1 million m ^{3} for Răut 7 and Răut 8. About 0.1 million m ^{3} - Ciulucul Mare 1 and 2 are discharged into the water bodies of the Ciulucul Mic basin, and 0.35 million m ^{3} of water accumulates for the entire basin. In the Cubolta river water bodies, the discharged volumes increase from 0 for Cubolta 1 to 0.17 million m ^{3} for Cubolta 2 and 0.43 million m ^{3} for Cubolta 3 and Cubolta 4. Within the river water bodies Small amounts of water are discharged to Botna , only to Botna 5, the volumes amount to 0.25 million m ^{3} (fig. 34).

For water bodies where information on water discharges is missing, the converted conventional size was used, which characterizes the volume of water supplied within the water body basin. The largest volume of supplied water was estimated for Bâc 4 and Dniester 5 with a volume of supplied water of 40-70 million m ^{3}, followed by Răut 3 and Dniester 4, the water quantities being around 15 million m ^{3} of water. For about 5 bodies of water, the values are between 1-3 million m ^{3} of water (Nistru 3, Işnovăt 3, Ichel 3, Bălţata, Răut 7), and for the other bodies of water, the volumes of water supplied are up to to 1 million m ^{3} of water. Volumes of supplied water of up to 0.1 million m ^{3} were estimated for 42 water bodies. It should be noted that the information on the water captured, supplied and discharged for the left of the Dniester is not complete. Also, the unmetered water used, mainly by the rural population, was not taken into account.

As a result of the evaluations of the volumes of water discharged, it was found that a significant impact is attributed to water bodies Bâc 4 and, cumulatively, Bâc 5, as well as Răut 3 or about 3% with a length of 105 km or 3.56%. The impact is expressed by the increase of water flows transferred from the Dniester river through the use and evacuation of water from the municipality of Chisinau, but also from the municipality of Balti. Average impact is estimated for the water bodies of the Răut River , located downstream of Bălţi municipality (Răut 4, 5, 6, 7, 8), as well as Işnovăţ 3 and Bălţata. The Turunciuc branch from the account of the capture and evacuation of water used for the operation of the CTE in the city. Dnestrovsk, these amounting to about 555 million m ^{3}. Thus, the total number of water bodies in the medium impact category is 8 or 8.42%, with a length of 276.6 km or 9.39%. The water volumes discharged within 84 water bodies or 88.4%, with a length of 2562.8 km or 87% are included in the low impact category, the cumulative water volumes increasing the water flows by up to 10% (tab. 22).

Table 22.

Bodies of water under the action of the impact of water evacuation on average flows

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	8	[redacted]
Share, %	[redacted]	8.42	[redacted]
CAR length, km	[redacted]	276.6	[redacted]
Share, %	[redacted]	9.39	[redacted]

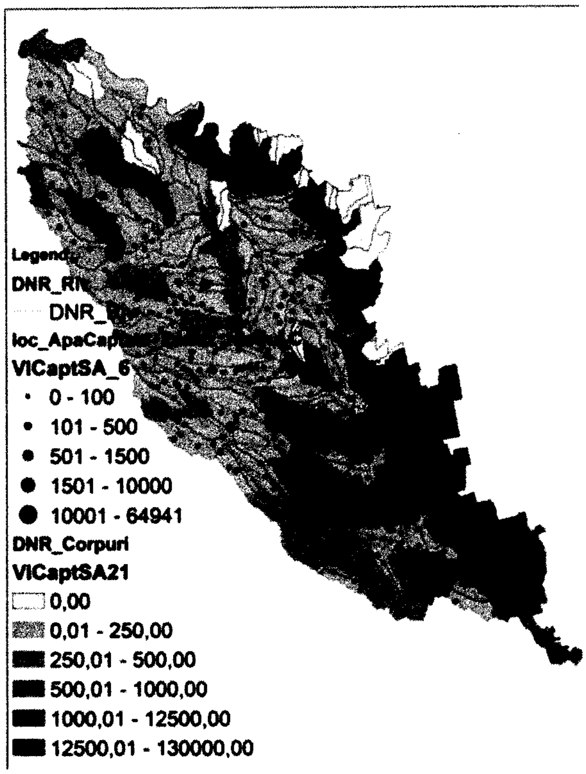


Figure 33. The volume of water captured by the public water supply system (note: without the left side of the Dniester)

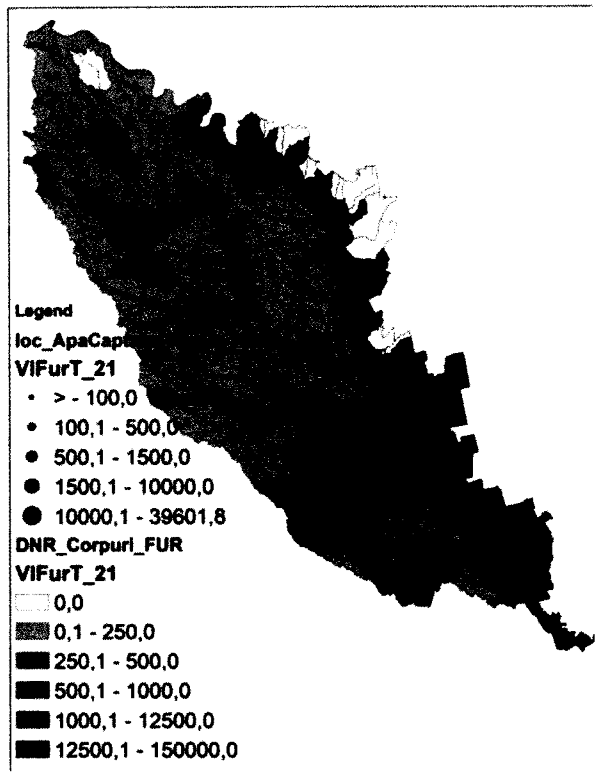


Figure 34. The total volume of supplied purified water discharged (note: without the left side of the Dniester)

3.4.2. Urbanization

One of the pressure factors determining the redistribution of water resources is urbanization. It causes the increase of surface runoff due to the increase of impermeable surfaces. In turn, there is a reduction in rainwater infiltration and as a result groundwater recharge. The largest share of the area occupied by localities, about 30% of the area of the basin, is specific to the Bâc 4 water body, which passes through the municipality of Chisinau. It is followed by Işnovăţ 3, with a share of localities of 20%. Within the basins of 32 water bodies, the share of localities falls within the limits of 10-20%, and for other 59 basins, the share of the mentioned element is between 3 and 10% (fig. 34). The smallest shares of the urbanized areas are specific for the water bodies of the tributaries of the Bâc, Botna , Răut rivers .

Urbanization processes increase surface runoff. In this sense, the largest increases in water resources, over 50%, were assessed for the Bâc 4 water body, which passes through the municipality of Chisinau, the impact being significant. Average impact is attributed to 62 bodies of water or 65.3% with a length of 2110.8 km or 71.7%. Their water resources increase by about 10-30%. The respective bodies of water are spread over the entire territory of the fl basin . Dniester, without being any legality. Another 32 bodies of water or 33.7% , with a length of 796.3 km or 27%, are included in the low impact category of urbanization processes, the increase in water volume being up to 10% (fig. 35 , tab. 23).

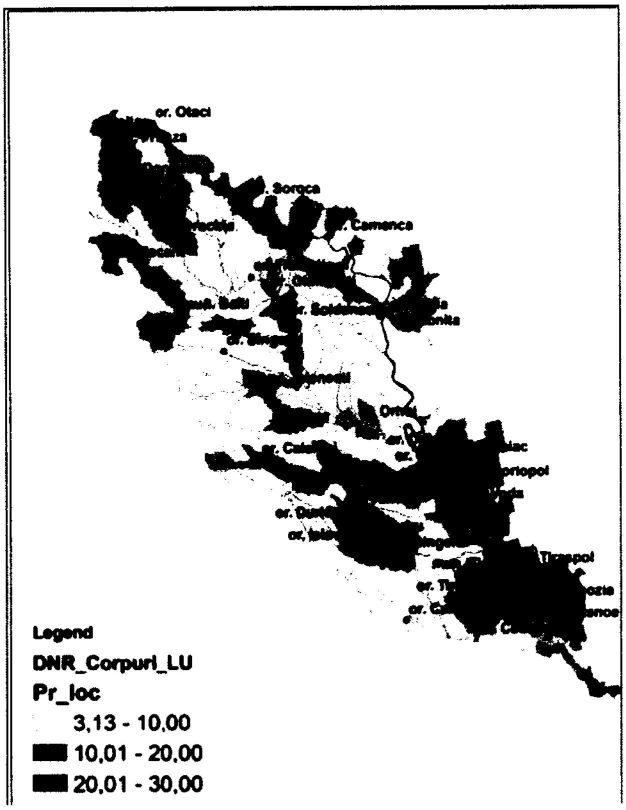


Figure 34. Weight area summary of localities

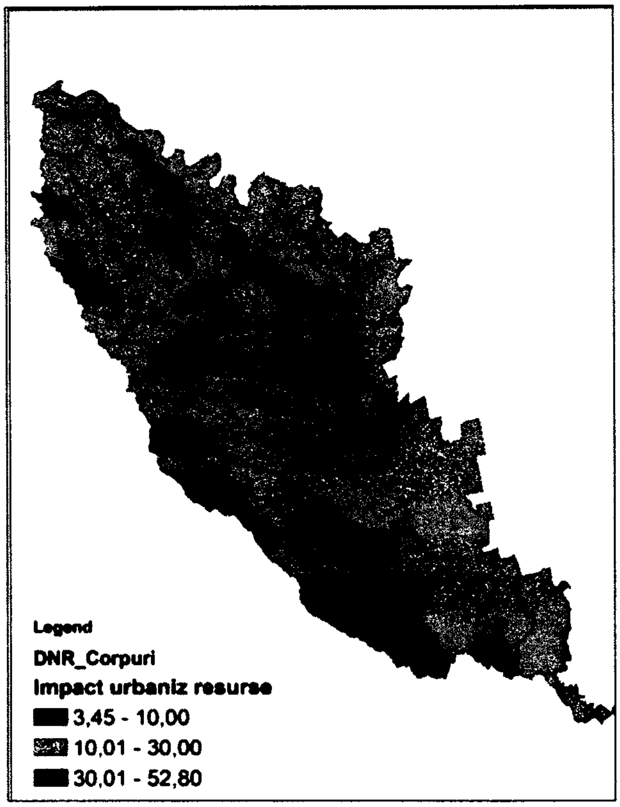


Figure 35. Increase water resources _ under the the action urbanization

Table 23.

Bodies of water under the action of the impact of urbanization

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	62	[redacted]
Share, %	[redacted]	65.3	[redacted]
CAR length, km	[redacted]	2110.[illegible]	[redacted]
Share, %	[redacted]	71.7	[redacted]

3.4.3. Water reservoirs within DBHN

Accumulations of water of anthropic origin were created to meet different economic needs (fishing, irrigation, electricity production, recreation, etc.), as well as to regulate the flow of the river and control floods. They are divided into two conventional categories: reservoirs with a volume of over 1 million m ^{3} and ponds with a volume below the mentioned value. The reduction of water volumes of water bodies is conditioned by the presence of water accumulations, and occurs due to additional evaporation of water from the mirror of these basins. Despite the fact that the weight of the surface of the mirror of water accumulations compared to the surface of the basins is quite small, this factor has quite large influences on water resources, especially, during the warm period of the year.

The weight of the mirror surface of water accumulations is about 0 - 8.1%. The highest weights are specific for bodies of water that form water accumulations. For the Bâc 3 basin – the water body - the Ghidighici reservoir – the weight of the surface of the water mirror is 8.1%, for Işnovăţ 2 – the water body - the Dănceni / Ialoveni reservoir - 6.38%, and for Dniester 4 – water body - Dubăsari reservoir – 5.2%. About 2-4% of the basin surface of 6 water bodies is covered with water accumulations. They are located in the upper part of the rivers Cubolta, Răut , Ciulucul de Mijloc, as well as in the lower part of the Dniester. Within 32 basins of water bodies, the weight of the surface of water accumulations is about 1-2%, they are located in the Botna , Ichel and Răut basins . The other bodies of water are insurance with areas occupied by artificial lakes with weights less than 1% (fig. 36).

The impact of water accumulations causes the reduction of water resources. In particular, the water resources of 4 water bodies are reduced by more than 30% (Bîc 3, Işnovăţ 2, Dniester 4 and Ciulucul de Mijloc 2), their length being 165.2 km or 5.6%. Approximately half of the water bodies are classified in the medium impact class, these being in the upper and middle part of the Răut River , Botna , but also in the lower part of the Bâc River basin, as well as the Dniester. This category includes all the water bodies of the Ichel river . In the class of water bodies with a small impact produced by water accumulations are included 45 water bodies or 47.3% with a length of 1457.6 km or 49.5% (fig. 37, tab. 24).

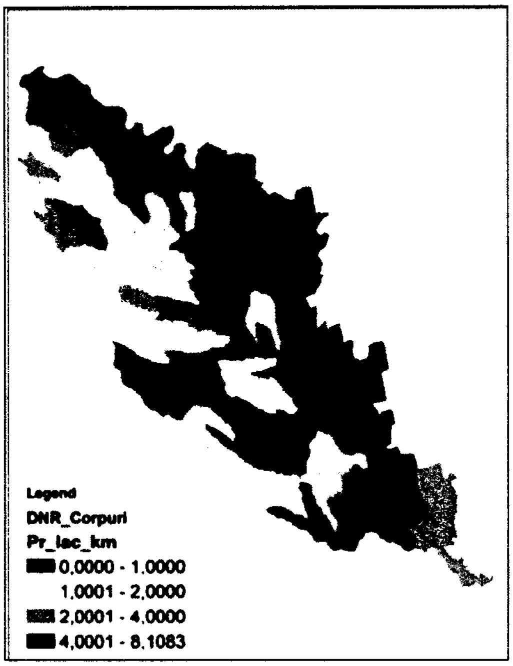


Figure 36. Weight area summation of water accumulations _

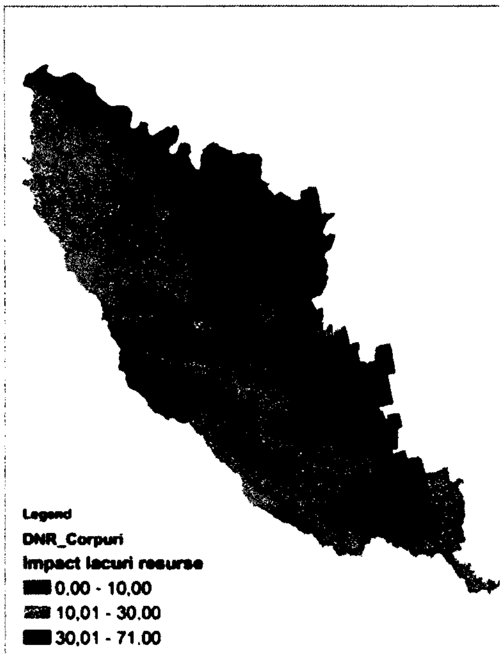


Figure 37. Decrease water resources _ under the the action reservoirs _ _

Table 24. Water bodies under the impact of reservoirs

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	46	[redacted]
Share, %	[redacted]	48.4	[redacted]
CAR length, km	[redacted]	1321.77	[redacted]
Share, %	[redacted]	44.9	[redacted]

3.4.4. The impact of the Dniester Hydropower Complex

3.4.4.1. Changing the hydrological regime

The annual water flow and volume, in the upstream part of the CHN, for the periods before and after construction, show approximately equal values. Downstream of CHN, the hydrological characteristics decrease: water volumes decrease from 8.7 km ^{3} to 7.9 km ^{3}, which constitutes 9.2%. On a monthly basis, in a regularized regime, water flow trends are significantly decreasing in the months of February-April: March – 40%, April – 27%, February – 18%. In the summer period, the changes are minor, and for the autumn period, increases of 10-14% are observed. Thus, the general downward trend of the average monthly flow for the spring and summer periods on the entire sector downstream from CHN to the mouth of the spillway is attested. The flow increase is observed in the seasons characterized by lower flow values: autumn and winter.

The minimum flows upstream of the CHN, for the period before the construction of the CHN and after, are equal to 34 m ^{3} /s and 52 m ^{3} /s, the increase being 52%. And downstream, the minimum daily flows have doubled, constituting 107 m ^{3} /s (compared to 51 m ^{3} /s, before the construction of the CHN). With reference to the impact of CHN operation on the maximum annual flows, a slight increase in these characteristics can be observed in the upstream part, and towards the downstream side, a reduction of the maximum flows by approximately 30% is observed. This has led to the reduction of flood risk.

3.4.4.2. Changing the thermal regime of the water

The evacuation of water through the CHE-1 turbines takes place from the lower layers of the water of the reservoir. Here the water temperature is low and remains constant throughout the year, so it is not influenced by climatic factors (only the water on the surface of the reservoir changes its temperature under the influence of the climatic factor). The average annual values for the observation periods show that the general trend in the periods up to the CHN of the water temperature is constant, while in the period after the construction of the CHN the linear trend is upward at all stations (fig. 38).

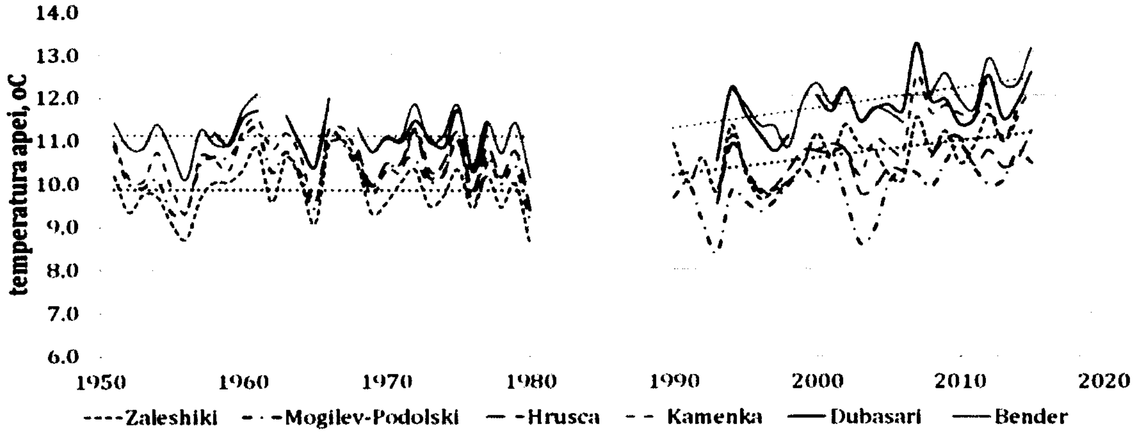


Figure 38. Dynamics of water temperature of the Dniester river

However, if during the 2 periods upstream of the CHN the average water temperature is 9.84°C and 10.64°C, the increase being 0.8°C, downstream of the CHN a decrease is observed of the average temperature by 0.44°C, from 10.29°C to 9.86°C. Downstream, at Hruşca p. the average temperature for both periods is 10.4°C, at Dubăsari p. they are already 11.14°C and 11.7°C, the increase being 0.56°C, at p. Bender - 11.1°C and 11.92°C, the increase being 0.82°C, similar to that at p. Zaleşciki . Respectively, on the downstream sector of the CHN, despite the increasing temperature trends, the data analysis shows that the average temperature decreases downstream of the CHN, remains unchanged near the Hruşca p. sector, and starts to increase from the Camencii area towards the mouth of the pouring, the increase at p. Bender being similar to that at p. Zalesciki . In this sense, if we stick to the idea that the water temperature in the whole sector must increase by 0.8°C, then immediately downstream of the CHN, the current temperature should be 11.1°C, but at the moment it is of 9.86°C, i.e. 1.24°C lower. Therefore, the sector that is subject to thermal changes is more than 140 km.

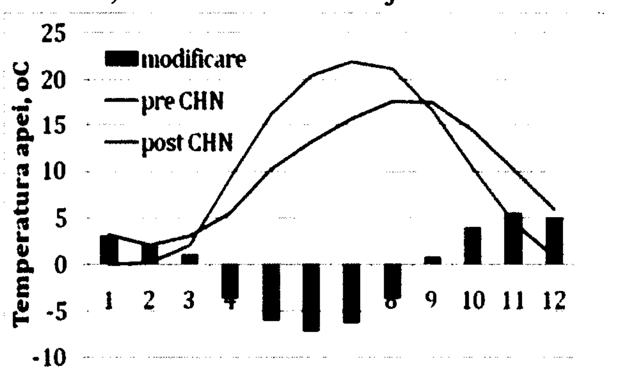


Figure 39. Dynamics of the average monthly water temperature downstream of CHN

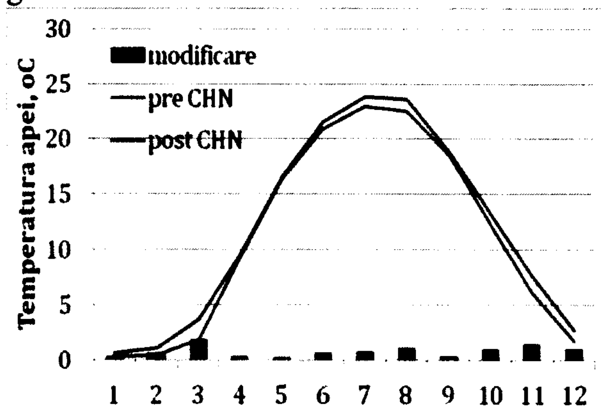


Figure 40. Dynamics of the average monthly water temperature at p. Bender

During the year, there is a decrease in the temperature of the river water in the spring-summer period, and an increase in the autumn-winter periods downstream of the CHN. In the summer season, the temperature change is the biggest. If before the construction of CHN the temperatures were on average 20-21°C, then after CHN they are already 3.9 -7.2°C lower and become in June +13.1°C, July - +15, 6°C, August - +17.5°C. It is observed that post-CHN maximum temperatures move from July-

August to August-September, with values rising up to +17.5°C (3.6°C less than pre-CHN). Finally, it is observed that the sector most affected by the change in water temperature determined by the operation of CHN extends up to h. Camenca. Thus, on this sector, the water temperature decreases during the warm period and the maximum shifts by 1 month, and increases during the cold period. It should be noted that no changes were identified in the thermal regime of water fl . Dniester under the action of the Dubăsari reservoir. As a result of the analysis of the changes in the thermal regime of the Dniester river water, it is considered important to attribute the high impact of CHN on the Dniester 1 and Dniester 2 water bodies and the medium impact for Dniester 3.

3.5. Evaluation of water bodies at risk of non-fulfillment of environmental objectives

3.5.1. Point sources of pollution

The identification of water bodies at risk of not reaching the environmental objectives was carried out using the " one -out- all -out" principle. This approach is based on the principle that each pressure exceeding one of the risk criteria has a decisive effect on the overall risk status of the entire water body. The entire affected water body must be included in the category of water bodies at risk of not reaching the environmental objectives if a risk category is exceeded in a certain place within the water body .

Identification bodies of water TO risk of not reaching the environmental objectives under the the action sources punctiform was _ made in the the base review dATES with look TO NUMBER and the density population , the number population connected TO aqueduct systems _ and sewerage , volumes and the quality WATER PLANT evacuated , treatment plants _ etc. _

In the result have former 58 bodies of water identified TO risk or 61% with a length total of 1867.98 km or 63.4%, these being located in _ big part , in the middle part and lower TANKS tributaries RIVER Dniester . 37 bodies of water are falling in the class possible TO risk or 38.9% with a length of 1076.4 km or 36.6%. In the This one category are included the water bodies of the river Dniester , tributaries sMALL you Raul Bad , the courses upper reaches of the rivers Cubolta , Căinari , Ciulucul Mic , Botna , etc. _ (tab . 25, fig . 41).

Table 25.

Bodies of water under the action of the impact of point pollution

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	58	[redacted]
Share, %	[redacted]	61	[redacted]
CAR length, km	[redacted]	1867.98	[redacted]
Share, %	[redacted]	63.4	[redacted]

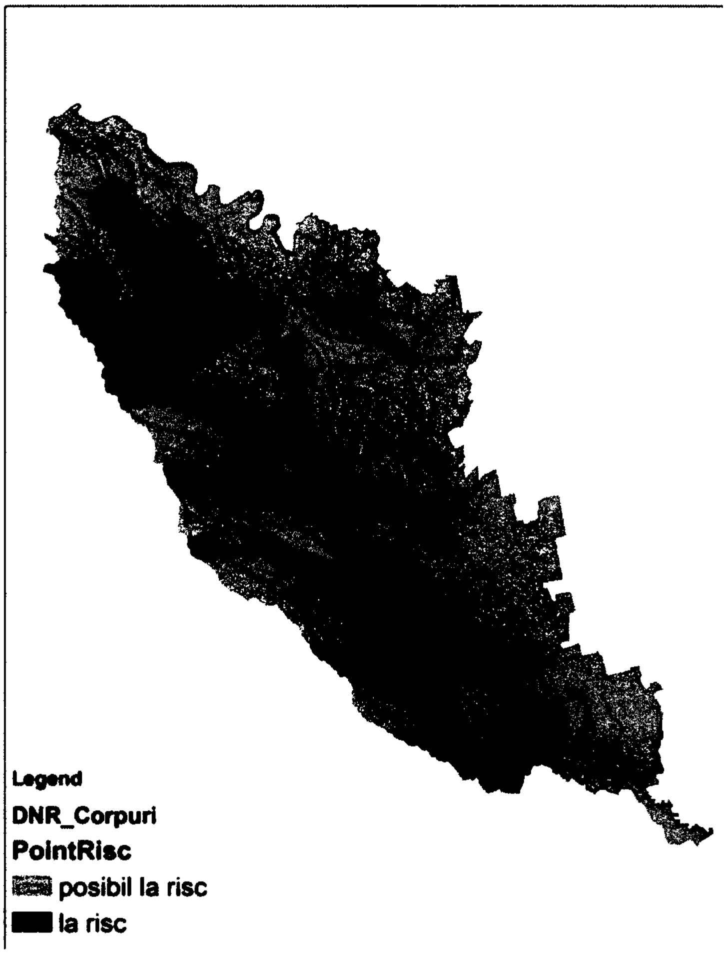


Figure 41. Bodies of water TO risk conformable pollution FROM source point

3.5.2. Sources of pollution broadcast

from the two pollution sources _ diffuse : lands Agriculture and complex zootechnics , impact major It is AWARDED FIRST pressure factor _ and minor of the _ the second In the result , first COMBINING the information for all bodies of water , it was FOUND that 82 bodies of water or 86.3% with a length of 2634.98 km or 89.5% it WITHIN in the class TO risk of not reaching the environmental objectives . 11 bodies of water or 11.6% with a length of 277.62 km or 9.42% have former classifier Right bodies of water possible TO risk . In the THE TANKS THESE bodies it attest to a weight May large surface areas wooded , fact which decrease the impact anthropic . These bodies of water are STATIONS in the PLATEAU Codrilor : Cula 1, Cula 2, Ichel 1, Pojarna , Bâc 1, Bâc 2, Bâc 3, Bucovăţ , Botna 1, Vatici , Molovateţ . In the category free risk are included bodies of water Isnovăţ 1 and Isnovăţ 2, weight forest being significant .

Table 26.

Water bodies under the influence of diffuse pollution

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	11	[redacted]
Share, %	[redacted]	11.6	[redacted]
CAR length, km	[redacted]	277.62	[redacted]
Share, %	[redacted]	9.42	[redacted]

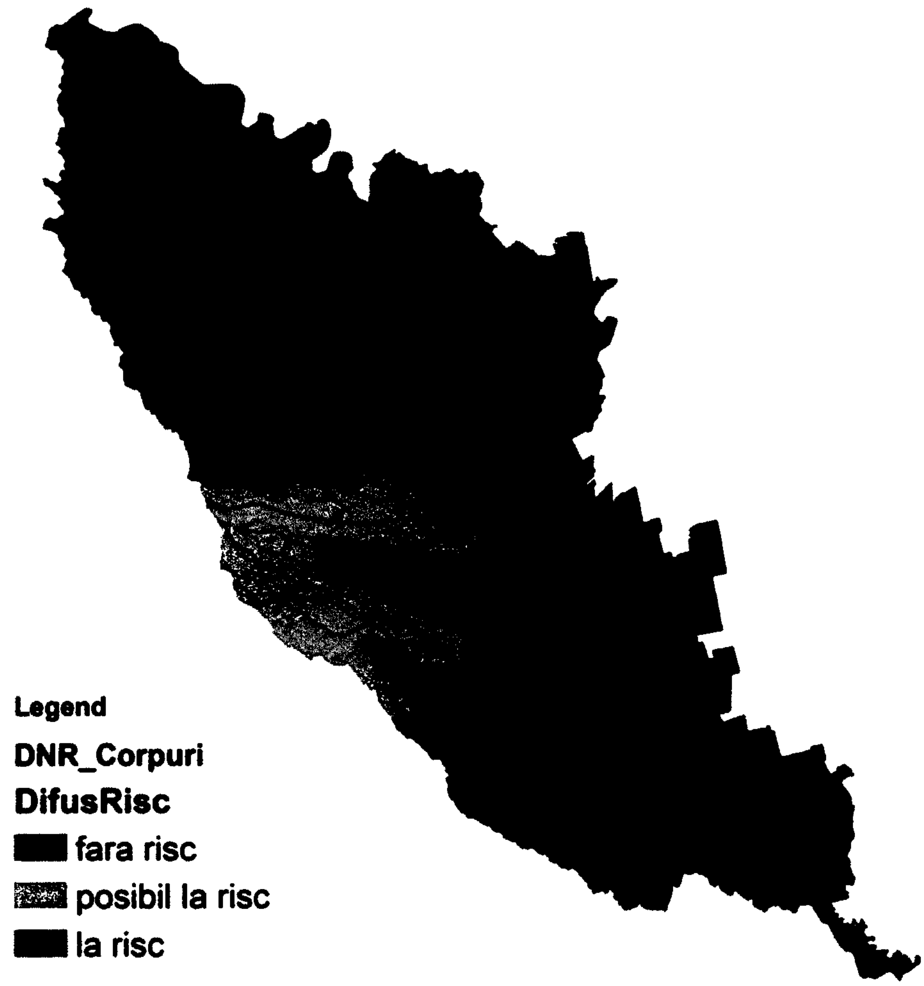


Figure 42. Bodies of water TO risk conformable source loudspeaker

3.5.3. Alterations Hydromorphology

Pressure factors _ CONSIDER to identify _ MODs Hydromorphology of bodies of water have former : the dams and water accumulations _ STATIONS on course , the impact complex HYDRO ENERGETIC Dniester , the arrangement the rivers in the THE localities , damming , canal systems , as well and regularization the water course . Have former EXAMINED and MODs water bodies - water accumulations . _ _ In the conformity with evaluation iMPACT cumulative of all pressure factors _ on STATUS hydromorphological of water bodies , was _ identified that TO risk of not reaching the environmental objectives there are 42 bodies of water or 44.2%, inclusive and water bodies - lakes . _ The length their total _ is 1534.3 km or 52.1%. In the This one category it INCLUDES most of them water bodies of the river Dniester , all of them water bodies of rivers _ Bac , Botna , Ichel , Cula , etc and some bodies of river water _ Bad , in special the FROM COURSE lower . Water bodies _ possible TO risk I'm 43 at number or 45.2%, the length their total _ being 1150.6 km or 39%. These are preponderance some tributary you the rivers Raut and Băc , like and the left tributaries of the Dniester . Water bodies _ free risk it's 10 a.m number or 10.5%, with a length of 257.8 km or 8.75%. These are placed in the the northern part of DBHN, the courses HIGHER of the rivers Bad , Căinari , Cubolta , as well and in the THE PLATEAU Dniester Dobruşa , Ciorna 1, Rezina , Cogâlnic 1.

Table 27.

Water bodies under the action of the impact of hydromorphological alterations

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	43	[redacted]
Share, %	[redacted]	45.2	[redacted]
CAR length, km	[redacted]	1150.6	[redacted]
Share, %	[redacted]	39.0	[redacted]

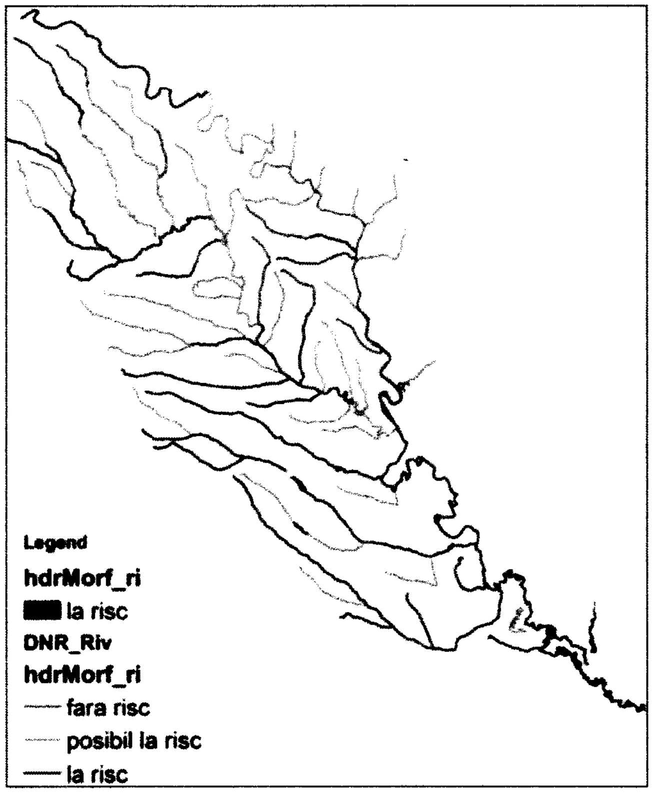


Figure 43. Bodies of water TO risk conformable adulteration Hydromorphology

3.5.3. amendments hydrological

For evaluation bodies of water TO risk of non- fulfillment of environmental objectives determined by impact pressure factors _ on features quantitative of water resources was _ _ analyzed the effect abstraction and DISCHARGE of waters , of urbanization and water accumulations , such as _ and activities _ agricultural . In the the outcome assessment impact Atrophic summary on water resources was _ _ identified for 4 bodies of water water resources _ GROW with over 30% again for 8 bodies of water debits it increased with a weight between 10 and 30%. For of 20 bodies of water water volumes _ describe with about 10-30%, again for 3 cups of water these it diminishes and May a lot , by 30-60%. For 59 bodies of water , the impact pressure factors _ it express through changes of ±10%.

In the final , from the 95 bodies of water , 59 or 62% with a length of 1893.6 km or 64.3% are falling in the category THE free risk associated , 29 other bodies of water or 30.5% with a length of 886.56 km are Liked that being possible TO risk , and 7 bodies of water or 7.36% with a length of 164.3 km or 5.57% are classifier that being TO risk of not reaching the environmental objectives (tab . 28, fig . 44 and 45).

Table 28.

Water bodies under the influence of the impact on the quantitative status of water resources

	[redacted]	Possibly at risk	[redacted]
CAR number	[redacted]	29	[redacted]
Share, %	[redacted]	30.5	[redacted]
CAR length, km	[redacted]	886.56	[redacted]
Share, %	[redacted]	30.1	[redacted]

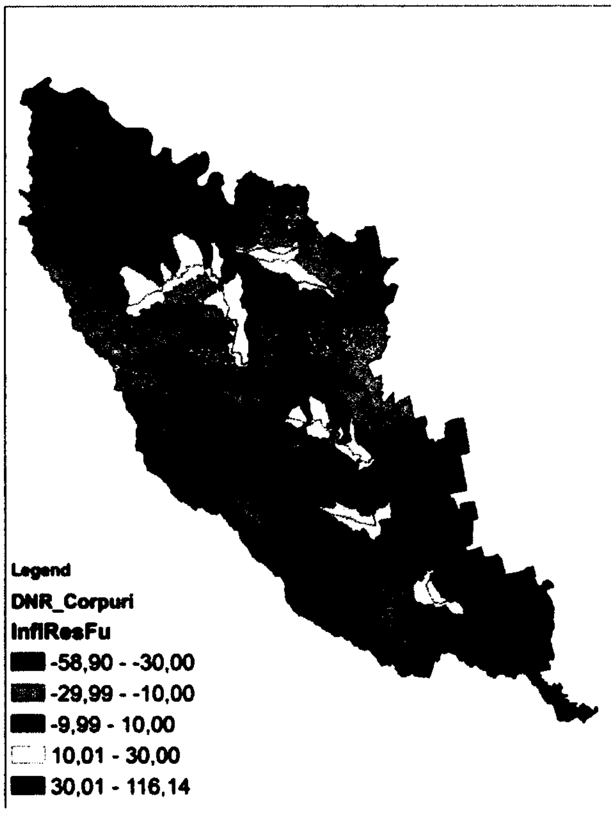


Figure 44. Modification water leaks _ under the the action the activity humanity

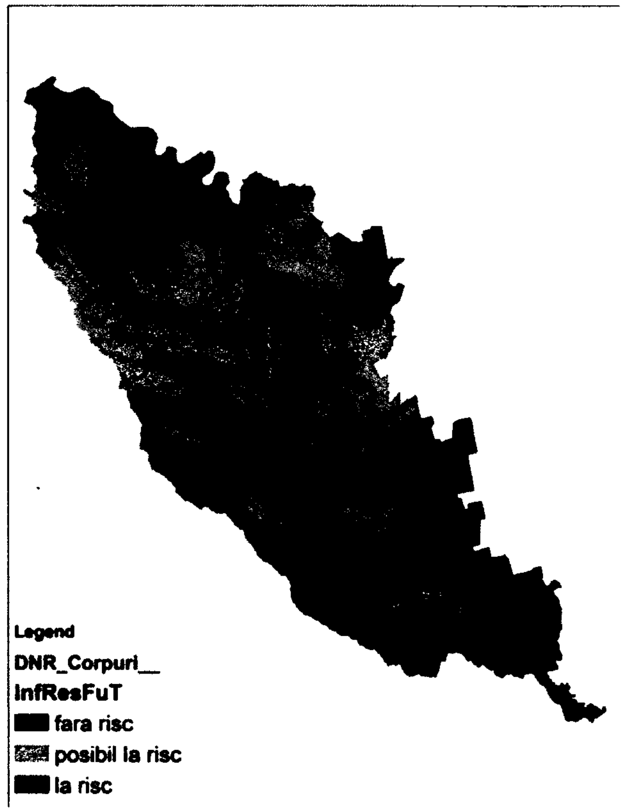


Figure 45. Bodies of water TO risk conformable amendments hydrological

4. Characterization of underground water bodies

4.1. Alluvial-deluvial aquifer horizon a,adA3, Holocene, CAS MDNSGWQ110

This aquifer horizon is well developed and widespread in the Dniester river meadow, in the valleys and meadows of the Dniester tributaries, as well as in the region of larger ravines and ravines. Alluvial deposits of the Holocene, represented by clayey sands, sands, sandy clays, sand-gravel, often alternating with clayey deposits, serve as aquifers. Alluvial deposits are mostly characterized by a double-layer structure, the lower layer, the most saturated with water, represented by a river-river facies, and the upper one, represented in most cases by sandy clays with thicknesses of 1, 0-4.0 m, characterized by meadow facies. The thickness of the aquifer horizon, depending on the lithological component, varies between 0.5-18.0 m of the total of 40.0 m of Holocene alluvial deposits, on average the thickness of the aquifer horizons is 1.0-8.0 m.

The opening depth of groundwater varies between 0 m and 7.0-8.0 m, sometimes 15.0-20.0 m, averaging 0.5-3.0 m, depending on the opening area, whether it is a meadow area, terrace, slope of a ravine, etc. The feeding of the aquifer horizon takes place through the infiltration of atmospheric precipitation, the influx of underground water from other aquifer horizons, and during floods, through the infiltration of water from surface water bodies (lakes, ponds, rivers, canals).

The discharge of the aquifer horizon takes place by the drainage, at ebb, of underground water by rivers and streams, also by the infiltration of water into other aquifer horizons located below. On most of the spreading territory, the waters of the aquifer horizon are without pressure, only in some places the height of the piezometric pressure reaches several meters.

The filtration coefficient in the Dniester river meadow varies from 5.0 m/day to 315.0 m/day (Soroca- Ţechinovca region), further north between 5.0-80.0 m/day (Podoima- Ternovca). The waters of the alluvial horizon in the Dniester river valley are sweet, with mineralization of 0.7-1.0 g/l, and in the valleys-meadows of small rivers, the mineralization reaches values of 3.0-7.0 g/l (fig. 46) . The specific flow of wells, wells, springs varies from a few hundredths to 0.7-0.8 l/s. The waters in the northern part are mainly hydrocarbonate-sodium with fixed residue 1.0-1.5 g/l, in the south sulfate with fixed residue 1.5-3.0 g/l.

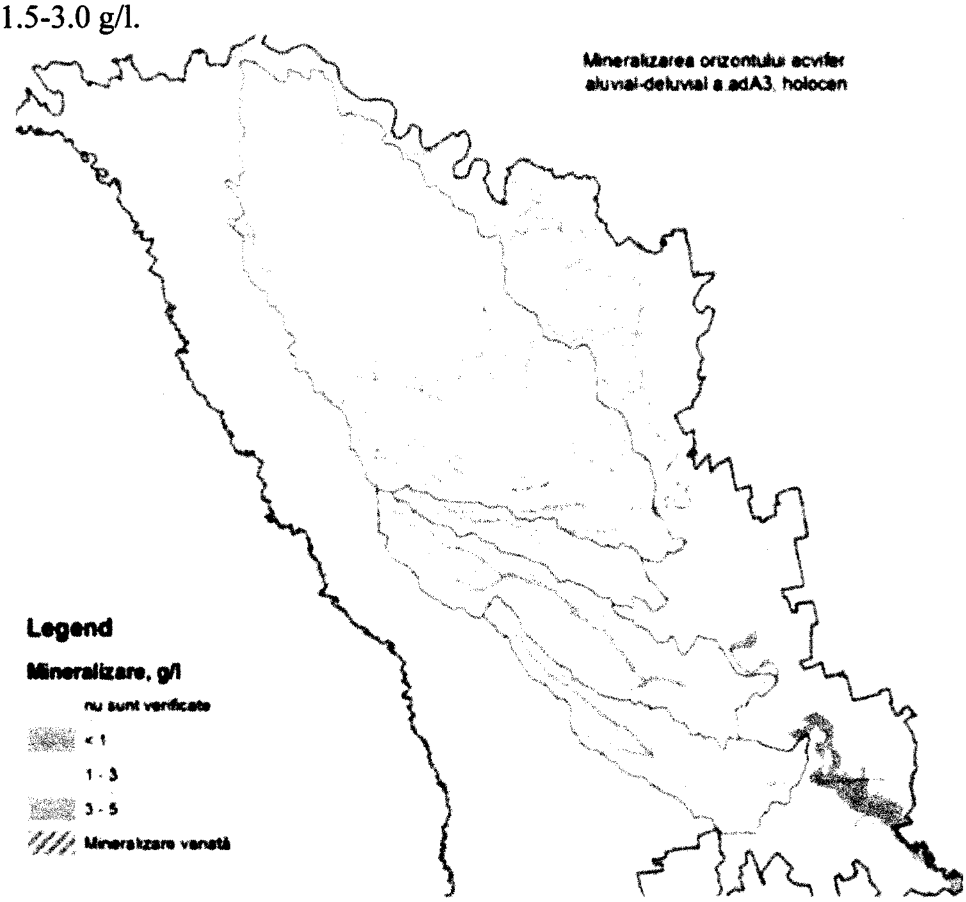


Figure 46. Mineralization of the alluvial-deluvial aquifer, a,adA $_3$ CAS MDNSGWQ110

Due to a weak protection of the aquifer horizon, the underground water is subject to surface pollution, so that in most cases the water is hard, with a high concentration of iron and nitrates. The underground water of the alluvial complex is widely used as water for technical purposes, also in the decentralized supply as drinking water, and after treatment it is also used in the centralized population water supply networks.

4.2. Pliocene-Pleistocene aN2-aA1+2 aquifer complex, CAS MDNSGWQ210

The groundwaters of the Lower Pleistocene deposits are included in a single aquifer complex due to common conditions of supply and dispersal. The spreading area is limited, occupying the slopes and meadows of the valleys of the Dniester, Răut , Ciulucul Mare and other small rivers, it can be traced in the form of continuous strips (fig. 47). The waters of the complex are related to the deposits of terraces IX above the meadows.

Clay -sandy rocks, clayey sand, sand of various grain sizes with inclusions of gravel and gravel serve as aquifers . They are laid horizontally or at an angle, depending on the inclination of the base of the terraces. In the lower part of the deposits, clayey -sandy rocks are laid , and in the region of the Dniester, Răut rivers with limestone. Water saturation of the complex depends on the lithological composition and porosity of the underlying rocks. The thickness of the aquifer layers varies from 0.3 to 12.0 m, constituting an average of 2.0-6.0 m. The opening depth of the waters of this complex varies between 0.0-38.0 m, in environment 2, 0-8.0 m.

The supply region of the aquifer complex coincides with the spreading region. The main source of groundwater supply is atmospheric precipitation, but also water from the upper horizons of water basins in their area of influence. The movement of water usually occurs along the valleys-meadows, as well as from the upper terraces to the lower ones. The waters of this complex are discharged in the alluvial, alluvial-deluvial deposits of the meadows, in Sarmatian sands.

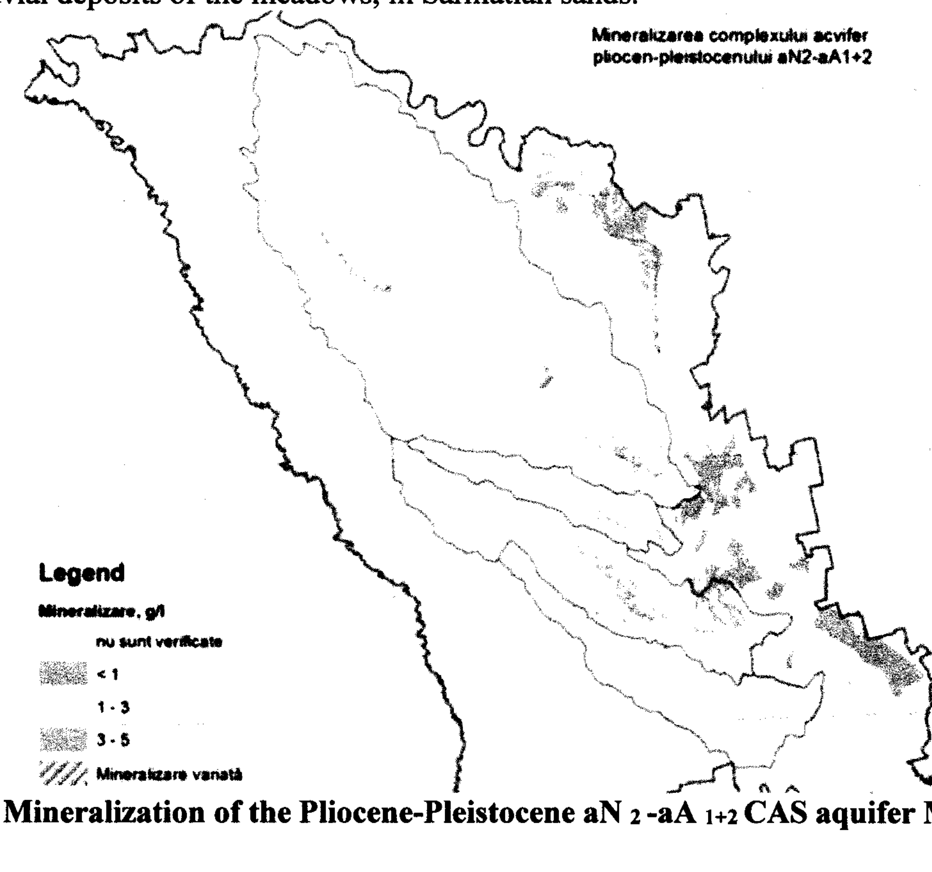


Figure 47. Mineralization of the Pliocene-Pleistocene aN $_2$ -aA $_{1+2}$ CAS aquifer MDNSGWQ210

Groundwater is generally without pressure, and in some places the pressure value reaches 0.5-3.0 m. The flow of springs does not exceed 0.5 l/s, more often we meet 0.05-0.1 l/s. the flow rate of wells varies between 0.005-0.4 l/s, the flow rate of wells 0.001-0.4 l/s. The filtration coefficient varies between 0.03-5.10 m/day, more often 1.0 m/day. The hydraulic conductivity of aquifer deposits varies between 0.02-12.0 m ^{2} /day. After mineralization, the waters are from sweet to salty (fig. 47), according to the chemical composition, the waters are hydrocarbons , sulphate- magnesium -sodium hydrocarbons in fresh waters, in slightly salty waters they are hydrocarbon- sulphates , magnesium-sodium sulphate.

Often the content of nitrates in waters reaches values above 600 mg/dm ^{3}, but there are also waters where pollution is absent. According to the degree of hardness, the waters have values between 4.1-52.2 mg- eqv /dm ^{3}, hard waters are more common. The waters of the aquifer complex of the alluvial deposits of the IX terraces have a great practical use. Among the negative elements that do not allow the use of these waters on a large scale are the low filtration parameters, low aquifer capacity, the high amount of nitrates, chlorides, sulfates, hardness and high degree of mineralization.

In general, the waters of the aquifer complex are used by the population for the needs of individual households, being captured from springs, wells, less often through wells.

4.3.Upper Sarmatian-Meotian aquifer complex N1s3-m , *CAS* MDNSGWD410

The underground waters of the upper Sarmatian and Meotian deposits, within the limits of the Dniester river basin, are developed in the central and southern part of the Republic of Moldova (fig. 48). As aquifers there are sands, located in clays in the form of lenses with thicknesses of 2.0-28.0 m, sometimes with siltstones and conglomerates in the form of the same lenses. They are spread over water balance regions. The aquifer horizons, being spread sporadically, do not have a well-established aquifer level. The thickness of the layers saturated with water varies from 1.50 m to 14.0 m, on average 2.0-5.0 m. The opening depth of the aquifer horizons varies from 0.00 m to 47.0 m.

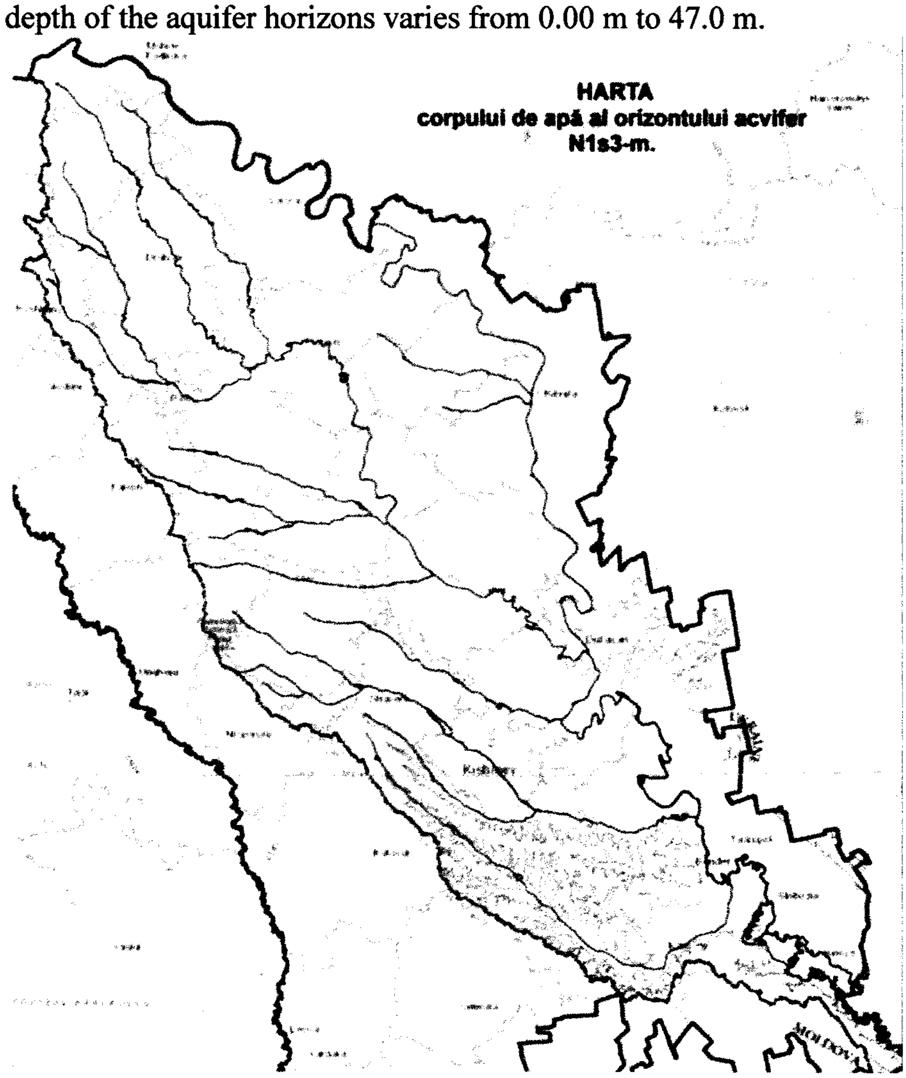


Figure 48. Location of the Upper Sarmatian-Meotian N1s3-m aquifer , CAS MDNSGWD410

The springs come to the surface at different hypsometric levels on the water table, mostly constituting the first aquifer horizon, as the lower impermeable layer serves the clays of the clay - sandy complex of the middle Sarmatian. The feeding region coincides with the spreading surface. Due to the fragmentation of the land, the waters of the complex are drained into the quaternary deposits.

The hydraulic conductivity of the lenses is low, usually it does not exceed 10-15 m^2/day, rarely 20-25 m^2/day. The flow rate of the springs falls within the values of 0.05-0.35 l/s, more often hundredths of l/s, the specific flow rate of the wells varies within the limits of 0.001-0.32 l/s, the filtration coefficient has values between 0, 1-0.4 m/day, in some cases it reaches 2.0 m/day (in wells). According to hardness, the waters are hard and very hard with values starting from 4.6 mg- eqv . Fixed residue varies widely and depends on mineralization.

The waters of the aquifer complex are from sweet to salty, hydrocarbonate-calcium-magnesium with mineralization from 0.7 g/l to 5.0 g/l, diverse chemical composition, the content of fluorine in the waters varies from 0.2 mg/ l to 2.2 mg/l.

Nitrate pollution is observed when the waters of the complex are located close to the surface of the day, so due to the reduced degree of protection, the waters of the aquifer complex of the upper Sarmatian-Meotian have little practical importance from a qualitative and quantitative point of view in the centralized water supply of the population. The spread surface of the Sarmatian-upper-Meotian water body is shown in Figure 10, the characteristic of the water body is shown in Table 7.

4.4.The aquifer horizon of the middle Sarmatian $N_1 s_2$, *("Codrii" sand-clay formation) CAS* MDNSGWQ510.

This CAS is associated with the clayey -sandy terrigenous formation of Middle Sarmatia (Codrii formation) in the central and northern part of the studied basin (fig. 49). This formation is overlain by alluvial - deluvial deposits of Pliocene - Pleistocene terraces and Holocene deposits. The aquifers are fine silty sands in clay layers from 1.1 to 20.0 m thick, predominantly 10.0 m. The clay layers between the water-bearing rocks are fractured and there is a good relationship between the different sandy layers . This CAS is mostly covered and shallow: it is the first surface aquifer.

This CAS indented by rivers, which is a case of local saturation of aquifer water. The groundwater level varies from 0 to 25.1 m, more often 5.0 - 10.0 m. This aquifer is covered and has no pressure. Low local pressure (up to 1.5 m) can be found in catchment areas. The flows of the existing springs are in the range of 0.008 - 0.35 l/sec. The flow rate of the boreholes varies between 0.001 and 0.23 l/sec, sometimes up to 0.32 l/sec. The filtration coefficient is in the range from 0.001 to 0.59 m/day, more often 0.01 - 0.1 m/day.

Hydraulic conductivity changes from 0.012 to 5.50 m^2/day, more often 0.10 - 1.0 m^2/day. The water content and filtration parameters of this complex are heterogeneous both in spatial distribution and in the geological section.

The chemical composition and mineralization of the groundwater in this CAS is very diverse. Fresh waters are quite common and distributed practically throughout the studied territory. They are mainly calcium-magnesium bicarbonate and magnesium-calcium by chemical composition. They are mainly calcium-magnesium bicarbonate and magnesium-calcium by chemical composition. There is also sulfate-sodium bicarbonate-magnesium or less chloride-bicarbonate. These waters are predominantly hydrogen-carbonated, the cationic composition is mixed (Ca, Mg, Na). The sulfate ion varies in the wide range, from 20.0 to 484.0 mg/l. There are several points with very high sulfate content 1956.0 - 2059.0 mg/l. Chloride ion does not exceed the MAL and varies in the range of 7.0 - 174.0 mg/l. The hardness varies from 5.4 to 43.9 mg- eq /l. Mineralization changes in the range of 0.1 - 1.0 g/l in the northern part and up to 3.0 g/l in the central and southern part of the studied territory. This CAS is sensitive to anthropogenic pollution with nitrates and other components from agricultural and industrial activity.

Groundwater recharge coincides with the spreading area of this aquifer. Water sources are precipitation and seepage from upper aquifers. This CAS is drained by rivers and streams. The main discharge is carried out in alluvial and alluvial-deluvial aquifers of rivers. The groundwater regime depends on atmospheric precipitation. The groundwater level is in the range of 0.25 to 3.0 m.

Water from this groundwater body is used for local drinking and agricultural water supply from wells and shallow springs.

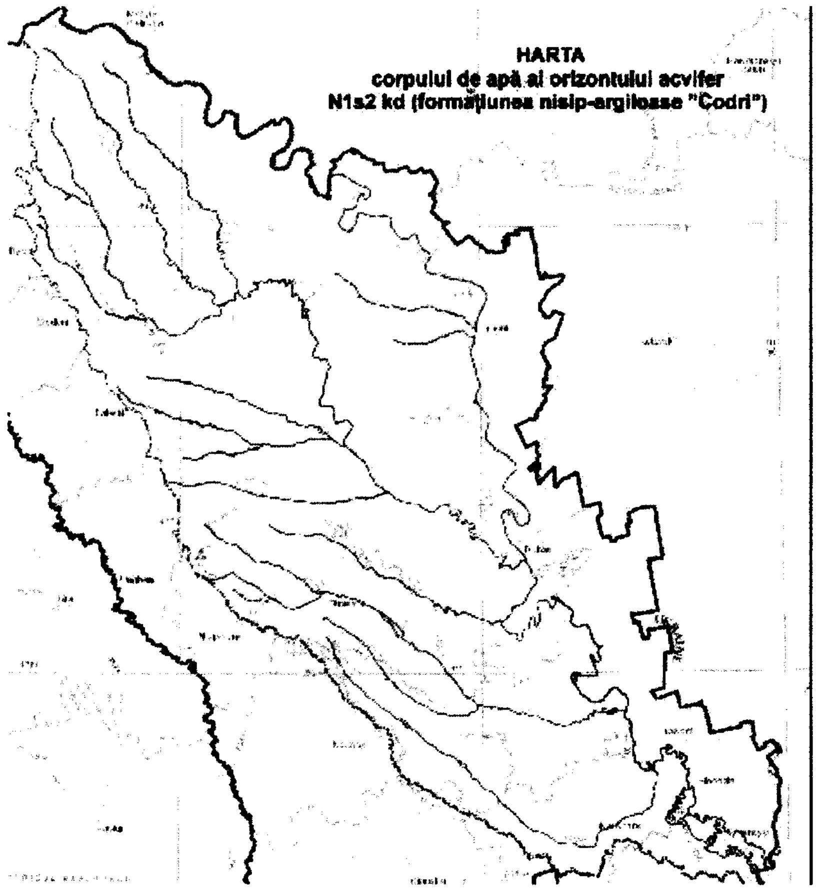


Figure 49. Location of the Middle Sarmatian aquifer N1S2-kd, ("Codrii" sand-clay formation) $N_1 s_2$ kd , CAS MDNSGWQ510

As a result of the analysis of available information related to the geological and hydrogeological conditions, 8 bodies of water were identified, classified and delimited within the boundaries of the Dniester river basin. CAS MDNSGWQ510 of the aquifer horizon of the middle Sarmatian clayey sand formation "Codrii" $N_1 s_2$- kd is proposed. This CAS is widely used for local water supply and is under intense impact from various sources of pollution. At the same time, the formation of underground water reserves on the territory of the country depends on the state of this CAS. From a qualitative point of view, in most water bodies there are exceeded values of some microbiological, chemical and indicative parameters due to both natural and anthropogenic factors.

4.5.Middle Sarmatian aquifer horizon $N_1 s_2$, *CAS* MDNSGWD610

The aquifer horizon of Middle Sarmatian age is spread in the South-West part of the Dniester river basin. From a lithological point of view, the respective horizon is presented by small and medium-grained sands, with lenticular intercalations of clays, sandstones and limestones.

The thickness of the aquifer horizon changes from 5.0-15.0 m to 20.0-50.0 m. The upper part of the sands in the northern part of the spreading territory has absolute elevations of "+120.0 m", being submerged gradually to the south and southwest to "-210.0 m" (fig. 50). The Congerian sands are covered by the clays of the upper layer of the Middle Sarmatian, and at the bottom by the clays of the lower layer of the Middle Sarmatian. The supply of the aquifer horizon occurs due to the infiltration of atmospheric precipitation, and the discharge occurs in the lower aquifer horizons.

The aquifer horizon is under pressure, the pressure value increases with the depth of the rock complex towards the southwest from 20.0 to 224.0 m.

The opening depth of the aquifer horizons varies from 5 m to 150 m. The piezometric surface of the aquifer horizon in the Middle Sarmatian sands is at absolute elevations of +80.0 m in the north and "+10.0 m" in the southern According to the chemical composition, the waters are hydrocarbonate-sulphate , hydrocarbonate-chlorine, chlorine-hydrocarbonate-sodium. Water mineralization varies from 0.5 g/l to 0.6 g/l. The hydrogeological parameters of the Congerian aquifer horizon depend on the composition of the aquifer rocks. The flow rate of the probes changes from a few hundredths to 0.4-0.7 l/s. The filtration coefficient from 0.6 m/day to 5.0 m/day, hydraulic conductivity in sands from 20.0 m ^{2} /day to 50.0 m ^{2} /day. The underground waters attributed to this horizon are widely used in the centralized water supply of the population, in order to satisfy drinking, domestic and production technical needs.

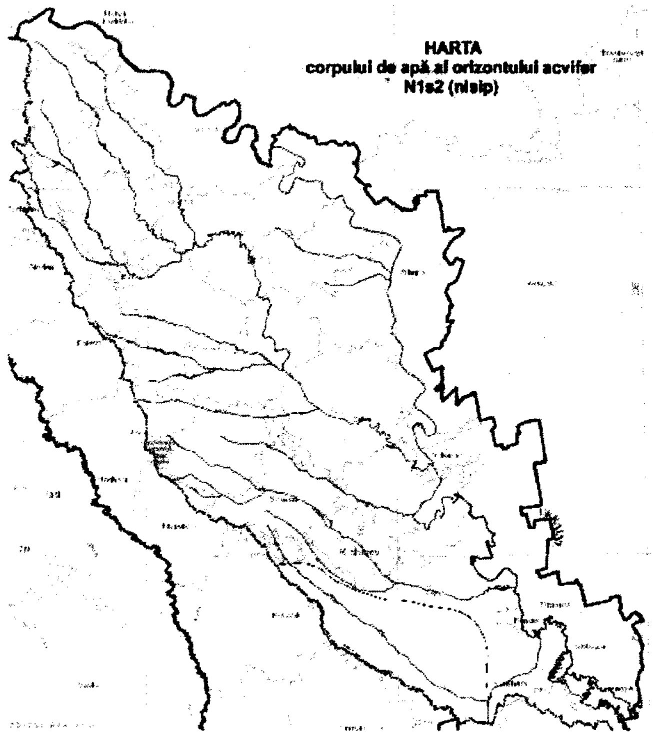


Figure 50. Location of the aquifer horizon of the middle Sarmatian N_1s_2 (congenerian) , CAS MDNSGWD610

4.6.Badenian -Sarmatian aquifer horizon N_1bs_1, CAS MDNSGWD710, MDNSGWD720

The Baden-Sarmatian aquifer complex is the main source of water supply and is spread over almost the entire territory of the Republic of Moldova, with the exception of the southern end of the republic, and some strips of the Dniester river valley. From a hydraulic point of view, it constitutes a complex aquifer horizon that unites the aquifer horizons of the lower Sarmatian and the Badenian in the northern part, and of the middle and lower Sarmatian in the central and southern part. As aquifers, limestones with intercalations of microgranular sands , less often clays and marls are present .

To the west of the reef area, clays with sand and marl substrates are spread as aquifers, and the lower part of the aquifer complex is made up of Lower Sarmatian limestones.

The aquifer complex deepens in a southern and southwestern direction. In the north of the republic, it comes to the surface, in the south at depths of 400.0 - 600.0 m. In the northern part, the aquifers saturated with water reach thicknesses of 30.0 - 45.0 m, towards the south 80, 0 - 160.0 m, and towards the Prut basin it reaches 5.0-10.0 m.

The waters further northwest of the village of Naslavcea-Bălți-Floresti are without pressure. Otherwise, the waters are under pressure, and the height of the column under pressure changes from 10.0-20.0 m in the north to 140.0-580.0 m in the south of the Republic. The hydraulic conductivity through the rocks varies a lot, so on the slope sectors and the water balance it does not exceed 50.0 m ^{2} /day, in the river meadows it has the value of 100.0-200.0 m ^{2} /day, in the Răut river meadow 1850 ,0 m ^{2} /day. The filtration coefficient varies from 0.007-3.88 m/day, on average 0.01-0.3 m/day. The flow rate of the probes 1.6-14.3 l/s, the specific flow rate 0.55-3.0 l/s. The flow rate of the springs does not exceed 0.1-0.2 l/s. The flow rate of wells and wells varies between 0.004 l/s to 0.14 l/s. The waters are sweet, brackish, salty, the mineralization value changes from 0.4 g/l to 68.2 g/l, the hardness varies within the limits of 0.51 - 9 mg- eqv /l, the fluorine content 0.4- 1.14 mg/l. According to the chemical composition, the waters are predominantly hydrocarbonate- sulphate , with sodium as the predominant cation.

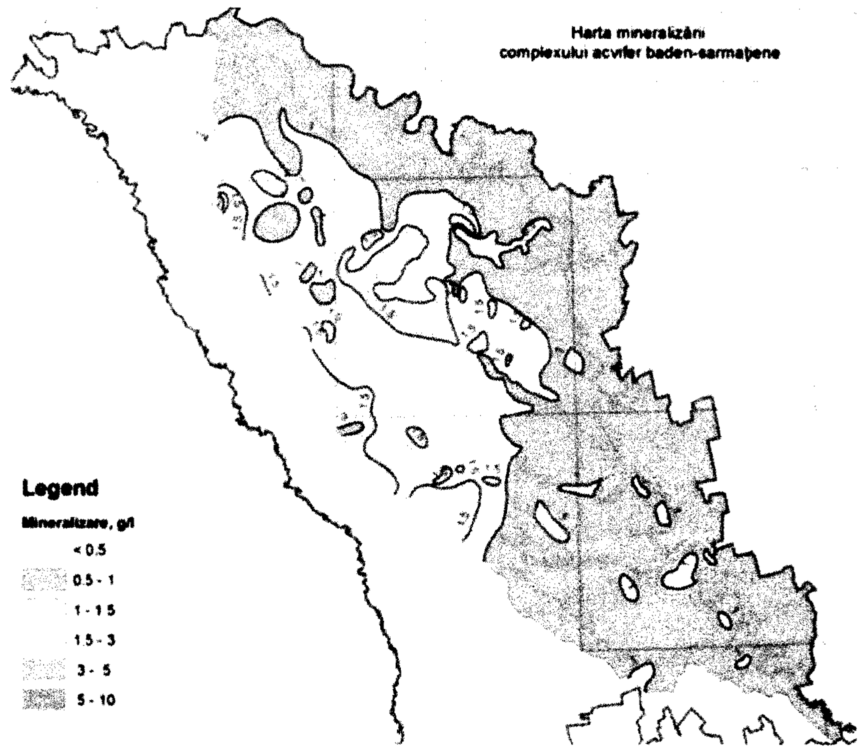


Figure 51. Mineralization of the Badenian -Sarmatian aquifer complex N_1 b+s $_1$, CAS MDNSGWD710, MDNSGWD720.

The underground waters attributed to this complex constitute an important source of centralized water supply for the population, to meet drinking, domestic and production technical needs.

4.7.2 aquifer horizon , CAS MDNSGWD810

The Silurian-Cretaceous aquifer complex is spread over the entire territory of the Republic of Moldova, but is exploited, for the purpose of supplying water to the population, only in the northern part of the republic. Cretaceous rocks, represented by limestone, serve as aquifers, which in the western direction are replaced by sandstones, opacs , spongolites , with thicknesses from 10.0 - 20.0 m to 60.0 - 70.0 m. The lower part of Silurian deposits is represented by limestone with intercalations of argillite and marl with thicknesses from the first meters in the Dniester river valley and up to 230.0 - 240.0 m in the region of Fălești. The average thickness of the complex usually falls between 10.0 - 15.0 m in the region of the city of Drochia and up to 280.0 - 330.0 m in the region of Balti. The rocks of this complex are covered by siliceous limestones, marls, tripoli of Cenomanian age, which separates the Silurian-Cretaceous aquifer complex from the Badenian -Sarmatian one. In the northern part, these delimiting layers are missing, and in the eastern part, on the Naslavcea-Coşernița-Râbnița line and in the limits of the Cubolta, Căinari and Răut rivers, the upper Cenomanian aquifers are covered by clays attributed to the lower Sarmatian- Badenian , the thickness of which is 7.0 - 10.0 m. On most of the territory, the groundwater of the aquifer complex is under pressure, rising from 10.0 - 20.0 m in the northern regions, up to 80.0 - 85.0 m in the Balti region.

The aquifer complex is poorly saturated with water, on most of the spreading territory, the hydraulic conductivity value is 10.0 - 25.0 m^2 /day. In the river valleys, the hydraulic conductivity increases up to 240.0 - 350.0 m^2 /day. The flow rate of the wells varies from 40.0-50.0 m^3 /day to 1200.0 - 1300.0 m^3 /day.

The mineralization of groundwater of the Silurian-Cretaceous complex within the exploitation limits varies from 0.5 g/l to 1.5 g/l and in the southern distribution region it can reach values of 3.0 g/l and higher (fig. 52). According to the chemical composition, groundwater is mainly hydrocarbonate-sulphate-sodium. The content of fluoride in the waters of the Silurian-Cretaceous complex varies from 0.2 to 3.0 mg/l and more (fig. 52).

The underground waters attributed to the Silurian-Cretaceous complex are used to meet domestic and technical production needs, in most cases being exploited simultaneously with the underground waters attributed to the Badenian -Sarmatian complex. The depth of exploration-exploitation wells varies from 100 m in the northern part to 200-250 m in the southern part.

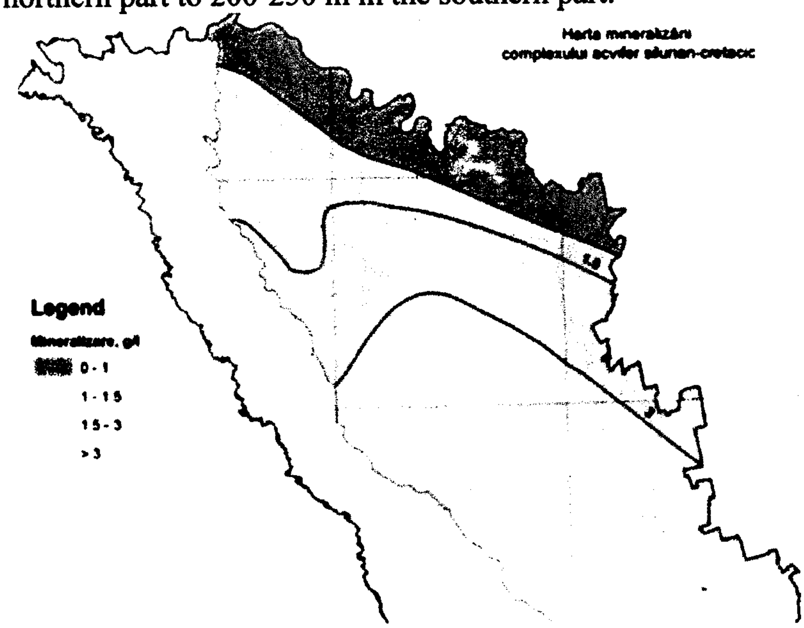


Figure 52. Mineralization of the Silurian - Cretaceous aquifer complex S – K_2, CAS MDNSGWD810

4.8.Vendian-Rifeic aquifer complex VR, CAS MDNSGWD91 0

Vend - Rifeic aquifer complex has practical application only for the water supply of a limited territory, along the Dniester river valley from the town of Otaci to the village of Podoima. The role of the aquifer is played by sandstones of Riphean and Vendian -Paleozoic age, laid in the form of layers with thicknesses of 20.0 - 30.0 m among argillite, siltstone and other rocks with low porosity. In some places in the Dniester meadow, in certain sectors, the sandstone aquifers are covered by clayey sands and gravel-sand of Quaternary age. The depth of exploration and exploitation wells varies from 25.0 - 50.0 m in the meadow and up to 340.0 - 380.0 m towards the water balance regions.

The waters of the complex have piezometric pressure, the height of which changes from 3.0 m to 10.0 m in the Dniester river meadow in the north and up to 100.0 - 250.0 m on the water level. Hydraulic conductivity, in general, does not exceed 15.0 - 20.0 m^2/day, increasing in the areas of tectonic fractures in the river meadow up to 300.0-1782.0 m^2/day.

According to the chemical composition, the waters are chlorine-hydrocarbonate- sulphate with the predominance of the sodium cation. Water mineralization varies from 0.4 g/l to 1.3-1.7 g/l (fig. 53). In most of the distribution territory, the groundwater has a high fluoride content (up to 2.0-4.0 mg/l) and only in the connection areas or adjacent to the rivers, the fluoride content in the groundwater does not exceed 1.2 mg/l.

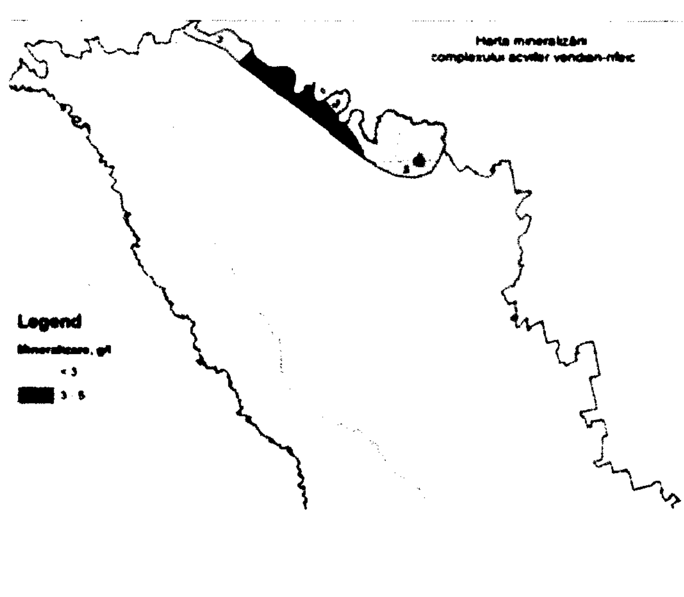


Figure 53. Mineralization of the Vendian-Rifeic aquifer complex , CAS MDNSGWD910.

5 . The quality of water resources and the monitoring system

5.1. Surface water quality

The ecological status is defined by the quality elements indicated in Annex V of the Water Framework Directive (WFD) (transposed by the Water Law no. 272 of 23.12.2011 with the related regulations), respectively the biological quality elements, the hydromorphological elements , general physico -chemical elements and specific pollutants (synthetic and non-synthetic).

The assessment of the state of surface waters was carried out according to the following principle: the analysis of the annual averages for the biological elements and the percentiles for the period of 2017-2022, after which the quality classes of the monitored parameters were established for each river sector according to the Regulation on quality requirements of the environment for surface waters. At the same time, the guide developed within the EPIRB project served as a useful tool for establishing the ecological and chemical status [3]- "Guide regarding the chemical status of surface water bodies for Pressure-Impact analysis/Risk Assessment in accordance with the EU DCA".

To classify the ecological state of water bodies, the classification system was used, which provides for five quality classes, respectively: very good, good, moderately polluted, polluted and very polluted. For biological elements the classification system includes the five previously mentioned classes compared to their average. For general physico -chemical support elements and specific pollutants (synthetic and non-synthetic) the 90th percentile was calculated (10th percentile for oxygenation parameters) and evaluated according to the five classes.

During the 6-year period (2017-2022), 38 monitoring sections located on rivers and lakes were monitored (figs. 54 and 55). Of these, in 7 sections a moderately polluted ecological state is attested (class III); 9 sections have a polluted ecological state (class IV); and the rest of the sections, 22 in number, have a very polluted ecological state (V class; figure 54, tab. 30).

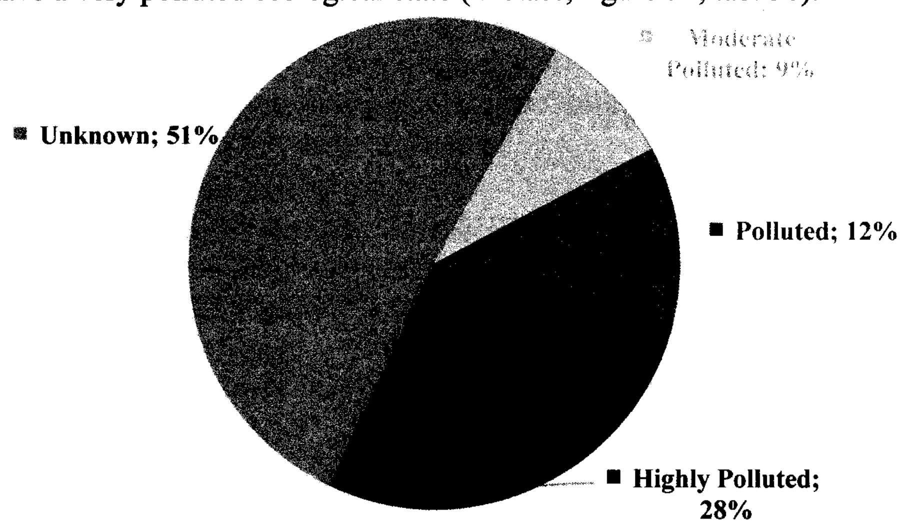


Figure 54. Ecological status of water bodies, rivers and lakes in the Dniester DBH

good ***chemical status*** of surface waters is the chemical status required in order to achieve the environmental objectives for surface waters set out in Article 4(1)(a) of the DCA, this means the chemical status achieved by a body of surface water in which the level of concentrations of pollutants does not exceed the value of the environmental quality standards (EQS), established in Annex IX and under Art. 16 (7) of the DCA, as well as in other Community legislative acts that establish such standards at Community level (Directive 2013/39 /EU). Environmental quality standards (EQS) are defined as the

[3] EPIRB - Environmental Protection of International River Basins (http://blacksea-riverbasins.net/)

concentrations of pollutants or groups of pollutants in water, sediment or biota , which must not be exceeded in order to ensure the protection of human health and the aquatic environment.

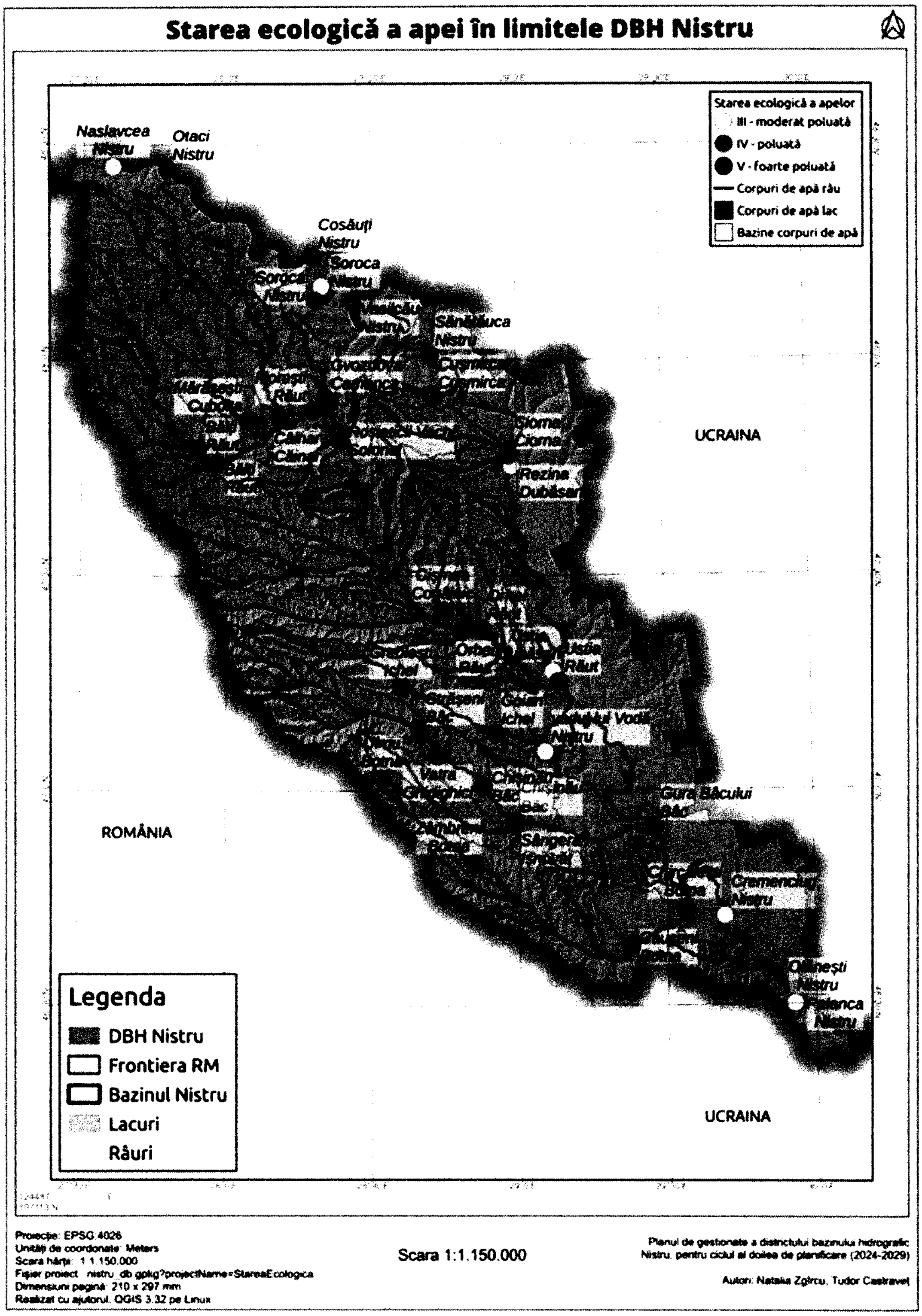


Figure 55. Ecological status of water bodies rivers and lakes in DBHN

Among the 45 regulated priority substances, within the limits of DBHN, only 15 are monitored and only in the "water" environment. At the same time, it is worth mentioning that the limits of detection/quantification of the investigated priority substances are too high, often above the maximum admissible concentration or the annual reference average according to Directive 2013/39/EU.

For the evaluation of the chemical state of the water, the environmental quality standards indicated in Directive 2013/39/EU were taken as a reference, since they represent the limits used at the

European level and, as a value, are lower than those indicated in the national legislation (HG 890 /2013). Thus, for the period of 2017-2022, exceedances of the maximum admissible concentration (CMA) for dissolved mercury can be found in the sections: r. Nistru - or. Vadul-lui-Vodă (0.084 µg/l/October 2019) and Botna r. - Ulmu village (0.81 µg/l/February 2017; 0.088 µg/l/April 2017).

The concentrations of priority substances investigated during the years 2017-2022 in BH Dniester that exceed the annual reference average are presented in figure 56 and table 30.

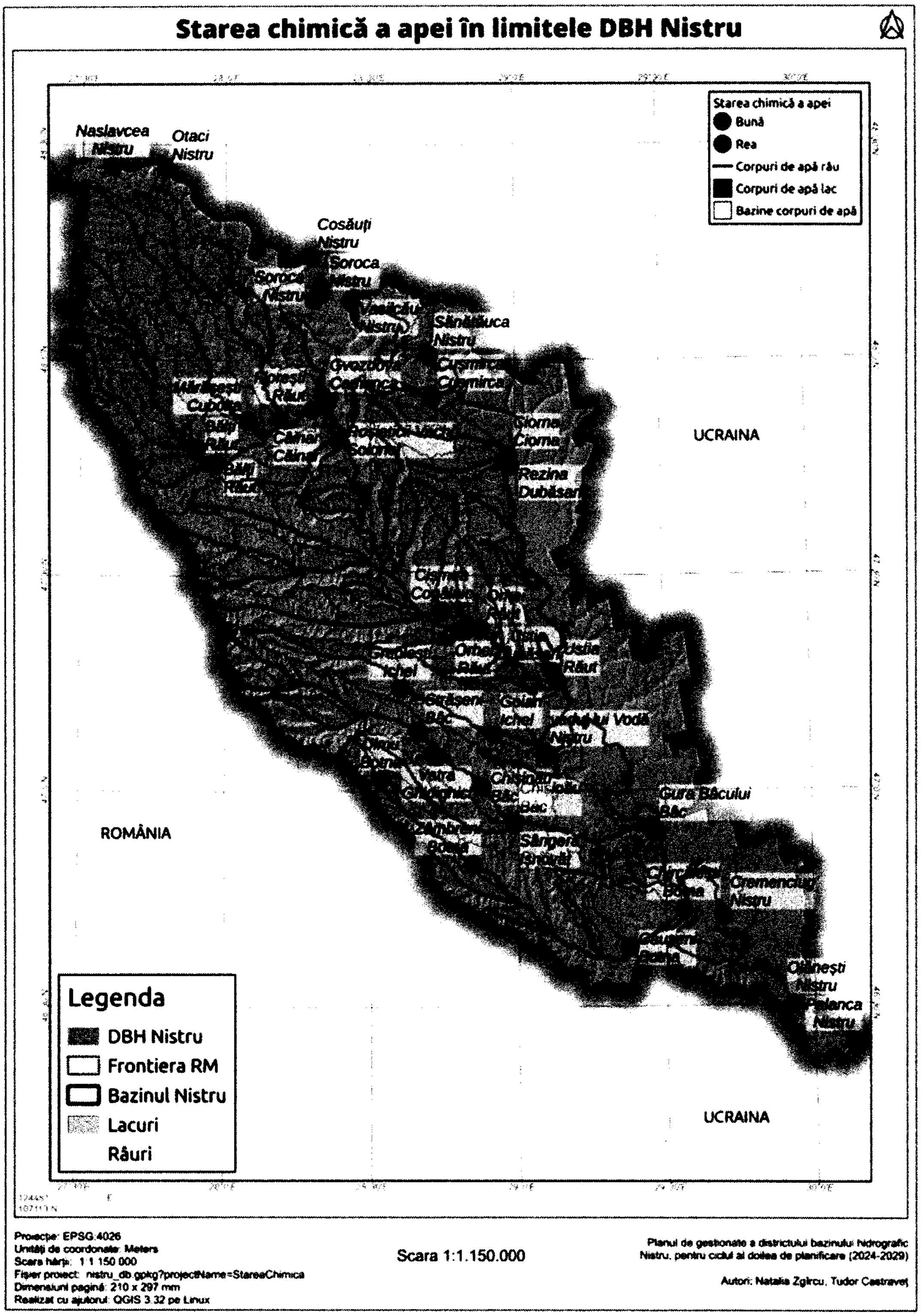


Figure 56. Chemical status of water bodies rivers and lakes in DBHN

Table 30.

Annual averages of priority substances determined in DBHN, 2017-2022, exceeding reference values according to Directive 2013/39/EU

The monitoring section	The investigated parameter	Reference year	Annual average
Dniester river - Naslavcea village, upstream	Fluoranthene, µg/l	2018	0.023
r. Dniester - or. Vadul -lui-Vodă	Dissolved lead, µg/l	2020	1,715
Dniester r. - s. Palanca, downstream	Fluoranthene, µg/l	2017	0.026
		2018	0.026
r. Răut - mun. Bălţi, upstream	Dissolved cadmium, µg/l	2017	0.266
r. Răut - mun. Bălţi, downstream	Dissolved cadmium, µg/l	2017	0.307
		2018	0.180
		2020	0.216
Răut r. - Floreşti town, upstream	Dissolved cadmium, µg/l	2017	0.175
		2020	0.126
Răut r. - Orhei town, upstream	Dissolved cadmium, µg/l	2020	0.099
r.Cubolta - s. Mărăşeşti, downstream	Dissolved cadmium, µg/l	2017	0.289
r. Ichel - s. Goian, downstream	Dissolved cadmium, µg/l	2017	0.174
Botna r. - Ulmu village, Ialoveni r., upstream	Dissolved cadmium, µg/l	2017	0.102
Botna r. - Căuşeni town, upstream	Fluoranthene, µg/l	2017	0.105
	Dissolved nickel, µg/l	2018	4,840
r. Botna - s. Chircăiesti	Dissolved cadmium, µg/l	2017	0.099

Of the 38 monitoring sections – 12 do not meet the environmental objectives and have a bad chemical state (tab. 31).

Table 31.

Ecological and chemical state of water within the boundaries of the Dniester watershed district

No. order	Monitored station	Ecological status	Chemical state
1	Nistru r. - s. Naslavcea, Ocniţa r., upstream	III	bad
2	Dniester district - Otaci town, Ocniţa district		
3	Dniester district - Cosăuţi village, Soroca district		
4	Dniester river - Soroca town, upstream	III	
5	Dniester r. - Soroca town, downstream		
6	Dniester r. - Vasilcău village, Soroca district		
7	Dniester district - Sănătăuca village, Floreşti district		
8	base. Dubăsari - city Rezina	III	
9	base. Dubăsari - s. Ustia, Dubăsari district upstream	III	
10	r. Dniester - or. Vadul -lui-Vodă	III	bad
11	Dniester r. - Cremenciug s., Căuşeni r	III	
12	Nistru district - Olăneşti village, Ştefan Vodă district	III	
13	Dniester district - Palanca village, Ştefan Vodă district, downstream		bad
14	Cuşmirca r. - Cuşmirca village, Soldăneşti district, downstream		
15	Ciorna district - Ciorna village, Rezina district, upstream		
16	r. Răut - mun. Bălţi, upstream	V	bad
17	r. Răut - mun. Bălţi, downstream	V	bad
18	Răut r. - Floreşti town, upstream	V	bad
19	Răut r. - Orhei town, upstream	V	bad
20	r. Răut - or. Orhei, downstream	V	

21	Răut r. - Ustia village , Dubăsari r., downstream	V	
22	Cubolta r. - Mărăşeşti village , Sîngerei r-n , downstream	V	bad
2. 3	Căinar r. - Gura Căinarului village, Floreşti r	V	
24	Camenca district - Gvozdova village , Floreşti district, upstream	V	
25	Cohâlnic district - Cişmea village , Orhei district, upstream	V	
26	Soloneţ r. - Roşieticii Vechi village, Floreşti r	V	
27	Ichel district - Grebleşti village , Străseni district, upstream	V	
28	Ichel district - Goian village , Chisinau municipality, downstream	V	bad
29	r.Bîc - or.Străseni , downstream	V	
30	base. Ghidighici - city Vatra , upstream	V	
31	Bîc r. - Chişinău municipality , upstream	V	
32	Bîc r. - Chişinău municipality , downstream (Săngera town)	V	
33	r.Bîc - s.Gura Bîcului , Anenii Noi district, downstream	V	
34	Isnovăţ r. - Sangera town , Chişinău municipality, downstream	V	
35	Botna district - Ulmu village , Ialoveni district, upstream		bad
36	Botna district - Zambreni village , Ialoveni district	V	
37	Botna r. - Căuşeni town , upstream	V	bad
38	Botna district - Chircăiesti village , Căuşeni district	V	bad

5.2. Surface water monitoring

Water condition monitoring is a system for evaluating the biological, physico -chemical and hydromorphological parameters of water according to natural and anthropogenic conditions. The surface water quality monitoring program was developed in accordance with the legislation in force and represents the instrument for assessing their condition, for the purpose of developing and approving management plans at basin level .

national water quality monitoring system was established within the State Hydrometeorological Service in accordance with the Order of the General Department of Hydrometeorological Services (ГУГМС) no. 87 of 24.04.1964 on the organization of an observation service on the chemical composition of atmospheric air, surface waters and seas. Systematic observations, however, began to be carried out since the 80s with an emphasis on monitoring the cross-border rivers: Dniester and Prut. Starting from January 2019, with the establishment of the Environment Agency by HG no. 549 [4], both the laboratories and the water quality monitoring task were taken over by it.

In general, 2 types of monitoring are planned in DBHN:

- surveillance monitoring (S) – aims to assess the state of all waters within each river basin or sub-basin , providing information for: validation of the impact assessment procedure, effective development of subsequent monitoring programs, evaluation of the long-term variation trend in quality and the amount of water resources, the development of criteria for highlighting water bodies at the administrative-territorial level, as well as arguing for the optimization of the national monitoring system;
- operational monitoring (O) - aims to establish the state of those bodies of water identified, following surveillance monitoring , as presenting the risk of not meeting the environmental objectives for water, as well as the evaluation of the changes arising from the application of the program of measures, included in the watershed management plan.

[4]GD no. 549 of 13.06.2018 with regarding the constitution , organization and functioning the Environment Agency

In case of accidental pollution or in order to identify the causes of exceeding the water quality requirements, monitoring is carried out investigative (I).

The monitoring sections of biological, physico -chemical elements and priority substances for surface water bodies within the DBHN are shown in figures 55 and 56 and include river and lake water bodies , a total of 38 stations. Compared to the first DBHN management plan, the monitoring network underwent updates - the number of monitoring sections increased by 15, respectively facilitating the assessment of the ecological state, as well as covering data gaps. The investigation medium for surface water bodies is represented only by water, and the quality elements, the physical -chemical parameters, as well as the minimum monitoring frequencies are partially consistent with the requirements of the Water Framework Directive (tab. 32) since the fish fauna do not it is neither stipulated by GD 890, nor regularly documented by one of the institutions subordinate to the ministry.

Table 32.

Quality elements, parameters and the minimum monitoring frequencies in the surveillance program and the operational program

Type of water body	**Quality elements**		**parameters**	**Frequency**	
				Surveillance monitoring	**Operational monitoring**
				1 year during a management cycle	*2 years during a management cycle*
River and Lake	Biological elements	Benthic invertebrates	Taxonomic composition (list and number of species); Density (ind /m ^{2}); Saprobic index	1x/year	1x/year
River and Lake		Phytoplankton (large rivers and lakes)	Taxonomic composition (list and number of species); Density (thousand cells/ml); Biomass (mg/l) Saprobic index ; Chlorophyll a (μg/l)	1x/year	1x/year
River and Lake		Phytobenthos (small rivers)	Taxonomic composition (list and number of species); Saprobic index	1x/year	1x/year
Lake		macro	Taxonomic composition (species list)	1x/year	1x/year
River&Lake	Physico - chemical elements	The state of the thermal regime	Water temperature	4x/year	4x/year
River&Lake		Oxygen regime status	Dissolved oxygen, oxygen saturation, CBO_5, CCO_{Cr}, CCO_{Mn}	4x/year	4x/year
River&Lake		State of acidification	pH	4x/year	4x/year
River&Lake		Nutrients	$N\text{-}NO_2$, $N\text{-}NO_3$, $N\text{-}NH_4$, $P\text{-}PO_4$, Ptotal	4x/year	4x/year
River&Lake		Specific pollutants	Phenols, petroleum products, Cu, Zn, anion - active detergents	4x/year	4x/year

Bad& Lake	Priority substances	pcb PAH Heavy metals		1x/year	1x/year

The joint water sampling program at the border between the Republic of Moldova and Ukraine was developed by the Moldovan -Ukrainian working group and approved jointly with the national laboratories that are involved in the joint sampling and exchange of information based on the Agreement on the use and protection of transboundary waters signed between the Government of the Republic of Moldova and the Government of Ukraine on October 23, 1994 . Thus, starting from 2009, common samples are taken within the DBHN and quarterly data exchange is carried out on the Dniester River (sections : Otaci town and Palanca village).

In order to ensure the accuracy and confidentiality of surface water quality monitoring data, the Reference Laboratory of the Environment Agency is accredited for a series of physical -chemical parameters to the international standard ISO 17025. At the same time, to demonstrate its capability, it participates annually in tests of efficiency, organized both at national and international level.

As a result of projects to strengthen technical capacities, the laboratories were equipped with high-performance equipment and benefited from training in order to reach the performance level for accredited laboratories that produce truthful environmental data following the application of international standardized methods in accordance with the DCA.

5.3. Groundwater quality

The operational underground water reserves have better quality for drinking water supply (according to HG 931 of 20.11.2013) near fl . Dniester The distribution of groundwater mineralization in the evaluated reserves illustrates this fact (fig. 57). The quality of the Groundwater Bodies in the assessed reserves is presented in tables 33 and 34.

Currently, in the Republic of Moldova, for reserve testing, the methodology for evaluating operational underground water reserves is used. At the same time, on the territory of the Republic of Moldova, the studies carried out previously do not allow an evaluation of all groundwater resources, which includes an evaluation of the balance calculations for the formation of groundwater resources and the numerical modeling of the groundwater flow for different aquifers and their interaction between they.

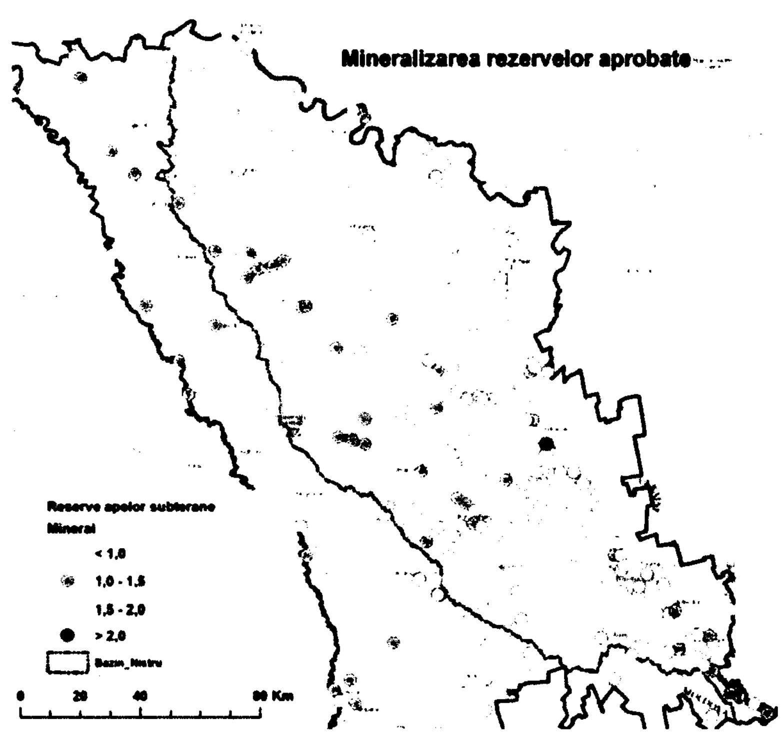


Figure 57. Groundwater mineralization of operational groundwater reserves

Table 33.

Chemical composition of groundwater reserves within DBHN limits

№	The horizon (aquifer complex	Groundwater body code	pH	Mineralization, g/l	Hardness, degree germ.	Geochemical type of waters	Components that may exceed the supported level
1	Alluvial aquifer horizon (a,adA $_3$)	**MDNSGWQ110**	7.0 - 8.5	0.6 -1.5	2.5-31.0	HCO $_3$ -SO $_4$ -Ca-Na-Mg	SO $_4$ up to 450 mg/l, NO $_3$, NO $_2$
2	The aquifer complex of the Upper Sarmatian-Meotian (N $_1$ S $_3$ +m)	**MDNSGWD410**	7.5 - 8.7	0.9 - 1.4	0.8-25.0	HCO $_3$ - Cup, SO $_4$ -Cl-Na	mineralization, hardness, sulfates, chlorides (south) Fe, F, NH $_4$
3	The aquifer complex of the Middle Sarmatian (congerian sand) (N $_1$ S $_2$)	**MDNSGWD610**	7.8 - 8.0	0.6 - 2.5	0.8-5.6	HCO $_3$ -SO $_4$ -Na; HCO $_3$ -Cl-Na	mineralization, hardness, chlorides (south), NH $_4$ up to 9.8 mg/l, Mn, Sr, Fe, F, chromatic up to 70 degrees.
4	Badenian - Sarmatian aquifer complex (N $_1$ b+s $_1$)	**MDNSGWD710 MDNSGWD720**	7.5 - 9.0	0.5 - 2.0	1.4-42.0	HCO $_3$ -SO $_4$ -Cl -Na-Ca-Mg	mineralization, hardness, Na, NH $_4$, NO $_3$, Fe; micro-components: Al, Sr, Mn, F,
5	Silurian-Cretaceous aquifer complex (K $_2$ +S)	**MDNSGWD810**	7.5 - 8.0	0.6 – 3.1	0.8-31.0	HCO $_3$ -SO $_4$ -Cl-Na-Ca-Mg	mineralization, hardness, Na up to 600 mg/l, NH $_4$, NO $_3$, micro-components: Al, Mn, F
6	Vendian-Rifeic aquifer complex (V $_1$ +R $_3$)	**MDNSGWD910**	7.7 - 8.7	0.7 - 1.5	17 - 25	SO $_4$ HCO $_3$ Cl-Na Ca	NO $_3$, F up to 7.5 mg/l

For the update, as well as the coherent evaluation of the trends of change in the qualitative and quantitative aspects of the underground water bodies, it is necessary to improve the national groundwater monitoring system by providing all CAS with monitoring points, using modern methods of water quality analysis, broadening of the spectrum of water quality parameters and the use of water isotope analysis methods for the assessment of the balance and formation of reserves of aquatic resources. It is very important to use the methods of modeling the natural water cycle processes to improve the methods of evaluation and forecasting the formation of the quality and quantity of aquatic resources for the purpose of their sustainable management and exploitation.

Despite the insufficiency of the necessary data and in order to express the quality status of groundwater in accordance with the Water Framework Directive, deep groundwater bodies (covered with impervious layers) can potentially be assigned to the category of good (table 34).

Table 34.

Characteristic of aquifers and groundwater bodies within the boundaries of the Dniester river basin

Name of the groundwater body	CAS code	Classification of the body of water according to:		
		General qualitative condition	Influence on salinity	Water reserves

Alluvial-deluvial aquifer horizon a,adA 3 , Holocene	**MDNSGWQ110**	**Good for the Dniester river , unsatisfactory for small rivers**	Not noticeable	Descending, seasonal fluctuations
The aquifer complex of the Pliocene-Pleistocene aN 2- aA I+2	**MDNSGWQ210**	**Unsatisfactory**	Not noticeable	Descending, seasonal fluctuations
The aquifer complex of the Upper Sarmatian-Meotian N 1 s 3 -m	**MDNSGWD410**	**Hi**	Not noticeable	Descending, seasonal fluctuations
The aquifer horizon of the middle Sarmatian clayey sand formation "Codrii) N 1 s 2- kd	**MDNSGWQ510**	**Unsatisfactory**	Not noticeable	Descending, seasonal fluctuations
Middle Sarmatian aquifer horizon N 1 s 2 (sand)	**MDNSGWD610**	**Hi**	Not noticeable	Downward
Badenian -Sarmatian aquifer complex N 1 bs 1	**MDNSGWD710, MDNSGWD720**	**Hi**	Not noticeable	Downward
The Silurian-Cretaceous KS aquifer complex	**MDNSGWD810**	**Hi**	Not noticeable	ascending
Vendian-Rifeic VR aquifer complex	**MDNSGWD910**	**Hi**	Not noticeable	Insignificant fluctuations

5.4. Groundwater monitoring

Groundwater monitoring in accordance with the Decree of the Government of the Republic of Moldova no. 932 of November 20, 2013 "Regulation on the systematic monitoring and record of the state of surface waters and underground waters" is carried out according to scientifically based monitoring programs, which include continuous observations of significant aspects of dynamic processes, scientific analyzes of past processes, with detecting the factors that led to the change in the qualitative and quantitative state, and a model for forecasting the evolution of the system.

The quantitative monitoring network is established to assess and justify the quantitative status of groundwater bodies, and to assess the risks of reducing their reserves. The surveillance monitoring network is designed to assess the chemical status of groundwater and long-term trends in pollutant concentrations caused by natural and anthropogenic influences . The operational monitoring network is designed to determine the status of all groundwater bodies at risk of not meeting environmental objectives.

The underground water monitoring network within the DBHN consists of 117 wells located in disturbed water catchment areas and slightly disturbed areas (close to natural conditions). The location of the observation points of the network was made based on the preliminary hydrogeological zone of the territory of the Republic of Moldova, made more than 40 years ago (year 1977). The location of the monitoring probes is shown in figure 58.

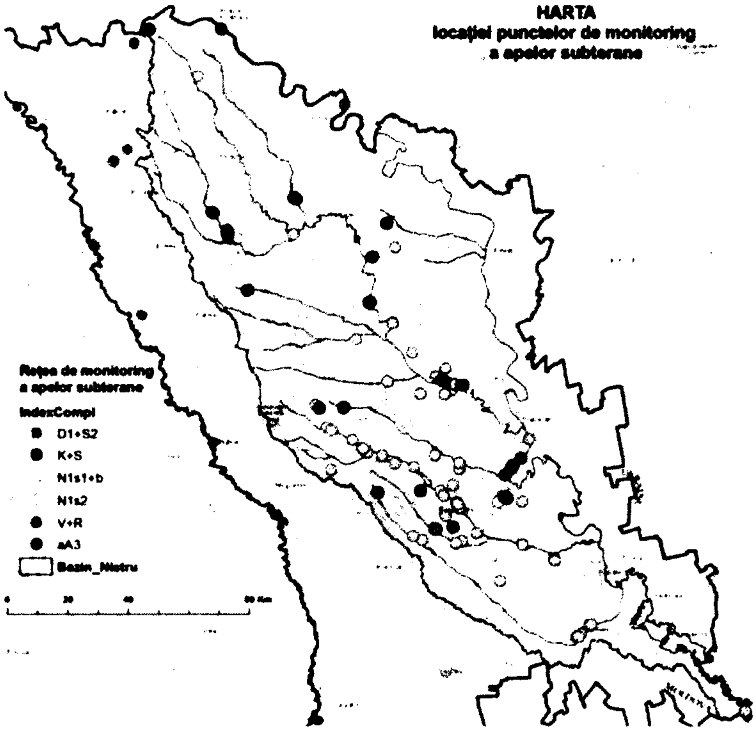


Figure 58. Location of groundwater monitoring wells

6 . Protected areas

According to article 19 [1] "Protected areas" of the Water Law no. 272/2011, it is mentioned that at the level of each hydrographic district, protected areas of water bodies are identified and registered. The record of protected areas is carried out through the Register of protected areas, a component part of the State Water Cadastre, which includes the following types of protected areas:

a) the areas intended to collect drinking water from surface and underground waters, which have an average flow of more than 10 m^3 per day or which serve more than 50 people, as well as from water bodies that can be used as such in the future;

b) the areas intended for the protection of aquatic species of economic importance – stagnant bodies of water or watercourses, habitats of indigenous species, which maintain biodiversity and whose existence is important for the management of water resources;

c) water bodies intended for recreation, including those identified as bathing waters;

d) areas sensitive to nutrients , including vulnerable areas and sensitive areas, especially those in agglomerations without wastewater treatment plants, those in which there are discharges of insufficiently or improperly treated wastewater and those in which systems for treatment are not certified biological wastewater, identified based on a methodology approved by the Government;

e) areas intended for the protection of habitats or species, where the maintenance or improvement of the state of the waters is an important factor for their protection, including areas important for the Emerald network and wetlands of international importance.

Information on protected areas is included in the River Basin District Management Plan, at each revision thereof, and is supplemented with maps, indicating the location of each protected area, as well as the provisions of the national legislation on the basis of which the respective areas were identified.

The overall environmental objective for water body protected areas is to achieve "good ecological status" of water intended for human consumption, protection of economically important aquatic species, bathing waters, nutrient sensitive areas and nitrate vulnerable areas, protection of habitats and species of flora and fauna where the maintenance or improvement of water status is an important factor.

6. 1. Protected areas for water intakes intended for drinking

Within each hydrographic district, the following are identified:

1) all water bodies used to capture drinking water intended for human consumption, which provide on average at least 10 m^3 per day or serve at least 50 people;

2) water bodies intended for such use in the future.

The specific objectives for protected areas with water intended for human consumption are:

a) ensuring the necessary protection of the drinking water catchment area in order to prevent deterioration of water quality and to reduce the level of purification treatment necessary for the production of drinking water, maintaining quality standards for the microbiological, chemical and organoleptic parameters of drinking water;

b) monitoring the quality of drinking water and providing consumers with adequate and up-to-date information about water quality.

Protected areas are identified and designated by the local public administration authorities, based on the urban planning documentation and the opinions of the Environment Agency, the Geology and Mineral Resources Agency, the National Public Health Agency.

According to the Regulation on sanitary protection areas of water intakes, approved by GD no. 949 of 25.11.2013, sanitary protection zones are created within three perimeters:

a) perimeter I – sanitary protection zone with severe regime, includes the territory of the water intake;
b) perimeter II – sanitary protection zone with restriction regime;
c) perimeter III – sanitary protection zone with observation regime, includes the adjacent territories, where water protection measures against pollution are foreseen.

The dimensions of the perimeters of the sanitary protection zones of the surface and underground water intakes depend on the physical -geographical, hydrogeological and hydrological parameters, the existing/potential sources of pollution and the range of the zone of negative influence (contamination) on the water sources.

The delimitation of the perimeters of the protected areas and their dimensions for waters intended for human consumption from underground and surface sources are established according to the Regulation on sanitary protection zones of water intakes, adopted by Government Decision no. 949/2013, The activities in perimeters I, II and III of the sanitary protection zone of underground and surface water intakes are also regulated.

According to the data of the "Apele Moldovei" Agency, the average amount of water used from surface sources in DBHN is 664.2 million m ^{3} /year, and from underground sources 94.4 million m ^{3} /year. About 110 million m ^{3} of the total water used for household purposes, including potable water, are used . In DBHN, there are currently only 3 intakes of drinking water from surface waters (Cosăuţi village, Soroca district, Tarasova village, Rezina district, Vadul-lui-Vodă town, Chişinău municipality).

For surface water intakes, the I perimeter of the sanitary protection zone of aqueducts from surface sources is established within the following limits: upstream - at least 200 m from the water intake; downstream - at least 100 m from the water intake; on the shore near the water intake - at least 100 m from the water mirror in the summer-autumn period.

The boundaries of perimeter II of the sanitary protection zone for water intakes must be removed in both directions from the intake at a distance of 3 km in the presence the prevailing direction of the winds up to 10% and at a distance of 5 km when present the prevailing wind direction more than 10%.

According to the information of the Environmental Protection Inspectorate (IPM), published in the IPM Yearbook, 2022 edition, in the Republic of Moldova there are 2,171 deep water wells intended for drinking water, of which more than 70% of exploitable artesian wells are located in DBHN localities (fig. 59).

The results of water quality analyses, used for drinking purposes, carried out by the laboratories of the National Agency for Public Health, reveal that for the period 2015-2021, an improvement in the quality of water from centralized underground and surface sources in terms of chemical parameters is attested (tab. 35).

Table 35.

The proportion of water samples that do not comply with the sanitary -chemical parameters, (%)

source	2015	2016	2017	2018	2019	2020	2021
Underground centralized sources	71.5	69.5	62.4	72.0	69.5	72.0	70.1
Centralized surface sources	30.9	38.3	19.4	9.0	8.4	11.3	31.7
Urban communal aqueducts from underground sources	39.4	44.5	40.0	39.0	37.5	45.2	50.8
Urban communal aqueducts from surface sources	5.9	8.2	9.0	7.0	13.0	17.8	15.7
Rural aqueducts	51.3	51.0	50.0	49.0	58.7	57.7	55.9
Aqueducts of children's institutions	54.3	61.7	61.0	40.0	43.0	20.0	47.2
well	84.0	79.6	77.0	73.0	72.5	74.1	74.0

Despite the fact that, in the estimated period, there is a decrease in the percentage of water samples from public wells that do not comply with the chemical parameters (on average by 3.0% annually), the situation in this chapter remains alarming, the estimated value being, in average, for the research period, of 76.3%. In well water, the share of non-conformity is conditioned in 60% of cases by the increased concentrations of nitrates. In order to prevent the risk of contamination or impurity of water as a result of human activity , in the protection zones, measures are imposed to prohibit certain activities , as well as measures to restrict the use of the land.

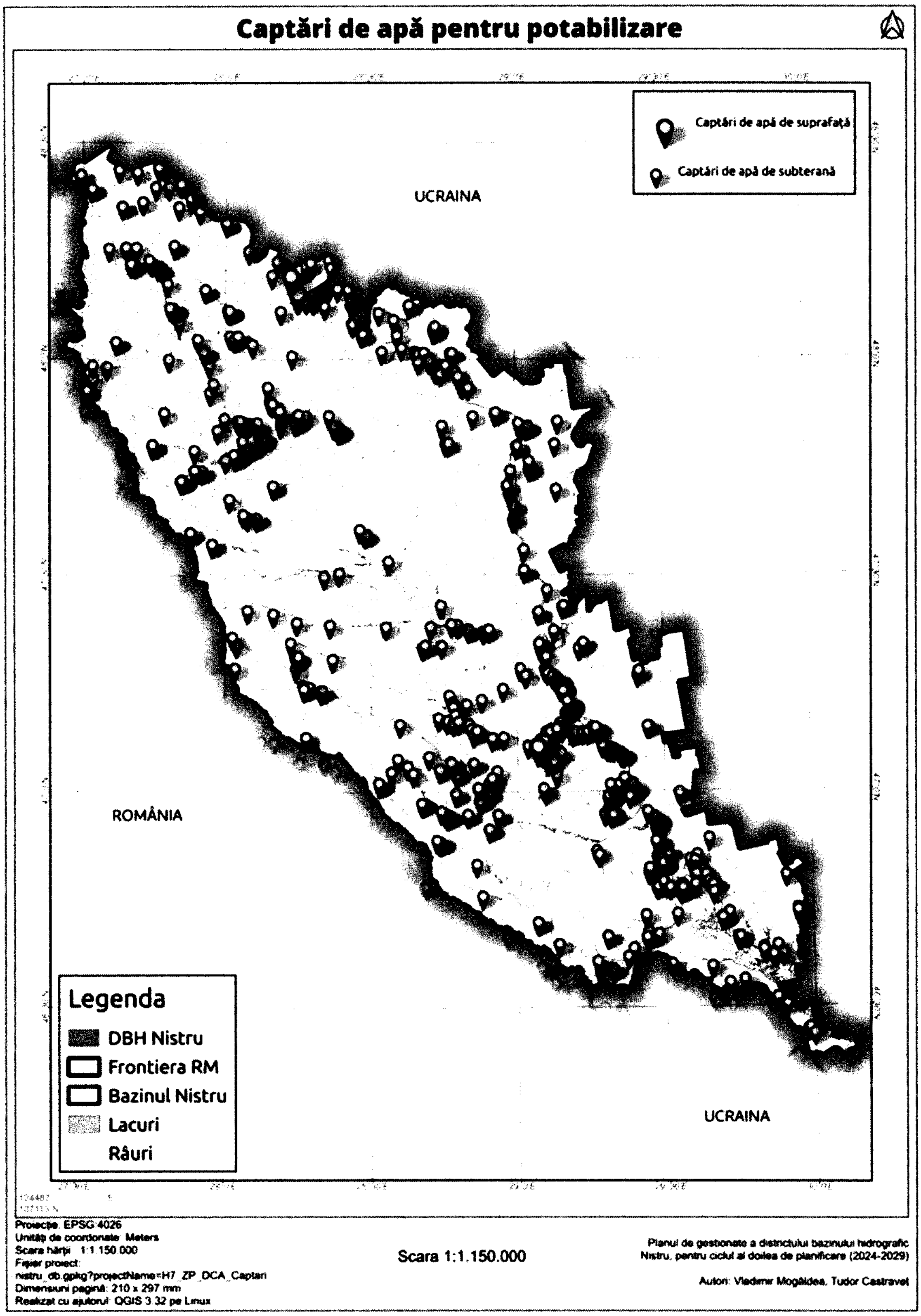


Figure 59. Water intakes for drinking water

6.2. Protected bathing areas

Bathing areas are designated where bathing is regulated by the National Agency for Public Health (ANSP), based on the quality of water resources, infrastructure and services provided and other measures taken to encourage bathing, including promotional measures aimed at tourist of the bathing area. When establishing the list of bathing areas, account is taken, first of all, of the information on the quality of surface waters received from ANSP and the Environment Agency and they are established based on the normative framework in force, namely, the Regulation of recreation areas related to water basins. Bathing areas are designated where bathing is traditionally practiced by a large number of bathing water users, based on local usage history , infrastructure and services provided and other measures taken to encourage bathing, including compliance with requirements and norms stipulated in national legislation. At the moment, 7 bathing areas are identified within the limits of DBHN: Soroca, Holercani, Dubăsari, Vatra, Vadul lui Vodă, Bender, Tiraspol (tab. 36, fig. 60).

Officially, these areas do not have the status of protected areas according to the DCA delimited in accordance with *the Methodology for the designation of the types of protected zones/areas according to the DCA* .

An important criterion for the designation of bathing areas is based on the assessment of the quality of the bathing waters. The water quality in the identified bathing areas does not always meet the requirements, but there is also no continuous monitoring of them, a mandatory element since they will be declared as bathing areas, protected areas according to the DCA. The monitoring and evaluation of bathing water is carried out for the following microbiological parameters (E. coli, enterococci, streptococci, parasites, viruses), and public information about the quality of bathing water and beach management is done through bathing profiles (according to the Regulation of recreation areas related to water basins - GD no. 737 of 11.06.2002), based on which symbols are displayed for the classification of bathing water quality (excellent, good, satisfactory or unsatisfactory) and for the prohibition of bathing.

The quantitative parameters of the bathing waters, which are taken into account when designating these areas, are: the speed of the water course (<0.5 m/sec), depths up to 2 m, optimal surface area of the beach (minimum 4 m^2 / pers.).

Table 36.

List of recreation areas related to water basins of importance Nation

No. do	The name of the area	The location	Responsible for operation
1.	Rest area "Vadul lui Vodă"	hours Vodă lui Vodă, Chisinau municipality	City Hall Vadul lui Vodă, Chisinau City Hall, " Moldsindbalneotur " Holding, National Tourism Agency , Ministry of Health, Labor and Social Protection [redacted]
3.	Rest area "Holercani"	com . Holercani, Dubăsari district	State Chancellery
4.	Rest area "Vatra"	hours Vatra, Chisinau municipality	Chisinau City Hall, City Hall Vatra, Ministry of Health, Labor and Social Protection [redacted]
5.	Rest area "Soroca"	Soroca municipality, Soroca district	Soroca District Council, Soroca Municipality Mayor's Office, " Moldsindbalneotur " Holding, National Tourism Agency , Ministry of Health, Labor and Social Protection [redacted]
6.	Rest area "Dubasari"	Dubăsari municipality	APL bodies, " Moldsindbalneotur " Holding, Ministry of Health, Labor and Social Protection [redacted]
7.	Rest area "Tiraspol"	Tiraspol municipality	APL bodies, " Moldsindbalneotur " Holding, Ministry of Health, Labor and Social Protection [redacted]
8.	"Bender" Rest Area	Bender municipality	APL bodies, " Moldsindbalneotur " Holding, Ministry of Health, Labor and Social Protection [redacted]

Source: *Regulation of recreation areas related to water basins, HG no. 737 of 11.06.2002, Annex 2*

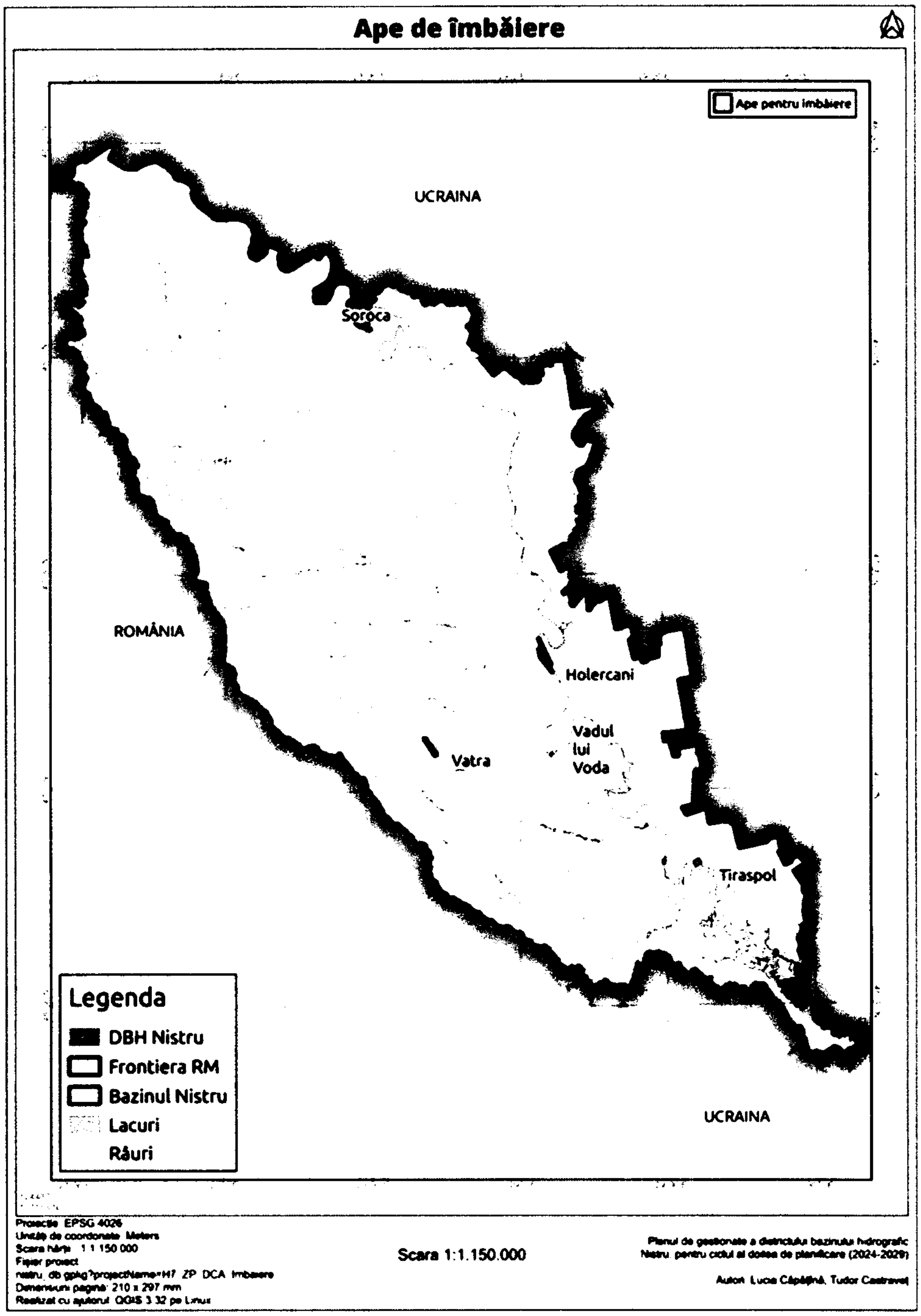


Figure 60. Map of bathing areas

6.3. Nutrient sensitive areas

The identification and delineation of nutrient- sensitive areas was carried out according to the Methodologies for the identification and designation of nutrient -sensitive areas and nitrate-vulnerable areas [HG no. 736/2020 regarding the approval of the Methodologies for the identification and designation of areas vulnerable to nitrates and areas sensitive to nutrients , published on 30.10.2020 in the Official Gazette no. 279-284].

Nutrient sensitive areas include:

1) natural fresh water lakes, other fresh water masses, which have been identified as eutrophic or which could soon become eutrophic if no protective measures are taken ;

2) fresh surface waters , intended for the capture of drinking water and which could contain a concentration of nitrates higher than 50 mg/l, if no preventive measures are taken.

As a result of the analysis of monitoring data from the Environment Agency for the years 2015-2022, it was determined that the physical -chemical quality of surface waters is strongly damaged by wastewater discharged from treatment plants, especially downstream of agglomerations greater than 10 000 equivalent inhabitants and as a consequence the degree of eutrophication of water bodies increases.

The methodology for the delimitation of areas sensitive to nutrients provides for the comparison of the value of indicators of all types (physical -chemical, biological) with the level of these indicators corresponding to the "moderately polluted" quality class stipulated in the Regulation on environmental quality requirements for surface waters (HG no. 890/2013) and which could lead to eutrophication .

nutrients were established (fig. 61):

- Copăcenca river (from the waste water discharge point from the SE town of Râşcani to the Răut river) ;
- Cubolta river (from the waste water discharge point from the SE town of Drochia to the Răut river) ;
- Răut river (from the wastewater discharge point from the SE town of Balti to the confluence with the Dniester river);
- fl . Dniester (from the town of Soroca to the mouth of the river);
- Ciulucul Mare river (from the waste water discharge point from the SE town of Sangerei to the confluence with the Răut river);
- Ichel river (from the wastewater discharge point from the SE town of Cricova to the confluence with the Dniester river;
- Bâc river (from the waste water discharge point of Călăraşi town to the confluence with the Dniester river);
- r. Botna (from the waste water discharge point from SE Costeşti to the Dniester river).

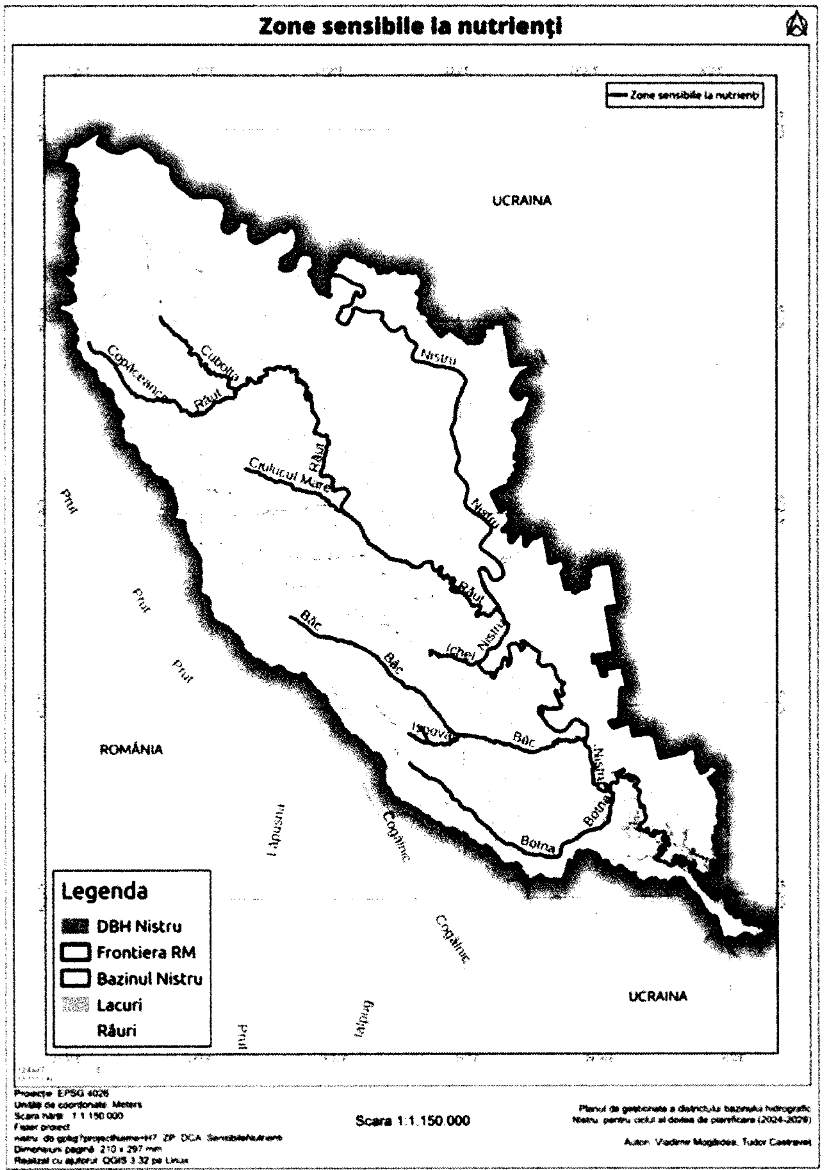


Figure 61. Nutrient sensitive areas

Of example , in BASIN 6 agglomerations are located in the hydrographic area of the Bâc river humanity with a number of inhabitants equivalents (le .) greater than 10 000. Two among them, or . Chisinau (669,700 le .) and hours _ Călăraşi (10,700 le .) have Water Treatment Stations _ Used (SEAU), again hours _ Străseni (17 700 le .), hour . Ialoveni (12 400 le .), hour . Durleşti (17,200 le .) and or. Codru (15,900 le .) are connected to SEAU Chisinau (fig. 62). volume WATER PLANT discharged from Călăraşi WWTP in Bac r constitutes 439 thousand m ^{3} /year, and from SEAU Chisinau 52129 thousand m ^{3} /year.

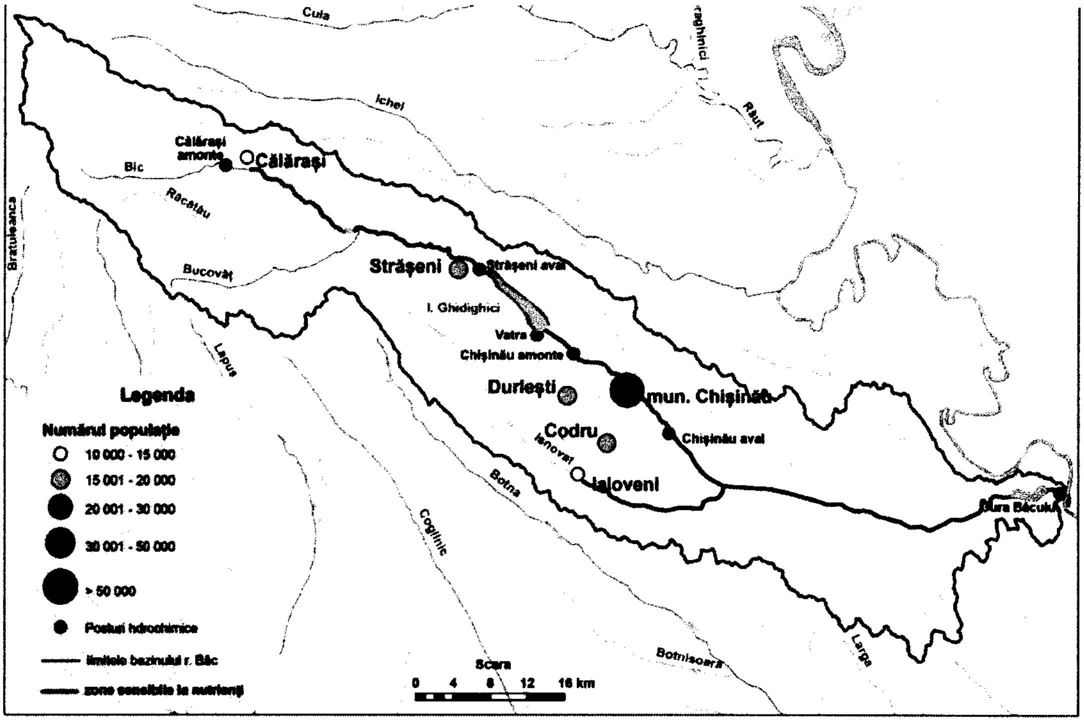


Figure 62. Zones sensitive to nutrients in the BASIN hydrographic of the Bâc river

Monitoring quality Bâc river water is carried out systematically in 6 sections as follows: or . _ Călăraşi (upstream), town Străseni (downstream) , the reservoir Ghidighici (or. Vatra), municipality . Chisinau (upstream and downstream) and the village of Gura Bicului. For the section upstream of Calarasi, riding established a surveillance program _ with the quarterly investigation quarterly of the Physicochemical parameters, whereas in the period warm of the year r. Bâc , on this section , remains without water due to irrigation canals _ and dams. _ For other sections was _ established an operational monitoring program with the frequency of 4 times/year of the conditions general, pollutants specific and substances _ priority. Data analyzed from monitoring sections _ prove that _ parameters causes of eutrophication - nitrogen and phosphorus, exceed the limits in the monitoring sections _ downstream of the discharge water used from SEAU (tab. 37). This refers especially at SEAU Chisinau, where downstream of the discharge used water (or . Singera), the concentration of nitrogen is higher than the permissible limit by 5 times, and of total phosphorus by more than 20 times.

Table 37.

Monitoring Sections Checklist for evaluation eutrophication and designation AREAS sensitive of r. Bâc

Parameter (*group*), Acronym, Unit of measurement	Average concentration (years 2015-2022) in monitoring sections					Limit concentration
	r. Bâc, or. Calarasi	r. Bâc, or. STRASENI	Lake Ghidighici, town Fireplace	r. Bâc, or. Bleed	Bâc r., Gura Bâcului village	
Category I - causal parameters - nutrients						
Mineral nitrogen, mg N/l	2.08	6.62	0.60	20.89	21.45	4.0
total phosphorus, mg P/l	0.818	1.82	0.673	2.46	2.73	0.2
Category II - response parameters - direct effects on algae and plants						
Saprobic index according to Pantle and Buck, Phytoplankton	2.17	2.5	2.25	2.7	2.6	2.0
Phytoplankton - biomass, mg/l	-	-	16.2	-	-	1.5
Chlorophyll-a, µg/l	18.9	20.8	8.30	3.6	3.6	20
bacterioplankton , mln . cel/ml	-	0.30	0.54	4.61	2.22	2.0

bacterioplankton , thousands. /ml at 22 ^{o}C	-	2.59	8.58	72.94	35.18	2.5
Category III - side effects and other indirect effects						
Dissolved oxygen, mg O_2 /l	8.26	4.21	10.78	2.04	2.54	<7
Oxygen saturation, %	68.9	36.8	102	19.5	24.5	<80%
Biochemical oxygen consumption (5 days), CBO_5, mg O_2/l	3.90	12.34	3.12	15.85	15.37	5
Chemical consumption of oxygen with dichromate, CCO_{Cr}, mg O_2/l	35.78	47,28	32.47	60.19	63,66	15

6.4. Nitrate Vulnerable Areas

Vulnerable areas to nitrates according to HG 736/2020 are the areas that contribute to the pollution and eutrophication of surface waters and the pollution of groundwater with nitrates from agricultural sources, being represented by the lands that supply:

1) fresh surface waters, especially those that serve or are intended to collect drinking water, that contain or risk containing a concentration of nitrates over 50 mg/l NO_3 (11.3 mg/l N);

2) groundwater that has or risks having a nitrate content of more than 50 mg/l NO_3 (11.3 mg/l N);

3) natural fresh water lakes, other fresh water masses that are subject or at risk in the future to be subject to eutrophication and that lead to nitrate pollution from agricultural sources.

Three types of vulnerable areas can be identified:

a) Potentially vulnerable areas: the conditions for the transfer of nitrates to water bodies are favorable, but there is no positive nitrogen balance at the locality level and the concentration of nitrates in groundwater is below 50 mg/l.

b) Vulnerable areas with current sources: the conditions for the transfer of nitrogen compounds to water bodies are favorable and there is a positive nitrogen balance at the locality level.

c) Vulnerable areas with historical sources: the conditions for the transfer of nitrogen compounds to water bodies are favorable, there is no positive nitrogen balance at the level of the locality, in the past there were animal husbandry complexes on the territory of the locality and the concentration of nitrates in the measured groundwater exceeds the value of 50 mg/l.

All land on the territory of the country that pollutes fresh surface water (especially intended for drinking water), underground water, natural fresh water lakes, other fresh water masses with nitrates from agricultural sources in concentrations are designated as nitrate-vulnerable areas higher than 50 mg NO_3/l (11.3 mg N/l) and / or contribute to the occurrence of eutrophication .

As a result of the analysis of the monitoring data of the Environment Agency, it was found that in the surface waters there are no exceedances of the $NO_{3\ concentration}$ higher than 50 mg/l. In the case of underground water bodies, essential exceedances are recorded in the case of the Holocene alluvial-deluvial aquifer (phreatic waters), on an area of approximately 41% of the country's territory (fig. 63).

Thus, in the case of the mentioned aquifer, 2 Nitrate Vulnerable Zones were identified:

- the upper course of the Cubolta river basin located in the north of the country;
- the central part of the country (based on the Codrilur Plateau).

from agricultural activities was developed , which contains provisions regarding:

- the periods when the application of fertilizers to the soil is contraindicated;
- the particularities of soil application of fertilizers on steeply sloping land;
- the method of soil application of fertilizers on water-saturated, flooded, frozen or snow-covered land;
- conditions for soil application of fertilizers near watercourses;
- the construction and capacity of manure storage containers, including measures to prevent water pollution from rainwater sources and infiltration into groundwater and surface water of liquids containing manure and effluents from stored plant material;
- the conditions for the application of chemical fertilizers and manure to the soil, which will keep the loss of nutrients to the water at an acceptable level;

- land use management, including the use of crop rotation systems and the ratio of land areas devoted to perennial crops to those devoted to annual crops;
- maintaining an optimal amount of vegetation during rainy periods, which would absorb nitrates from the soil, thus preventing water pollution with nitrates;
- the development by individual agricultural households of fertilizer application plans and the record of fertilizer use.

The code is aimed primarily at farmers in areas vulnerable to nitrate pollution. Action programs are established for these areas, which include a series of measures to reduce water pollution with nitrates and which are mandatorily applied in designated vulnerable areas.

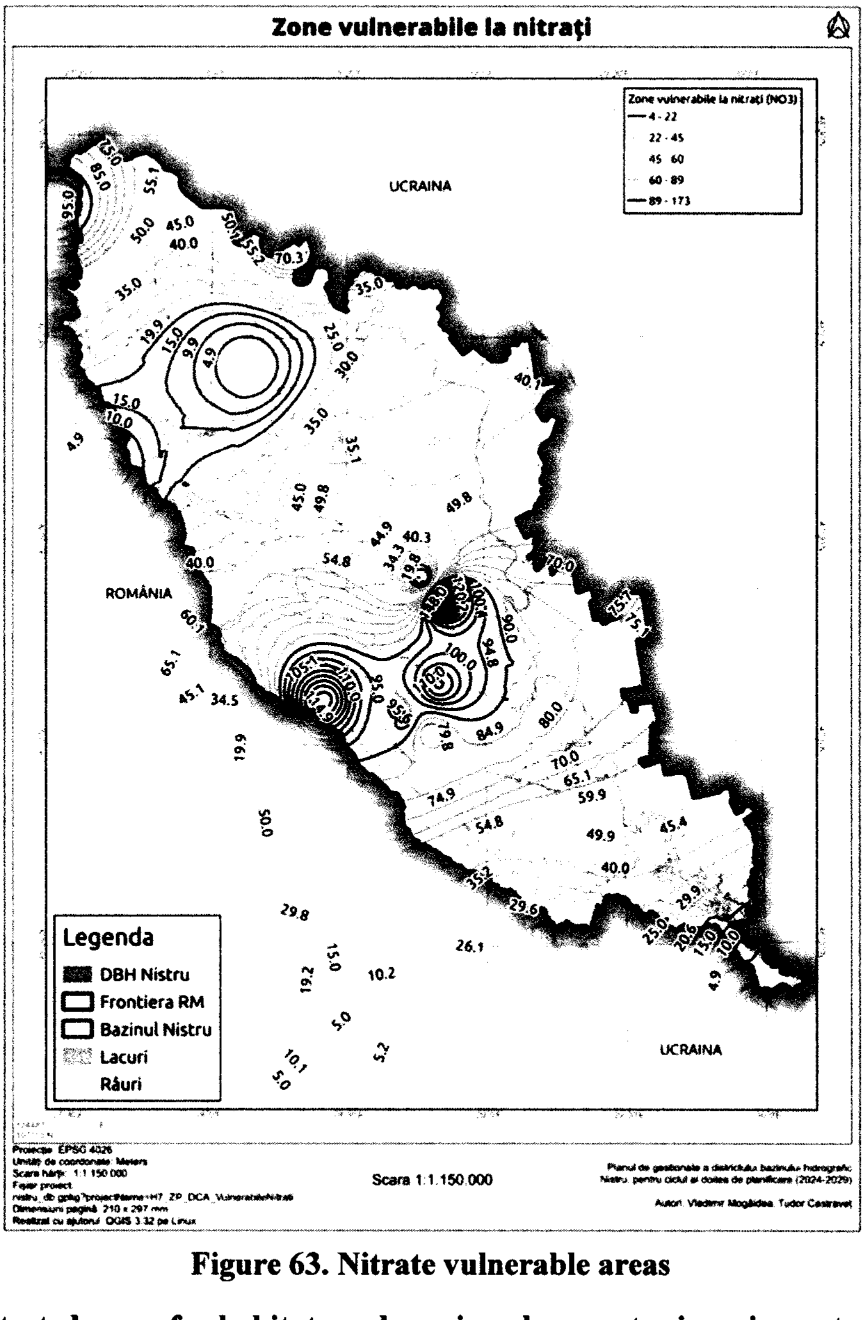


Figure 63. Nitrate vulnerable areas

6.5 . Protected areas for habitats and species where water is an important factor

Important areas for the protection of habitats (special conservation areas) or species (special protection areas) where the maintenance or improvement of water status is an important factor in their protection, including Natura 2000 sites (equivalent to the Emerald network for non-EU countries) , designated under the Habitats Directive 92/43/EEC and the Birds Directive 79/409/EEC. At the national level, they are identified according to Law no. 1538/1998 regarding the State Protected Natural Areas Fund. We mention the fact that through protected natural objects and complexes, a series of activities with a positive impact on the environment are implemented: preservation of the national gene pool ;

conservation of biological diversity and natural habitats; maintaining/restoring the ecological balance, the natural aspect of geographical landscapes, with the promotion of sustainable development of the environment.

The protected areas, due to the presence of a valuable biological diversity, with an important role in the conservation of habitats, species and landscapes, constitute **core areas of the National Ecological Network** (REN), an integral part of the pan-European ecological network. Among *the core areas of international importance of REN*, from the fl . Dniester we mention: *the core area Rudi-Arionesti; Sew; Cuciurgan ; Iagorlâc , etc.* At the same time, along fl . A series of core areas of national importance of the Dniester are located in the Dniester, which come to preserve the functionality of the geo- eco - systems in the region [5].

In the area of fl . Dniester, natural areas are of international interest due to the richness, uniqueness of habitats and rare species, included in:

Emerald sites (At 33 fords, Unguri – Holoşnita , Stâncile Dniester, Varancău Canyon , Climăutii de Jos, Poiana Curătura, Rezina, etc. , and in the Lower Dniester sector: Zolonceni , Dubăsarii Vechi, Telita Natural Protected Area, Hârbovăţ Forest, Lower Dniester etc.) [6];

Ramsar sites ("Hunguri-Holoşniţa" Wetland and "Lower Dniester" Wetlands).

The ecological network within the DBHN, made up of territories of habitats, landscapes and their elements, is important in the protection and conservation of biodiversity dependent on the water resource (fig. 64). According to the annexes of Law No. 94/2007 regarding the ecological network, within the DBHN are registered a series of natural habitats, with species of flora and fauna of European interest, the most representative (with an area of more than 1000 ha) being 15 sites (Codru, Unguri-Holoşnita, Codrii Orheiului, Bahmut-Hârjauca, Codrii Străsenilor, Lower Dniester, Stâncile Nistrene, Rezina, Stepa Balţului , Hârbovăţ Forest, Hânceşti Forest, Climăutii de Jos, Trebujeni protected natural area, Dubăsarii Vechi, Dobruşa).

In the same context, in the " **Reference list of habitat types of European interest for which Emerald sites have been declared** " from Law No. 94/2007 regarding the ecological network, within the DBHN a number of water-dependent habitats can be identified , the largest areas being located in the Lower Dniester site [7].

We mention the fact that on the territory of the Republic of Moldova, currently, 11 areas of avifaunistic importance are outlined , achieved by applying some quantitative ornithological criteria, regarding the sizes and trends of bird populations, and the protection status at international level. Within the DBHN, we list *7 **areas of avifaunistic importance*** (tab. 38).

Table 38.

Areas of avifaunistic importance within the Dniester DBH [8].

No. do	Code	Name	The surface, huh	Inclusion criteria
1.	001	Otaci-Holoşniţa (Dubasari basin)	1100	B2 (provides nesting and rearing habitats for aquatic species; presence *of Scolopacidae* and *Laridae* ; *Grus grus* , *Hieraaetus pennatus* , *Picus viridis*).
2.	005	Ghidighici basin	900	B1i (passage/stopping place for waterfowl).
3.	006	forests	5177	A1, B2, B3 - the presence of many globally threatened species, among which: *Aquila clanga* (multiplication), *Crex crex* (breeding) and Lanius minor (breeding). Eighteen species with an unfavorable conservation status at the European level occur in the region, out of a total of 150 sp.
4.	007	Goeni Bay	1500	B1i (provides breeding and passage/stopover habitats for waterfowl).
5.	008	Lake Salas	330	B1i (provides breeding and passage/stopover habitats for waterfowl).

[5] The law No. 94 from 04-05-2007 regarding the ecological network . https://www.legis.md/cautare/getResults?doc_id=133945&lang=ro#

[6] Convention of Conservation of European Wildlife and Natural Habitats . Emerald Network Reference Portal. https://www.coe.int/en/web/bern-convention/emerald-network-reference-portal

[7] Emerald - Standard Data Form . The Lower Dniester. https://natura2000.eea.europa.eu/Emerald/SDF.aspx?site=MD0000013

[8] Heath, MF, Evans, MI, Hoccom , DG, Payne, AJ and Peet, NB (eds) (2000) Important Bird Areas in Europe: priority sites for conservation. Volume 1: Northern Europe, Volume 2: Southern Europe. Cambridge, UK: BirdLife International. http://datazone.birdlife.org/userfiles/file/IBAs/EuCntryPDFs/IBA2000Vol2pp439-444_MD.pdf ..

6.	009	Copanca-Talmaza	6000	B1i (provides breeding and passage/stopover habitats for waterfowl).
7.	010	Cuciurgan basin	6400	A1, B1i, B2, B3 (provides breeding and passage/stopover habitats for waterfowl. The following 8 globally threatened species are recorded in this area: *Phalacrocorax pygmeus* (no breeding), *Anser erythropus* (passage), *Branta ruficollis* (passage), *Aythya nyroca* (growth), *Haliaeetus albicilla* (passage), *Aquila clanga* (passage), *Crex crex* (multiplication) and *Gallinago media* (passage).

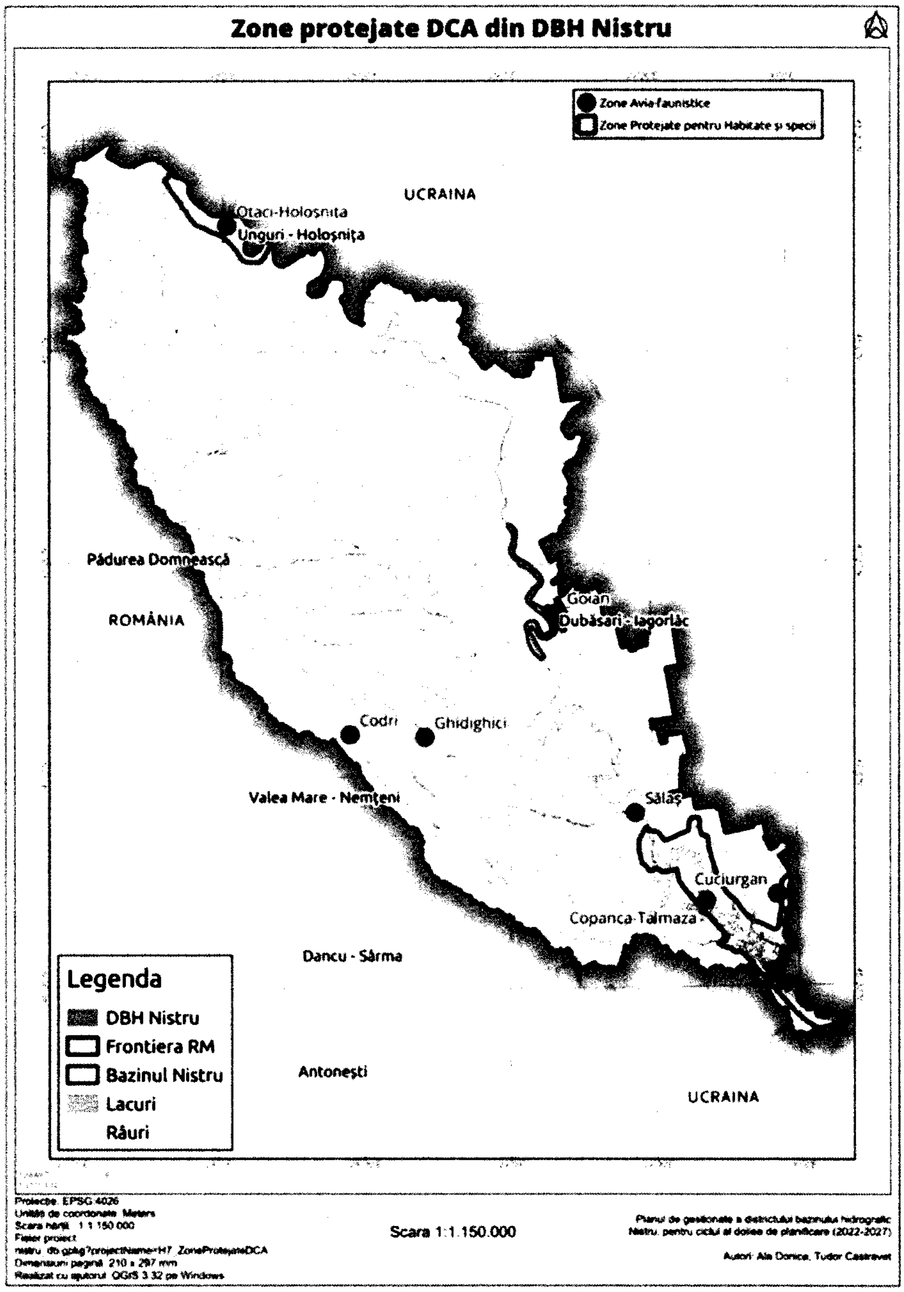


Figure 64. The most representative territories/areas dependent on water within DBHN

6. Environmental objectives (general)

In accordance with Art. 38 of the Water Law no. 272/2011, the environmental objectives for water are established with reference to the chemical and /or ecological state and /or to the quantitative state of surface waters , underground waters and protected areas.

Surface water is determined by its ecological and chemical state. Ecological status means the quality of the structure and functioning aquatic ecosystems associated with surface waters , and the chemical state of surface waters means the state generated by the concentration of pollutants in surface waters.

Groundwater quality is determined by the quantitative and chemical state of a body of water. The quantitative status represents the degree of damage to a body of underground water by direct and indirect captures.

D BHN Management Plan is to improve and maintain the ecological status of water resources, as well as their proper management under drought and flood conditions in the said basin district.

The general objectives are set to reduce the pollution of water resources and improve the health of the population, achieve a "good ecological" status of water intended for human consumption, protect water resources, reduce the pressures generated by hydromorphological alterations and adapt to climate change, improve the integrated management of the management water resources, including during periods of drought and floods, improving the status of the water resource as a primary factor.

Achieving good ecological status and good chemical status of surface water bodies are established according to the category of surface water body, respectively: natural water bodies (rivers , lakes), heavily modified water bodies (rivers , lakes accumulation, heavily modified natural lakes) and artificial water bodies.

Based on the identified pressures (in chapter 3), of the 95 bodies of surface water, 14 bodies (312 km) can reach good chemical and /or ecological and /or quantitative status in the next implementation cycle (until 2029), 29 bodies (754.4 km) - until 2035 and 52 bodies - until 2041 (1876.2 km) (fig. 64).

The environmental objectives for the status of groundwater bodies involve achieving good quantitative status and good qualitative (chemical) status and guaranteeing its non-deterioration. The environmental objectives represented by "good condition" from a qualitative point of view are defined by the threshold values established at the level of underground water bodies in the Republic of Moldova and which were approved by GD no. 931 of 20.11.2013 for the approval of the Regulation on the quality requirements of underground water.

In the case of groundwater, achieving/maintaining good status involves meeting a series of "conditions" defined in Annex V of the Water Framework Directive. Additional conditions for chemical status and assessment procedures are developed in the Groundwater Directive (Directive 2006/118/EC), as well as in the guidelines developed at the level of the Common Strategy for the Implementation of the WFD.

Groundwater bodies are classified into two classes, good and unsatisfactory, for both quantitative and chemical status. For the underground water bodies within the DBHN, environmental objectives have been established which can be found in tab. 38. It should be borne in mind that the dynamics of underground water is much slower than that of surface water, which is why the implemented measures make their effects felt after a longer period of time. The Water Framework Directive provides for groundwater and "preventing or limiting" the discharge of pollutants, as well as taking measures to reverse any significant and sustainable trends of increasing pollutant concentrations.

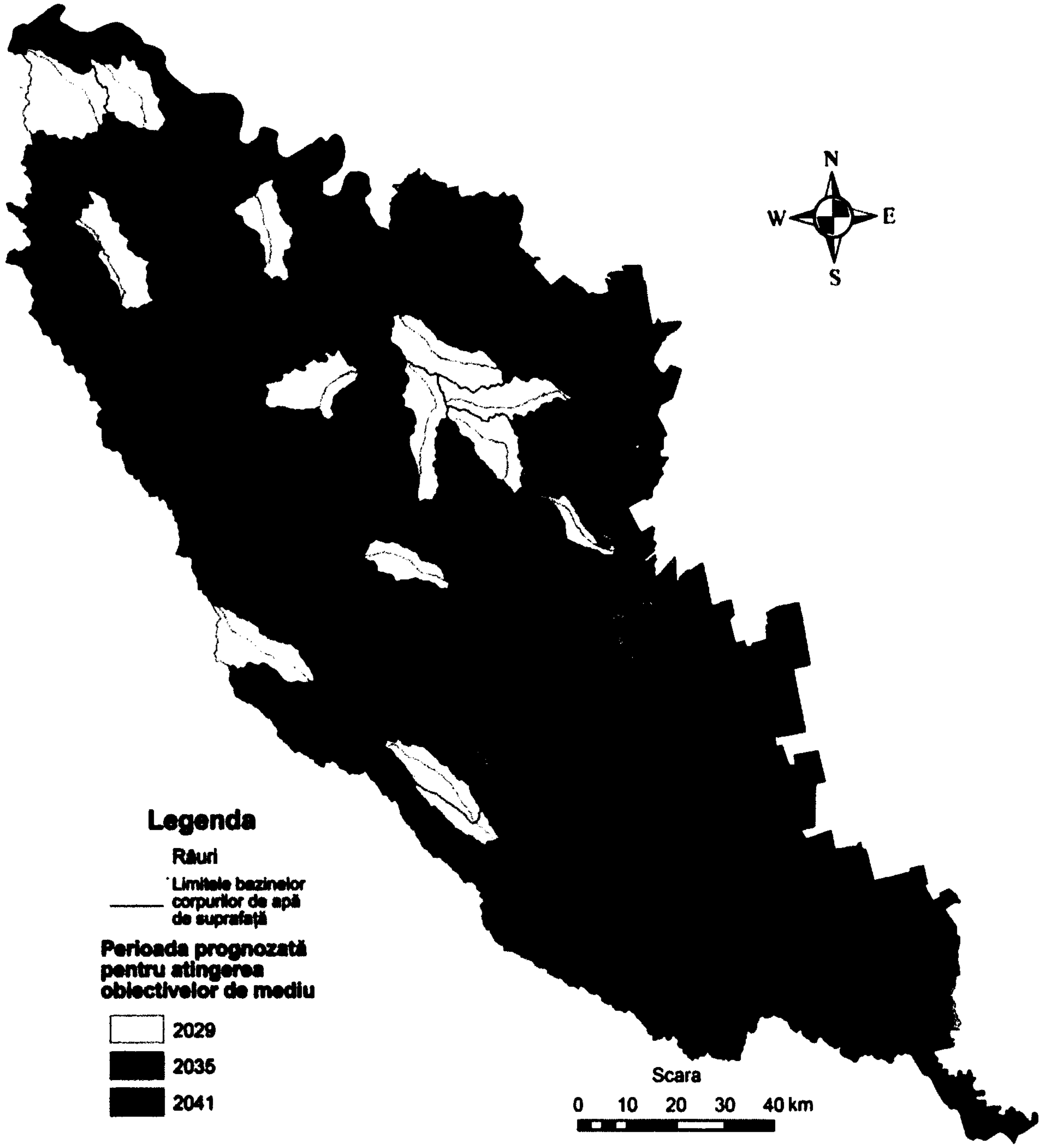


Figure 64. REACHING environmental objectives _ for surface water bodies _ _

For the underground water bodies within the DBHN, environmental objectives were established which can be found in table 38.

Table 38.

The environmental objectives set for groundwater bodies within the DBHN

Name of the groundwater body	CAS code	Classification of the body of water according to:	
		General qualitative condition	The environmental objective
Alluvial-deluvial aquifer horizon a,adA $_3$, Holocene	**MDNSGWQ110**	**Good for the Dniester river , unsatisfactory for small rivers**	"prevention or limitation" of pollution
The aquifer complex of the Pliocene-Pleistocene aN $_{2}$-aA $_{1+2}$	**MDNSGWQ210**	**Unsatisfactory**	"prevention or limitation" of pollution

The aquifer complex of the Upper Sarmatian-Meotian N_1s_3-m	**MDNSGWD410**	Hi	ensuring a balance between the volumes of captured and restoration waters
The aquifer horizon of the middle Sarmatian clayey sand formation "Codrii) N_1s_2-kd	**MDNSGWQ510**	**Unsatisfactory**	protect, improve and restore
Middle Sarmatian aquifer horizon N_1s_2(sand)	**MDNSGWD610**	Hi	ensuring a balance between the volumes of captured and restoration waters
Badenian -Sarmatian aquifer complex N_1bs_1	**MDNSGWD710, MDNSGWD7 20**	Hi	ensuring a balance between the volumes of captured and restoration waters
The Silurian-Cretaceous KS aquifer complex	**MDNSGWD81 0**	Hi	ensuring a balance between the volumes of captured and restoration waters
Vendian-Rifeic VR aquifer complex	**MDNSGWD91 0**	Hi	ensuring a balance between the volumes of captured and restoration waters

The environmental objectives for protected areas involve ensuring compliance with all the standards and objectives provided for in the legislation in the field, as follows:

- the protection of the quality of the water used for the capture for drinking purposes and the reduction of the level of treatment required for the production of drinking water by establishing specific norms/standards for the quality parameters/indicators - *areas designated for the capture of water for the use for drinking purposes* .
- the protection and improvement of the quality of those freshwaters that support or could support ichthyofauna - *areas designated for the protection of economically important aquatic species* .
- the conservation of natural habitats, species of wild flora and fauna and all species of birds, which are found in a wild state on the national territory and which are related to water bodies, taking into account the specific objectives for the protection of water-dependent species and habitats - *areas intended for the protection of habitats or species where the maintenance or improvement of water status is an important factor for their protection, including Natura 2000 sites* .
- reducing water pollution caused by nitrates from agricultural sources, preventing nitrate pollution, rationalizing and optimizing the use of chemical and organic fertilizers containing nitrogen compounds - *areas vulnerable to nitrates* . The action program applying to the designated areas and will include the measures provided for in the Code of Good Agricultural Practices.
- protecting the environment from damage caused by urban wastewater discharges - *nutrient sensitive areas* . The action program applying for the designated areas and will include in particular actions to improve the wastewater treatment system.
- preserving, protecting and improving the quality of the environment, as well as protecting people's health, through an appropriate management of the quality of bathing waters - *bodies of water designated as waters for recreational purposes, including areas designated as bathing waters* .

7. Economic analysis of the use of water resources

7.1. The legal and institutional framework of water use and protection

The national legislative basis regarding the use and protection of water resources is the Water Law, which is adapted and reflects, for the most part, the rules established by several Directives of the European Union, the basic ones being: Water Framework Directive (2000/60/EC), Directive on the treatment of urban waste water (91/271/EEC), Directive on the assessment and management of flood risks (2007/60/EC), Directive on the protection of waters against nitrate pollution from agricultural sources (91/676 EEC), Directive on the management of bathing water quality (2006/7/EC). Thus, among the common objectives of Directive no. 2000/60/EC and the aforementioned law, a primary role belongs to the development of watershed management plans.

Also, the normative-legislative framework for the use and administration of water resources is also stipulated in: Law no. 272- XIV of 10.02.1999 regarding drinking water; Law no. 1102 of 06.02.1997 regarding natural resources; The law regarding the protection zones and strips of river waters and water basins; Law no. 303 of 13.12.2013 regarding the public service of water supply and sewage; GD no. 199 of 20.03.2014 regarding the approval of the Water Supply Strategy and sanitation (2014 – 2028); The environmental strategy of the Republic of Moldova; Title VIII of the Fiscal Code regarding taxes for the use of natural resources; Law on environmental impact assessment; the methods for assessing the damage caused to the waters approved by the central environmental authority.

7.2.Water catchment

The volume of water captured and used is conditioned by the demand for water, the available water resources, as well as the capture, transport, water treatment and water use. Surface water resources vary considerably depending on the amount and annual course of atmospheric precipitation, especially during the period of active vegetation, with maximum water consumption for agricultural purposes. Groundwater reserves, in turn, vary depending on the geological and geophysical characteristics of the phreatic and deep aquifer layers, the amount of stored water and its physical -chemical composition in relation to the requirements for drinking or technical water used in various social activities - economic. Water demand and consumption are determined by the number and sizes of urban and industrial centers, agricultural households and monitored irrigated areas, rural localities with extensive functional aqueducts [9]. The official data are also considerably influenced by the level of water records by primary users and the transmission of information on water management indices (Form 1 water) to the statistical authorities and the "Moldova Waters" Agency.

According to the data of the "Apele Moldovei" Agency, in the period 2010-2022, in DBHN, the total volume of captured water was, on average, 810 million m^3, or ≈96% of the total volume of captured water in the Republic of Moldova, thus having the biggest contribution in the Republic's water supply. On average, 212 million m^{3} of water were captured from the Dniester river bed . Also, in the Răut hydrographic basin (BH), on average, 15.3 million m^{3} or 10% of the water captured in the DP of the DBHN were captured , including 4.9 million m^3 from the bed of the Răut river . In BH Bâc, 7.4 million m^{3} (about 5%) were captured , and in BH Botna – 2.4 million m^3 or 1.6% of the water captured in PD of DBHN.

The largest volume of water is captured in the Transnistrian Development Region (DR) (including the municipality of Bender) - about 689 million m^3 of water, which constitutes 85% of the total volume on DBHN (fig. 65). In the right side (PD) of the DBHN, on average, 122 million m^3 were captured , or only 15% of the total volume of water captured in the DBHN (fig. 36), including 75 million m^3 in the municipality of Chisinau. Over 90% of the total volume of water captured in the municipality is captured from the Dniester River at the Vadul lui Vodă station. In the riparian districts, on average,

[9] Bacal P., Lozovanu D. (coord.). Development Region _ Center . Geographical , socio-economic aspects and ecological . Chisinau : Dira Ap , 2020. p. 31.

34.8 million m^3 or 28% were collected , and in the rest of the districts in the PD of DBHN – 11.6 million m^3 or 9% of the total volume of water captured in the PD of DBHN (fig. 66).

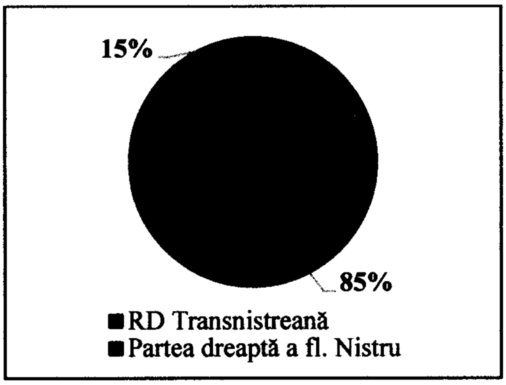


Fig. 65. The share of regions in the total volume of water captured in DH Dniester

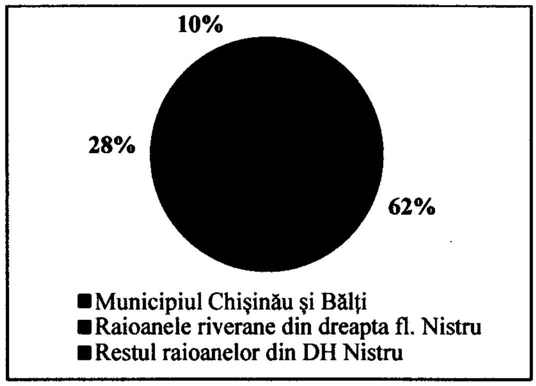


Fig. 66. The share of sub-regions in the total volume of water captured in PD of DH Dniester

Data source: Moldova Water Agency. Annual generalized reports on water use in the Republic of Moldova

In the year 2022, in the PD of DBHN, the largest volume of water is also captured in the municipality of Chisinau – 68.6 million m^3 of water or 54% of this region and approximately 8% of the water captured in the entire district (within the limits of the Republic of Moldova). Also, a large volume of captured water is registered in the Soroca district (15.3 million m^3 of water), which, by the way, is not a major water consumer, but here it is located by the company SA Acva Nord which managed the water collection station located upstream from the municipality of Soroca. Through the main aqueduct Soroca-Bălţi, the water captured at Soroca is delivered to the municipality of Bălţi, as well as to water supply companies and industrial enterprises in the localities, mainly urban, located in the vicinity of the respective aqueduct. Other river districts with a significant volume of captured water should also be noted, such as Anenii Noi (6.4 million m^3), Criuleni (5.4 million m^3), Orhei (4.3 million m^3) and Floreşti (2.7 million m^3), as well as in the districts of Drochia (2.5 million m^3) and Străseni (2.1 million m^3). The minimum volume of water captured in the Dniester DH can be seen in the smaller districts (Donduşeni, Rezina, Şoldăneşti), as well as in most of the districts partially included in the district, such as the districts of Râşcani (800 thousand m 3), Ocniţa (756 thousand m^3) and Făleşti (320 thousand m^3), as well as in smaller districts (fig. 67).

According to the Moldavian Water Agency, in 2022, 1,706 primary water users were registered in the Dniester DH (table 39), which represents 67% of the total number in the Republic. In the Dniester river bed, 711 beneficiaries or 42% of the Dniester DH were registered, including only 48 users (3%) up to the city of Soroca; 231 users from the city of Soroca to the city of Dubăsari (14%); 266 users from the city of Dubăsari to the city of Bender and 166 beneficiaries from the city of Bender to the mouth of the river Dniester.

Table 39. The volume of captured water (mil. m^3) according to the sources of origin and the share (%) of the Dniester DH and the total volume of captured water in the water administration sectors , year 2022

Water management sectors	The number of water beneficiaries		Total captured water		From surface sources		From underground sources	
	unity	%	million m^3	%	million m^3	%	million m^3	%
DH Dniester	**1706**	67	812	96	704	87	107	13
bed fl . Dniester	711	42	*213*	26	141	66	72	34
to the city of Soroca	48	3	15	2	14	96	0.7	4
to the city of Dubăsari	231	14	34	4	17	50	17	50
to the city of Bender	266	16	129	16	98	76	31	24
to the mouth fl . Dniester	166	10	606	75	572	94	34	6
BH Bad	495	29	16	2	2	12	14	88

BH Bac	420	25	8.3	1	0.9	11	7.4	89
BH Botna	80	5	2.8	0.3	0.4	14	2.4	86
Republic of Moldova	**2548**	**100**	**845**	**100**	**715.81**	85	**129.11**	15

Data source: Moldova Water Agency. The generalized report "Water use in the Republic of Moldova" year 2022

Figure 67. Share of water catchment sources in DBH Dniester (average 2010-2022)

The maximum number of beneficiaries is attested in BH Răut (495) and Bâc (420). This is justified by the fact that within their perimeter are located the municipalities of Chisinau and Bălţi, several cities with a large number of industrial enterprises, each with its own water supply, and numerous agricultural enterprises with massive water consumption, especially for irrigation and livestock complexes.

The maximum share (≥ 90%) of surface water catchment sources is found in the northern extremity (from Naslavcea to Soroca) and in the southern extremity (from Bender to the mouth) of the Dniester River course on the territory of the Republic of Moldova (fig. 68). The detached share of surface sources in the northern extremity is due to the water pumping stations operated by SA Acva Nord, located upstream of the city of Soroca (in Cosăuţi).

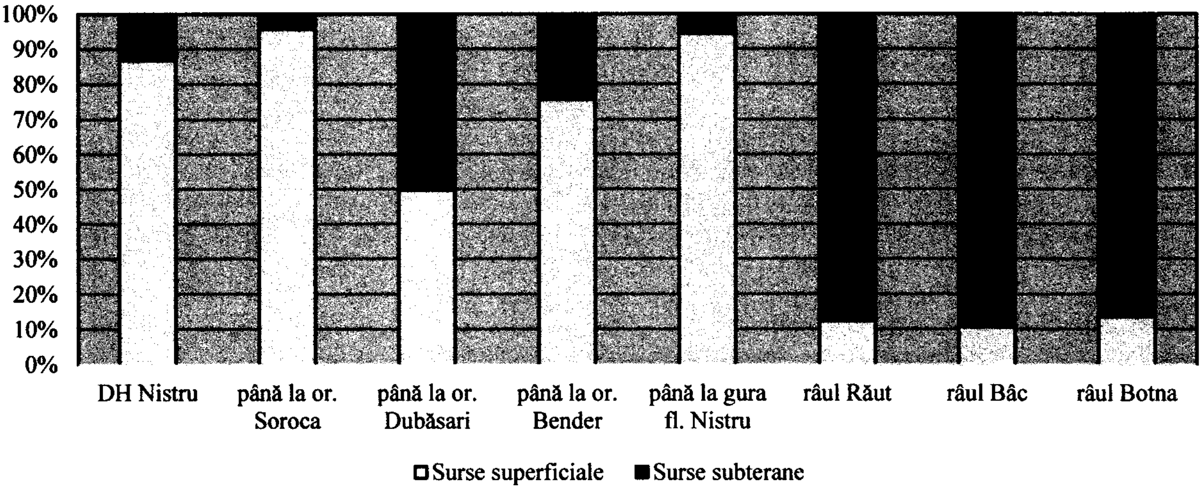


Fig. 68. The **share** (%) **of the sources of origin in the total volume of captured water in the water administration sectors of the Dniester DH**

Data source: Moldova Water Agency. The generalized report "Water use in the Republic of Moldova" year 2022

Also, the maximum share of surface sources in the southern extremity is due exclusively to the CET in the city of Dnestrovsk, which is supplied with technological water from the reservoir located on the side of the Dniester River course. The maximum volume of water collected at the Dnestrovsk CTE (553 million m^3) determines the detached predominance of surface sources both in the Dniester DH and in the Republic. In addition, the high share (76%) of surface sources in the sector between the Dubăsari reservoir and the city of Bender (fig. 68) is caused by the water supply from the Dniester river bed to the municipality of Chisinau and the large agricultural enterprises in that sector. At the same time, in the basins of the main right-hand tributaries of the Dniester River (Răut , Bâc, and Botna), underground sources predominate both for the water supply of the population and agro-industrial enterprises.

In the years 1990-2000, as a result of the deep socio-economic crisis, which marked, in particular, the agricultural and industrial enterprises, large consumers of water, there is a reduction of about 4 times in the total volume of captured water [10]or from ≈ 3.5 billion _ m^3 up to ≈870 million m^3, inclusive of the volume of water captured from surface sources - 4.4 times (≈3.3 billion m^3 to approx. 730 million m^3), and of the volume of water captured from the Dniester river bed was reduced from 760 million m^3 to 168 million m^3 .

[10]GD no. 814 of 17.10.2017 regarding the approval of the Management Plan of the Dniester hydrographic basin district (table 9 developed based on the data of the "Apele Moldovei" Agency). In: Official Gazette no. 371-382 of 27.10.2017.

In the period of 2010-2020, the total volume of captured water has an oscillating evolution, being influenced by the evolution of the data from the Transnistrian DR, which are almost constant throughout the analyzed period, with the exception of Râbniţa, which would not correspond to reality, given the significant reduction in the volume of industrial and agricultural production, as well as the number of the population.

On the right side of DH Dniester, the volume of water captured is also fluctuating, however, it is largely influenced by the economic evolution and weather-climatic peculiarities, having a general negative trend with maximum increases in dry years such as 2016, 2020 and 2022. The most significant reduction can be seen in the districts of Soldăneşti, Făleşti, Căuşeni and the municipality of Bălţi (by over 30%), including in the municipality of Chişinău – by 19%. At the same time, there is a significant increase in the volume of water captured in the riparian districts: Criuleni (2.7 times), Dubăsari (2.3 times) and Anenii noi by 1.9 times, this increase is largely due to the increase the demand for water for irrigation due to the frequent droughts during the analyzed period, the increase in access to the aqueduct, but also the higher technical capacities for capitalizing on water sources for irrigation compared to the other districts.

Due to the drought of 2022, a significant positive increase in the volume of water captured from surface sources was recorded in many districts , among which the districts of Criuleni (almost 7 times), Dubăsari (3.7 times), Anenii Noi (2.87 times). Donduşeni (4.2 times) and Teleneşti (2.6 times) districts should also be mentioned, where the trend of increasing the volume of water captured was practically uniform. During the analyzed period, there was a drastic decrease in the volume of water captured from surface sources of over 90% in Făleşti and Şoldăneşti districts, including Râbniţa (57%) and Rezina districts by over 70%, also as a result of the decrease in the volume total water captured.

At the district level, the volume of water captured from underground sources was practically unchanged during the analyzed period, but at the level of districts and municipalities it varied considerably. An increase of about 1.5 times can be seen in the Drochia and Străseni districts, including the Ialoveni, Anenii Noi and Floreşti districts of almost 1.3 times, this being largely due to the increase in metered water consumption due to access to centralized supply systems with water. The most significant decrease in the volume of captured water can be seen in the municipalities of Chisinau (40%) and Bălţi (30%), both due to the decrease in the total volume of captured water and the increase in technical capacities for the exploitation of surface water .

7.3.Use of water resources

According to the data of the Moldovan Water Agency, during the analyzed period (2010-2022), ***the total volume of water used in*** DBHN was, on average, 756 million m ^{3} or 97% of the total volume of water used in the Republic of Moldova. In the left side (PS) of the DBHN [11]were used, on average, 669 million m ^{3} or 88% of the DHBN, and in the right side (PD) of the DBHN [12]– only 86.9 million m ^{3} (12%), of which 47.5 million m ^{3} (55%) in the municipality of Chisinau and 23.8 million m ^{3} (27%) - in the river districts. The volume of water used is conditioned by the number and sizes of urban and industrial centers, rural localities with extensive functional aqueducts, as well as monitored irrigated areas. In PS of DBH Dniester, the maximum volume of water used is recorded in the cities of Dnestrovsk (555 million m ^{3}), Tiraspol (22.1 million m ^{3}), Bender (21.7 million m ^{3}) and Râbniţa (13, 3 million m ^{3}), and an average volume - in the cities of Grigoriopol (4.4 million m ^{3}), Dubăsari (2.9 million m ^{3}) and Slobozia (2.8 million m ^{3}). In the PD of DBH Dniester, the maximum volume of water is used in the municipalities of Chisinau and Balti (4.8 million m ^{3}), and an average volume - in the districts of Anenii Noi (4.0 million m ^{3}) and Orhei (3.9 mil. m ^{3}), Criuleni (2.5 mil. m ^{3}), Soroca (2.4 mil. m ^{3}) and Ialoveni (each 2.4 mil. m ^{3}), Floreşti (2.2 mil. m ^{3}) , Drochia, Dubăsari and Cauşeni (2.0 million m $^{3\ each}$). The minimum volume of ae attests in the smaller districts (Donduşeni, Rezina, Şoldăneşti, Camenca), as well as in the districts partially located within the limits of the Nistru DBH (Ocniţa, Râşcani, Făleşti, Ştefan Vodă), where the irrigation infrastructure is massively damaged.

Cuciurgan reservoir . On average, 162 million m ^{3} or only 21% of the total volume of water used in DHBN were used from the Dniester river bed. Also, in BH Răut , on average, 13.7 million m ^{3} or 12% of the total volume of water used

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[11]Including the village Benrer from the right side Dniester , which is part of Transnistrian DR

[12]Including the villages in the Dubăsari district on the left side of the Dniester subordinated to the Chisinau authorities

on the right side of the Dniester river, including from the Răut river bed – 4.2 million m [3] were used (3.7%). In BH Bâc (without the municipality of Chisinau) 6.4 million m [3] (5.7%) were used on average , and in BH Botna – 2.3 million m [3] (2.1%).

Table 40 **The volume** (mil. m [3]) of water used **and the weight of the categories of use by hydrographic sub-basins in the Dniester DBH** , average 2010-2022

Hydrographic basins	total			HOUSEHOLD		technology		agriculture					
								total		irrigation		Other agricultural uses	
	million m³	%	%	million m³	%	million m³	%	million m³	%	million m³	%	million m³	%
DBH Dniester	**756**	**97**		**108**	**14**	**579**	**77**	**66.7**	**8.8**	**40.9**	**5.4**	**25.8**	**3,4**
Dniester river bed	162	21		98	61	22.1	14	41.3	26	35.2	22	6.0	3.7
Raut	13.7	1.8	12	2.7	20	1,2	8.5	9.9	72	1.6	12	8.3	60
Bad bed	4.2	0.5	3.7	1.5	35	0.6	15	2.1	50	0.5	11	1.6	38
Bic	6.4	0.8	5.7	2.1	33	1,2	18	3.2	49	0.2	3.5	2.9	46
Buttock	2,3	0.3	2.1	0.3	15	0.1	4.1	1.8	78	0.3	14	1.5	64
PD DBH Dniester	**87.1**	**11**	**78**	**48.0**	**55**	**11.5**	**13**	**27.3**	**31**	**8.3**	**9.5**	**19.0**	**22**
PS DBH Nitsru	**669**	**86**		**59.9**	**9.0**	**568**	**85**	**39.4**	**5.9**	**32.6**	**4.9**	**6.8**	**1.0**
Total R. Moldova	**781**			**113**	**15**	**581**	**74**	**83.2**	**11**	**44.1**	**5,6**	**39.1**	**5.0**

Data source : Moldova Water Agency

3 or 88% of the total volume was used from ***surface sources*** in the DHBN , including 99.0 million m [3] (15%) from the perimeter of the Dniester River bed. From ***underground sources*** in DHBN were used, on average, 94.3 million m [3] or only 12% of the total volume of water used in DBH Dniester. At the same time, underground sources prevail separately in the basins of the main tributaries of the fl . Dniester, as well as in the absolute majority of localities, districts and cities on both banks of the Dniester, with the exception of the cities of Dnestrovsk, Chisinau and Balti, the districts of Soroca, Dubăsari, Anenii Noi and Ştefan Vodă.

The share of water use categories in DHBN is almost identical to that at the level of the Republic, and their values are mainly conditioned by those of the Transnistrian Development Region (DR), where a much higher water consumption is attested and detached prevails (85%) technological uses. Thus, in DHBN (fig. 69.a), for technological purposes, on average, 579 million m [3] or more than ¾ (77%) of the total volume of water used, for domestic purposes - 108 million m [3] were used (14%), and for agricultural purposes - only 66.7 million m [3] (8.8%), including for irrigation - 40.9 million m [3] (5.4%). Also, over 60% of the water from the Dniester river bed is used for household purposes, especially for the water supply of the municipalities of Chisinau and Balti.

[3] or 55% were used for household purposes from the total volume of water used (fig. 69.b). This fact is conditioned, to a large extent, by the municipality of Chisinau, where ≈80% of the total volume of water used for these purposes in the DP of DH Dniester was used for household purposes. In agriculture, on average, 27.3 million m 3 of water or 31% of the total volume were used , including for irrigation 8.3 million m [3] (9.5%), and for technological (industrial) purposes – 11.6 million m [3] (13%). In the municipalities of Chisinau and Balti, over 80% (41.7 million m [3]) were used for household purposes , for technological purposes – 19% (9.8 million m [3]), and for agricultural purposes – only 1.5 % (760 thousand m [3]). At the same time, in the districts of PD of DBH Dniester, on average, 26.6 million m [3] or more than ¾ of the total volume of water used were used for agricultural purposes

Water consumption for ***technological purposes*** is conditioned by the size and number of urban centers and industrial enterprises, by water consumption at the main industrial enterprises. Thus, of the approx. 579 million m [3] of water used for industrial purposes, 568 million m [3] or 98% are used by enterprises in the Transnistrian DR, including 553 million m [3] only at the Dnestrovsk CTE. The maximum volume of water used at the Dnestrovsk CTE determines the detached predominance of technological uses in the Republic of Moldova, despite its pronounced agrarian character. In addition, according to the data of the Statistical Service of Transnistria, in 2019, ≈300 million m [3] more than the amount indicated in the reports of the Moldavian Water Agency were used for technological purposes . A massive consumption of technological water can be seen in the cities of Tiraspol (3.5 million m [3]), Râbniţa (2.8 million m [3]) and Bender (1.7 million m [3]), which have a level of industrialization and a net higher water consumption compared to the cities on the right side of the Dniester. This fact is due to Soviet-era planning and the concentration of the most important heavy industry enterprises on the left side of the Dniester.

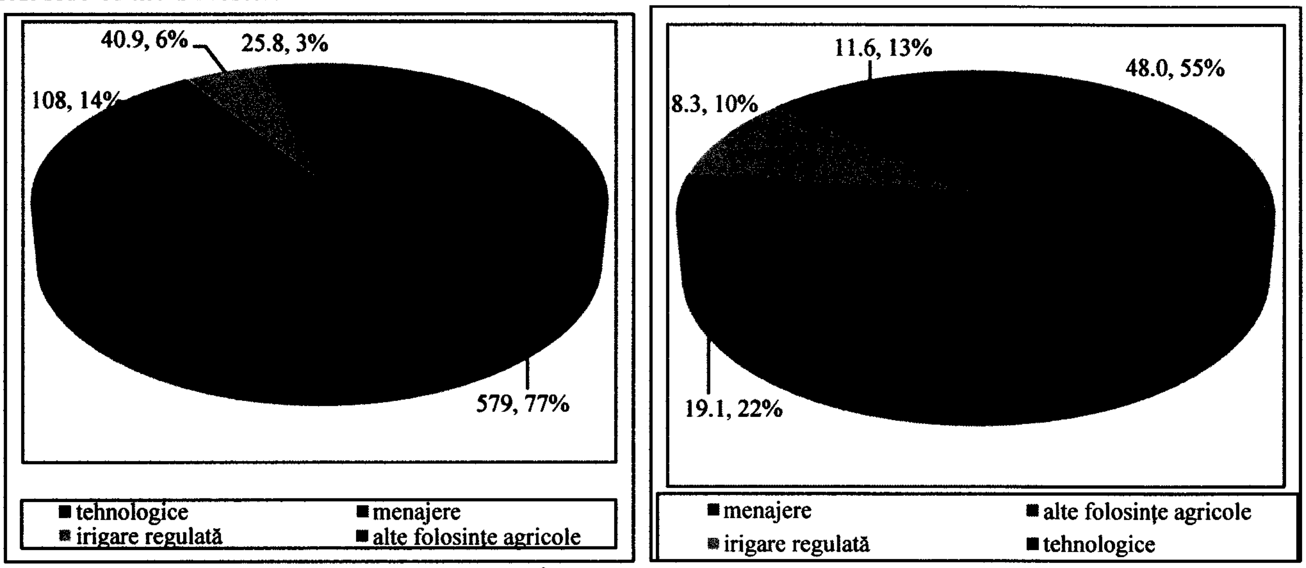

Figure 69. Volume of water used (mil. m ^{3}) and the share of use categories in DBHN (2010-2022 average)

a) DBH Dniester total b) PD of DH Dniester

The maximum share of water used for industrial purposes is observed in the cities of Dnestrovsk (99.6%), Râbnița (21%) and Tiraspol (16%), and in the DP of DH Dniester in the municipalities of Bălți (25%) and Chișinău (18%)), as well as in the more industrialized districts of Drochia (11%), Florești and Orhei (10%).

On average, 108 million m ^{3} or about 14% of the total volume were used for ***domestic purposes***, including ≈60 million m ^{3} (56%) on the left side and 48.0 million m ^{3} (44%) – in PD of DBHN. Household water consumption is conditioned by the size and number of urban centers and rural localities with extensive aqueducts subject to metering, as well as the number of the population with access to public aqueducts. In addition, in the Reports of the Moldavian Water Agency, only the water delivered to households in the urban environment is frequently assigned to the domestic use category, and the volume of water distributed by the operators of the public water supply systems in the rural environment is frequently indicated for agricultural use. This fact considerably reduces the share of household water uses in the districts.

Figure 70. Share of water use categories within DBHN limits, average of the years 2010-2022

In the PD of DBH Nistru, the maximum volume of water used for domestic purposes is observed in the municipalities of Chisinau (38.2) and Balti (3.5), and an average volume - in the districts of Orhei (947 thousand m ^{3}), Soroca (735 thousand m ^{3}), Florești (616 thousand m ^{3}), Ialoveni (663 thousand m ^{3}), with medium-sized urban centers. The minimum volume of water for household purposes is found in the districts, with smaller sizes and urban centers and/or which are partially located in the Dnistru river basin , including Șoldănești (58 thousand m ^{3}), Ștefan Vodă (66 thousand m ^{3}), Fălești (72 thousand m ^{3}), Telenești (110 thousand m ^{3}), Ocnița (128 thousand m ^{3}) and Dondușeni (130 thousand m ^{3}), the latter also having the least access to public aqueducts.

In the PS of DBH Dniester, the maximum consumption for household purposes in this region is recorded in the cities of Bender (19.9 million m ^{3}), Tiraspol (18.6 million m ^{3}), Râbnița (10.6 million m ^{3}) and Dubăsari (2.5 million m ^{3}), and the volume of water indicated in the Reports of the Moldavian Water Agency is almost constant throughout the analyzed period. At the same time, according to the Statistical Yearbook (2020) published by the Tiraspol authorities, the volume of water supplied to the population in this region has been reduced by more than 2 times and is 20.1 million m ^{3}, including in Tiraspol – 8.2 million m ^{3}, Bender – 4.3 million m ^{3}) and in Râbnița 2.5 million m ^{3}, which would correspond to the actual water consumption of the population in the respective region. A similar picture is emerging in the case of agricultural uses, especially for irrigation.

The maximum share of water used for domestic purposes is recorded in the municipalities of Chisinau (81%), Balti (72%), Bender (92%), Tiraspol (84%). A high share (<30%) is found in the districts in Călărași and Camenca districts, where spa resorts operate with a higher consumption of water (fig. 70).

For ***agricultural purposes , 66.7 million m*** ^{3} were used , which represents only 11% of the total volume of water used in the Republic, including 40.9 million m ^{3} (5.4%) – for irrigation. In the Transnistrian DR for agricultural purposes, 39.4 million m ^{3} or 59% of the total volume of water used for these purposes in DBHN and only 6% of the total volume of water used in the respective region were used, which is explained by the predominance absolute of industrial uses. In the PD of DBHN, in agriculture, on average, 27.3 million m ^{3} of water were used , including 25.7 million m ^{3} (31%), of which for irrigation – 8.3 million m ^{3} (10%). Despite the much lower weight compared to the industrial and domestic uses typical for urban spaces, agriculture predominates detachedly (with more than ¾) in the consumption of water resources in the absolute majority of districts. The volume of water used in agriculture, especially for irrigation, is conditioned by the available surface water resources, the flow of water courses and reservoirs, the level of records of water used in agriculture, as well as the technical-economic possibilities of water use by farmers. Therefore, the maximum volume of water used in agriculture is recorded in the river districts with direct access to the Dniester riverbed and located in the vicinity of the capital, including Anenii Noi (3.4 million m ^{3}), Criuleni (2.3 million m ^{3}), Orhei (2.1 million m ^{3}), Dubăsari (2.0 million m ^{3}), Soroca (1.8 million m ^{3}). The minimum volume is attested in the municipalities of Balti (160 thousand m ^{3}) and Chisinau (600 thousand m ^{3}), where household and industrial uses predominate, as well as in the smaller districts, with limited access to the Dniester River and partially located in the DBH Dniester

The maximum water consumption is recorded at large agricultural enterprises with a complex profile, especially when growing technical and fodder crops, vegetable crops, and the amount of water used depends not only on the need for water for agricultural purposes, but also on the current technical and financial capabilities of agricultural enterprises. The predominance of agricultural uses is evidenced in BH Botna (78%) and Răut (72%), where a greater share of water used for irrigation is also observed. Also, the greater share of household (33%) and industrial (18%) uses in BH Bâc is due to water captured from underground sources for the water supply of rural localities and some cities in the Chisinau municipality, Anenii Noi and Străseni districts . The share of industrial uses in BH Răut is, on average, 8.5%, including 15% in the perimeter of the bed of the Răut river (due to the cities of Bălţi, Orhei, Sângerea and Floreşti), and in BH Botna – only 4%.

For ***regular irrigation , on average, ≈41 million m*** ^{3} or 5.4% of the total volume were used , including in PS of DBH Dniester – 32.8 million m ^{3} (4.9%) and in PD of DH Dniester – 8.3 million m ^{3} (10%). In the riverine districts, on average, 6.7 million m ^{3} (28%) of the total volume of water used were used for irrigation , and in the rest of the districts in the Dniester DBH – 1.3 million m ^{3} (11 %). The relatively small volume of water used in irrigation is conditioned both by natural conditions (low flow and insufficient rainfall, increased risk of soil salinization), and by the technical -economic possibilities of using water for irrigation. Thus, the maximum consumption of water for irrigation is attested in the river districts on both banks of the Dniester in the sectors between the Dubăsari Reservoir and the mouth of the Dniester River, which have large capacities for capturing, transporting and using water for these purposes , including Grigoriopol (2.6 million m ^{3}), Anenii Noi (1.5 million m ^{3}), Dubăsari (1.4 million m ^{3}), Criuleni and Ştefan Vodă (each 1.0 million m ^{3}) . The maximum share of water used in irrigation is also observed in these districts, including Dubăsari (69%), Grigoriopol and Ştefan-Vodă districts (60% each). In most of the northern districts, including the riverside ones in the proximity of the Nistrean HPP, an average share (of 15-30%) of the water used in irrigation is attested, which is due to the more pronounced commercial character of agriculture in this region. In most of the central districts of the PD of the Dniester DH, especially in the western part, a low share of the water used in irrigation is observed, caused both by the relatively large distance from the Dniester river and the small volume of water, the unsatisfactory condition of the reservoirs , as well as the predominance of traditional agriculture and the financial shortage specific to the rural environment in the respective region .

In the years 2010-2020, the total volume of water used (fig. 71), records an oscillating evolution, and the values from the years 2020-2022 are almost equal to those from the years 2010-2012. The respective evolution is caused both by the annual progress of atmospheric precipitation and by the AAM data for the left side of the Dniester, which are almost constant during the respective period. Overall, in the DBH Dniester PD, a general positive dynamic is observed, which includes 2 sub-periods with opposite trends: negative - in the years 2010-2016 and positive - in the years 2017-2022. The maximum values in the years 2020 and 2022 are due to the manifestation of stronger droughts in these years. In most of the districts in the PD of DBH Dniester, there is a significant increase in the volume of water used. The highest growth rates are observed in the river districts, including Criuleni (2.9 times), Dubăsari (2.6 times), Anenii Noi (1.9 times), which benefited more massively from the Compact Program the rehabilitation of centralized irrigation systems, as well as the proximity of Chisinau as a market. Also, the significant increase in the volume of water used is found in the districts of Soroca, Drochia, Floreşti and Străseni (by 1.4 times), Ocniţa and Teleneşti (by 1.3 times). At the same time, the negative dynamics are recorded in the municipalities of Chisinau (1.2 times) and Bălţi (1.3 times), as well as in the districts of Soldăneşti, Rezina and Sângerei.

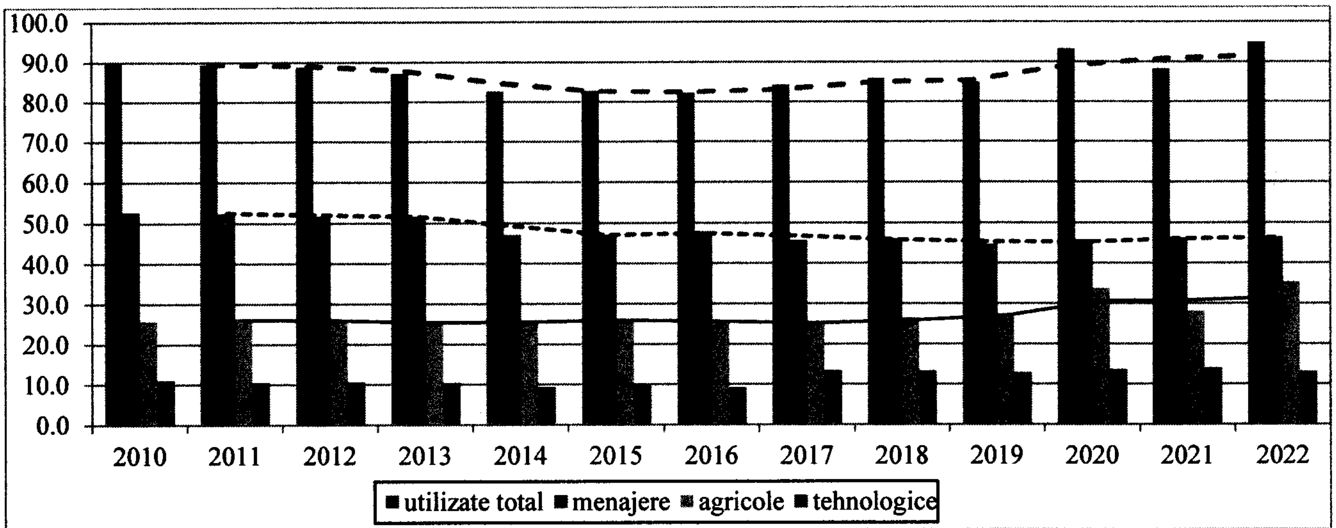

Figure 71 **Dynamics of the volume of water used in PD DBH Dniester according to categories of use**, in million m ^{3}

The positive dynamics is also observed in all the hydrographic sub-basins analyzed in the Dniester DBH, including the perimeter of the Răut River bed (1.4 times), BH Botna (1.3 times) and BH Răut (+6%) . The insignificant reduction (by 480 thousand m ^{3}) of the volume of water used is attested only in BH Bâc.

The volume of water used for ***technological purposes*** registers, as a whole, an oscillating evolution against the background of a general positive trend (1.2 times). The respective dynamics is mainly determined by the similar evolution of this indicator in the municipality of Chisinau, which contributes more than 80% to the total volume of water for industrial uses in the DBH Nistru PD. In the years 2010-2016, the total volume of water used for technological purposes decreased from 11.0 million m ^{3} to 9.1 million m ^{3}. This fact is due not only to the reduction in production volume or even the bankruptcy of many large and medium-sized industrial enterprises with massive water consumption, especially sugar factories, wineries, meat processing enterprises, dairy factories, but and the significant efficiency of water resource consumption at industrial enterprises. In the years 2017-2021, the volume of water used for technological purposes registers a significant increase (1.5 times), a fact that is mainly due to the municipalities of Chisinau and Balti, the increase in industrial production volumes, as a result of the implementation of the Agreement on Association with the EU, but also increasing the level of statistical reporting of water consumption.

In case of non-compliance with the Nistrean CHE Operating Regulations regarding the provision of established flow rates, then the industrial enterprises in the municipalities of Balti and Chisinau, Râbnița, which do not have alternative sources of sufficient water supply, will be significantly affected. In addition, the impact on industrial and agricultural enterprises will also increase due to the priorities set for the supply of drinking water to the population.

The volume of water used for ***domestic purposes*** registers, as a whole, an oscillating evolution against the background of a slightly pronounced negative general trend (1.2 times). The respective dynamics is mainly determined by the similar evolution of this indicator in the municipality of Chisinau. In the municipality of Bălți and in all the districts of PD of DBH Nistru (with the exception of Anenia Noi), an increase in the volume of water used for domestic purposes is observed. The positive dynamics are due to the rapid expansion of rural public aqueducts and metered water consumption.

The total volume of water used in *agriculture* registers a rather pronounced positive dynamic (≈1.4 times), which is more pronounced in the years 2018-2022. The maximum values were reached in the years 2020 and 2022, as a result of the higher demand for water in the conditions of the longer droughts of these years, but also the partial restoration of the irrigation systems, especially through the "Compact" Program and the "Moldova Orchard" Project . The multiple increase in the volume of water used for agricultural purposes can be seen in the river districts located downstream of the Dubăsari reservoir. Likewise, a significant increase is observed in the districts of Dondușeni (1.5 times), Ocnița and Drochia (1.4 times), Telenești and Florești (1.3 times). The negative dynamics is observed in the districts of Soldănești (1.8 times), Sângerei and Fălești (1.6 times), Căușeni (1.5 times), Rezina (1.4 times) and Râșcani (1.2 times times). In most districts, the increase in the volume of water used for agriculture is due not so much to the increase in water consumption in this sector, but to the significant increase in the volume of water delivered by the public rural water supply systems, attributed to agricultural uses. At the level of the hydrographic sub-basins analyzed, the maximum increase in the volume of water used in agriculture is also recorded in the perimeter of the bed of the Răut river (2.7 times) and in BH Bâc (+37%), and in the perimeter of the bed the Dniester river and BH Botna show an increase of 20-25%.

The total volume of water used for ***regular irrigation*** registers an oscillating evolution with insignificant deviations in the years 2010-2017 and a pronounced positive dynamic in the years 2018-2022. In the drier years - 2020 and 2022, a double amount (approx. 14.0 million m ^{3}) of water was used for irrigation compared to the average of the analyzed period. A significant increase in water used for irrigation purposes can be seen in the districts of Criuleni (7.8 times), Dubăsari (4.8 times), Donduşeni (4.2 times), Teleneşti (2.6 times), Anenii Noi (2.5 times), Soroca (1.5 times). The negative dynamics can be seen in Soldăneşti, Sângerei, Orhei, Rezina, Călăraşi and Drochia districts.

At the level of the hydrographic sub-basins analyzed, it is also observed that the detached predominance of household use in BH Bâc is due to the water captured from underground sources for the water supply of the rural population and some cities within the Chisinau municipality, as well as the population and budgetary organizations from urban and rural localities within the perimeter of this watershed. The predominance of water used in agriculture, including irrigation, can be seen in the Botna (81%) and Răut (72%) river basins, as well as in the Dniester river sector from Naslavcea to Soroca (52%) (fig. 72).

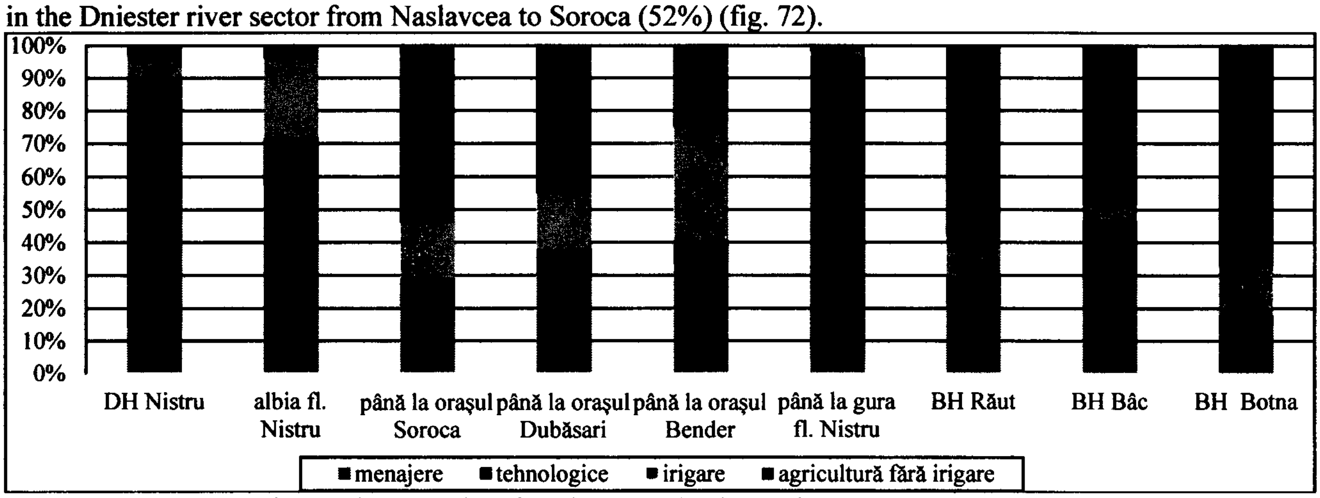

Figure 72. Share (%) of the main categories of use in the total volume of water used by water management sectors in the DHBN

Data source : Moldova Water Agency. The generalized report "Water use in the Republic of Moldova" year 2022

7.4.State and use of public water supply and sanitation systems

in DBHN , including 479 units (56%) in the river districts, in the rest of the districts of the region – 355 units (41%), in Chisinau municipality – 21, including 18 units – in the villages of municipality, and in the municipality of Bălti – 3 systems, including 2 in the rural area. The number and length of public aqueducts are conditioned both by the size of the districts and municipalities, by the number and size of the component localities, which have extensive functional aqueducts and ensure access to the majority of the population and other categories of water users, as well as by the available reserves of water from underground sources or surface area and the technical -financial capacities for their exploitation. Therefore, the maximum number of public water supply systems is recorded in the districts in the central part of the region, which have the maximum number of localities connected to centralized aqueducts, have water reserves, especially richer underground, including in the districts of Orhei (98), Teleneşti (88), Anenii Noi (80), Ialoveni (68), Sângerei (56) and Căuşeni (53). Fewer ***public*** water supply systems it can be seen in the northern districts, located in the area of direct impact of the Nistrean CHE, with less access to public aqueducts , including in Ocniţa (5), Donduşeni (15), Soroca (24) districts and in the districts with dimensions. In the rural area, 821 public water supply systems or 96% of the total number are registered , including 456 units (56%) - in the riverside districts of the Dniester River, 344 units (42%) - in the non-riverside districts and 21 units (2.6 %) – in the municipalities of Chisinau and Balti.

In the years 2010-2022, the number of centralized public water supply systems in DBHN registered an increase of about 2.1 times or from 410 units to 858 units (fig. 73). The positive dynamics is manifested in all districts of the region, including in the river districts ÷ 2.0 times (from 241 to 479 units) and in the rest of the districts of DBHN ÷ 2.4 times (from 147 to 355 units). The doubling of the number of public water supply systems is due exclusively to the rural environment, where a 2.3-fold increase (from 363 units to 821 units), including 2.2 times in the river districts and 2.5 or - in the rest of the districts of the PD of DBH Dniester. The highest rates of growth in the number of centralized public water supply systems are observed in the smaller districts , which have benefited from financial support from FEN, FNDR and external partners (EU, GIZ., ADA etc.), including in Rezina (from 1 to 36 units), Donduşeni (from 1 to 13 units), Soroca (from one to 22 units), Călăraşi (8.2 times), Făleşti (8.0 times), Râşcani (5.8 times) and Soldăneşti (3.8 times). At the same time, in the urban environment there is a reduction of 9 units (1.4 times). This fact is not due to the decommissioning and bankruptcy of urban systems, but to the implementation of recent optimization and regionalization policies of public services. The highest rates of growth can be seen in the years 2013-2016, which is due to the allocation of financial support from the FEN in order to achieve the objectives and targets established in the Strategy regarding water supply and sanitation (2014-2028), the National Program for the implementation of the Protocol on Water and Health (2016-2025), the National Project "Modernization of local public services" financed by GIZ, the regional sectoral programs for water supply and sanitation, etc.

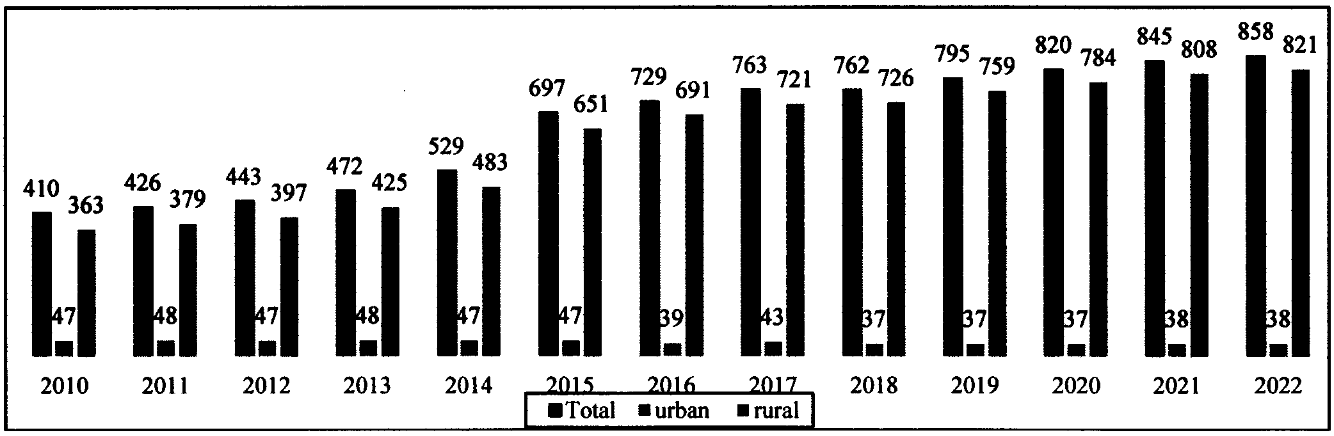

Figure 73. Dynamics of the number of public water supply systems, units

The total length of the public water supply networks in the DBH Dniester is 12.3 thousand km (fig. 74), including in the urban area – 4.7 thousand km (37%), and in the rural area ÷ 7.6 thousand km or 62% of the total length. During the analyzed period, the weights of the urban and rural environment reversed. Thus, if in 2010, only 39% (2.1 thousand km) of the total length of public aqueducts in the study region were concentrated in the rural environment, then in 2022, the share of the rural environment reached 62%, and the length of the aqueducts increased 3.6 times or 5.5 thousand km. In the urban environment, the length of the aqueducts increased during the analyzed period by 1.4 times or by 1.4 thousand km, especially due to the new connected neighborhoods or suburbs and the revision of data from the municipality of Chisinau. This is due to the fact that the public water supply systems in the urban environment were built, almost entirely, in the Soviet period, and the absolute majority of rural localities did not have centralized aqueducts or had a low degree of coverage, and the population was fed from fountains and springs.

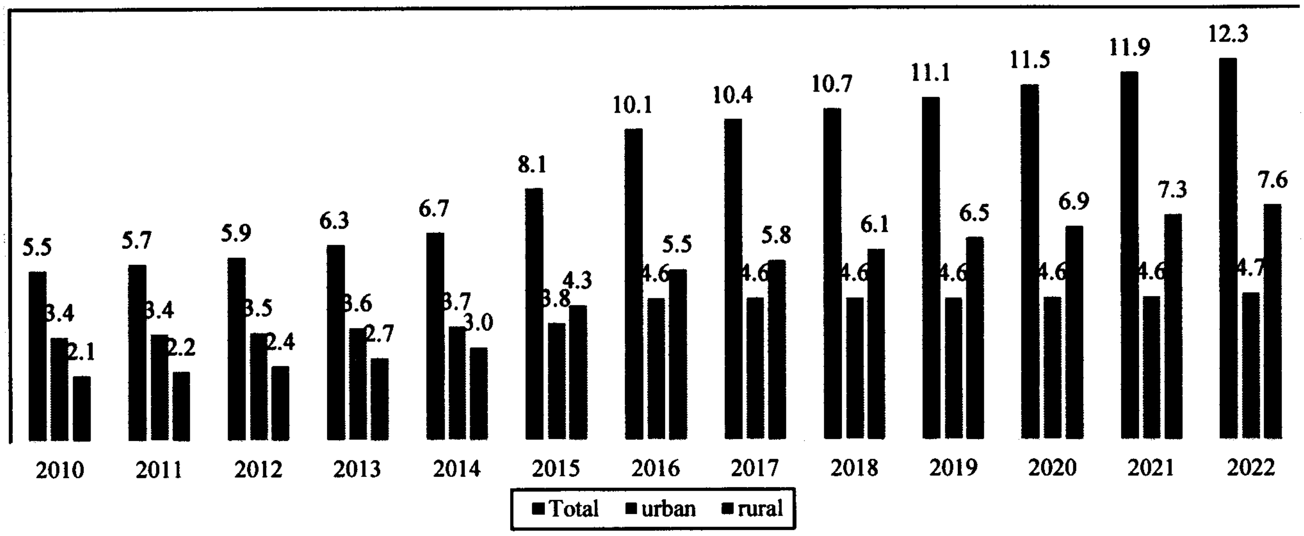

Figure 74. Dynamics of the length of public water supply systems, in thousands of km

In the riparian districts, the length of aqueducts increased by 2.2 times (by 2.7 thousand km), in extra-riverine districts - by 3.0 times (by 2.2 thousand km), and in Chisinau municipality - by 2, 0, a fact due, not so much to the double expansion of the existing aqueducts, but to the revision (in 2023) of the existing data, especially as a result of the transfer of the assets of other operators to the municipal companies providing water supply and sanitation services . The highest rates of expansion of public aqueducts are also observed in some central districts of the subregion with small and medium sizes, including the districts of Rezina (by ≈11 times or by 292 km), Donduşeni (by 3.6 times or by 140 km), Şoldăneşti (7.4 times 150 km) and Călăraşi (6.4 times or 412 km). The negative dynamics is observed only in the Ocniţa district (1.4 times or by 14.4 km), but currently ambitious projects for the construction of rural aqueducts have started in more than 10 rural localities in the district, which will be connected to the main Soroca aqueduct -Ocniţa. Also, in the Râşcani district, the interconnection of the supply networks from the Prut basin with those from the Dniester basin takes place. In addition, the construction of the Chisinau-Străseni-Călăraşi main aqueduct is planned, and the connection of the adjacent towns represents an opportunity that must be exploited. The distribution capacities of SA Apa Canal Chisinau are more than sufficient to deliver the water requirement (3-5 million m ^{3}) for the population and agricultural and industrial enterprises in the localities adjacent to the planned main aqueduct. In addition, the scenarios on the evolution of the amount of atmospheric precipitation and surface water runoff, the flow of the Dniester River at the catchment point at Vadul lui Vodă, prove to us that the water sources will be sufficient to ensure the additional volume of water, which is to be distributed through this main aqueduct.

At the same time, we also draw attention to possible risks. Thus, due to the current location of the collection point at Vadul lui Vodă (9 meters above the level of the minimum water level), in the case of excessive retention of water in the reservoirs at CHE 1 and at upstream hydroelectric plants, the non-assurance of water discharges and the flow established in the Operating Regulations of CHE Nistrean (1), but also the more frequent manifestation of strong droughts, there is a risk of the inability to ensure the necessary water consumption.

In the PD of DBH Dniester, water is supplied by 1119 ***pumping stations*** , of which 695 stations are located in the countryside. The pumping stations, which distribute the water for domestic use captured from the Dniester basin, serve the Vadul lui Vodă-Chişinău and Soroca-Bălţi main aqueducts, with their ramifications, as well as the Tărăsăuţi (rn . Rezina) catchment station on the right bank, which supplies the town of Râbniţa on the left bank of the Dniester. Most stations are operated in the municipality of Chisinau (196), as well as in the larger districts of the region, including Orhei (124), Căuşeni (91) and Teleneşti (87), with a more fragmented relief and richer water sources . At the same time, only about ¼ of the project capacities of the existing stations are used, a fact that is explained both by the advanced degree of wear and tear, and by the multiple reduction of water consumption in agriculture and industry. Most of the stations pump water for the drinking water supply of the population, and some stations pump part of the captured water both for domestic consumption and for agricultural and industrial purposes.

Access to public water supply systems. As a result of the presence of the municipalities of Chisinau and Balti, but also the rapid expansion of the public aqueduct network in the districts, currently ≈3/4 (73%) of the population in DBHN has access to public water supply systems, and the quality of the drinking water provided through aqueducts corresponds, to a large extent, to the sanitary -hygienic standards and has a higher quality compared to the water of wells and springs. In the urban environment, 95% of the population is connected , and in the rural environment 52%, including 51% - in the river districts, 49% - in the rest of the districts and 74% of the population of the villages in the Chisinau and Balti municipalities. In the municipality of Chisinau, the share of people connected to centralized aqueducts is 97%, including 75% - in the villages of the capital. In the municipality of Bălţi, the level of access of the population to aqueducts is slightly lower compared to the municipality of Chişinău and is 85%, including 86% in the city and 66% in the villages within it. At the district level, maximum access is observed in the districts in the lower reaches of the DBHN, including Căuşeni (89%), Ştefan-Vodă (82%), Anemii Noi (77%), as well as in some extra-riverine districts in the vicinity of the municipality Balti and Chisinau – Ialoveni (83%), Râscani (72%) and Sângerei (61%). The minimum access is attested in the districts with small sizes and peripheral position, especially in the northern part, including Ocniţa (17%), Donduşeni (33%) and Şoldăneşti (29%). In addition, the smaller districts were permanently disadvantaged. These districts appeared later and did not manage to benefit from sufficient funds for development, and parts of them frequently moved from one district to another, the component localities being marginalized. A low level of access to public aqueducts is also found in some districts near the municipalities of Chisinau and Băţi , including in Străseni (38%), Făleşti (30%) and Drochia (41%), a fact that is explained by the very low access of the rural population in these districts.

The total volume of water supplied through public aqueducts from DBHN was , on average, 73.0 million m ^{3} , which represents approximately 87% of the total volume of water delivered through public water supply systems in the Republic. On average, 62.5 million m ^{3} or 86% of the total volume was delivered by the water supply enterprises in the urban environment , while in the rural areas - only 10.5 million m ^{3} or 14%. The much higher share of the urban environment is due to the water supply companies from Chisinau and SA Acva Nord from the city of Soroca, which are supplied with water directly from the Dniester riverbed and supply more than ¾ (77%) of the total volume of water delivered by public water supply systems from DBHN . ***In the municipalities of Chisinau and Balti***, on average, 49.2 million m ^{3} or 2/3 (67%) of the total volume of water supplied by the public water supply systems of DBHN and ≈60% of the Republic were delivered, including 45.2 million m ^{3} - in the municipality of Chisinau and 4.0 million m ^{3} - in the municipality of Balti.

In the analyzed period (2010-2022), the total volume of water supplied by public water supply systems in DBHN registers an oscillating evolution against the background of a general positive trend (fig. 75), increasingly pronounced in recent years. In the years 2010-2014, there is a significant reduction (by 1.8 million m ^{3}), caused by the significant decrease in the volume of water delivered in the urban environment (from 63.0 million m ^{3} to 57.6 million . m ^{3}), especially in the municipality of Chisinau. Subsequently, a significant and constant increase is observed, which is mainly due to the multiple increase (by 4.2 times) of the volume of water delivered by rural public systems, but also of the volume of water supplied by SA Acva Nord from the city of Soroca (1.6 times). The multiple increase in the volume of water supplied by rural public systems is due to the similar increase in the length of aqueducts and metered water consumption in rural communities and the expansion of statistical reporting. The positive dynamics is manifested in all the districts of PD of DBH Dniester, as well as in Balti municipality . In the river districts , the volume of water supplied by the public aqueducts increased by 1.9 times, and in the extra-village ones - by 2.8 times. The highest growth rates can be seen in the districts, which previously had a very low level of access to rural public aqueducts, but which benefited from substantial funds in this area, including in Străşeni (7.8 times), Teleneşti (by 5 times), Soldăneşti (4.6 times), Criuleni (4.4 times), Donduşeni (3.3 times), Ştefan Vodă, Drochia and Râşcani (3.0 times), Rezina (2, 8 times times).

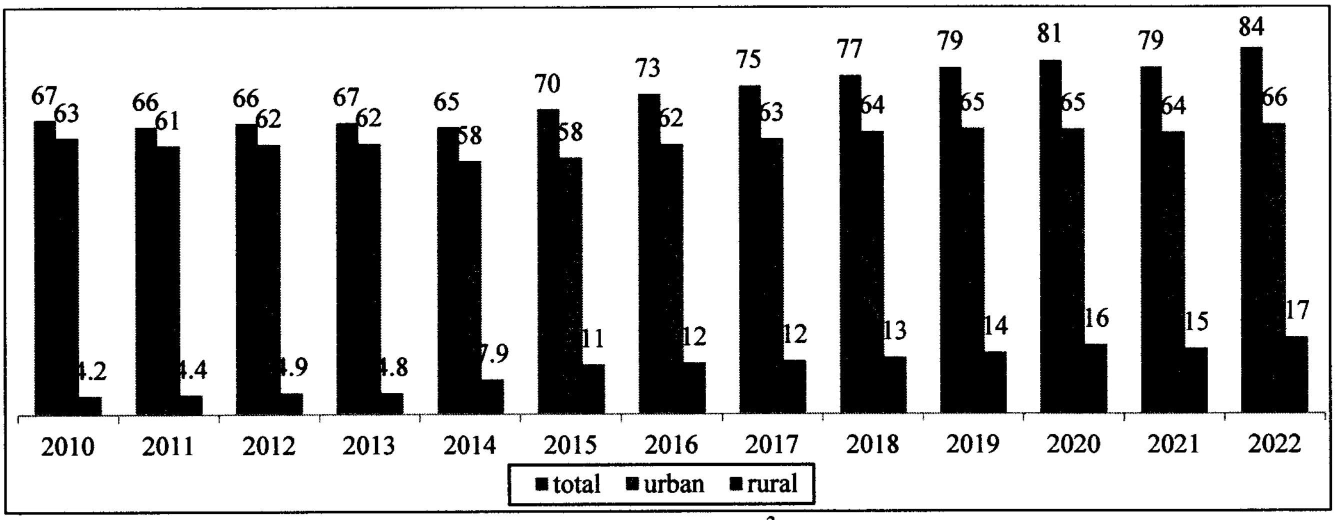

Figure 75. Dynamics of the total volume of water (mil. m ^{3}) delivered by public aqueducts in DBHN

The positive dynamics will be maintained, depending on the financing of the AAS Strategy, the regional programs in this field and the contribution of the LPAs. At the same time, taking into account the population decrease in the absolute majority of rural localities, with the exception of those near the capital and other more attractive suburban areas, water consumption will decrease, and some of the recently built aqueducts will become unprofitable and non-functional. At the same time, the multiple conveniences of centralized water supply, especially in suburban and large municipalities with various economic opportunities, will increase their water consumption.

7.5.Evacuation of waste water

In the years 2010-2022, an average of 672 million m ^{3} or more than 90% of the total volume of water discharged in the Republic of Moldova was discharged in DBHN, this is due to the large area of the district and the concentration of large urban centers within it and areas with developed irrigated agriculture. Of these, 602 mil. m ^{3} or 89% are evacuated by the enterprises of the Transnistrian DR, including 536 mil. m ^{3} (78%) of CTE Dnestrovsk, which are conventionally pure. At the same time, the official information from the Transnistrian RD does not fully reflect the existing current situation , because the indicated statistical data reflect the situation from the beginning of the 2000s, not being subsequently updated. Despite the higher development of the respective infrastructure, in the UTA SN there are many common problems for both banks of the Dniester, such as the destruction of the irrigation infrastructure, the increased wear and tear of the communal sewage and waste water purification networks, the presentation and partial processing of data regarding to water management.

In the right side of DBHN, 79 million m ^{3} of waste water or only 12% of the total volume are discharged, of which 55.8 million m ^{3} or about 71% are discharged by the municipality of Chisinau. But the actual volume of discharged wastewater is higher due to the fact that a good part of the agricultural households do not use waste water disposal systems, and most of the households in rural areas are not connected to the centralized sanitation network, and the discharged water is not evaluated.

The degree of purification of wastewater discharged by CTE Dnestrovsk determines the situation regarding wastewater in DBHN but also for the entire Republic, thus, 82% of these waters are conventionally pure. On the right side of the DBHN, only 6% of the volume of discharged waste water is conventionally pure, but in the Răut , Bâc and Botna river basins the share of these waters is less than 1%. The percentage of sufficiently treated waste water on the right side of the DBHN is 83%, this is due to the waste water of the municipality of Chisinau that is discharged into the Bâc river, but which in reality is treated superficially, not being passed through all the treatment steps, bringing to the river. They drink a high load of pollutants, which year after year leads to eutrophication and degradation of this river. In addition to the water discharged from the sewage treatment plant, a significant volume of polluted rainwater reaches the Bâc river, which flows directly into the river due to the incorrect operation of the rainwater drainage systems. Insufficiently treated waste water constitutes 5.5%, the largest share of which is in BH Botna – 73%, mostly coming from communal and agro-food enterprises.

At the level of districts and municipalities, in addition to the municipality of Chisinau, the largest volume of waste water discharged in the PD of DH Nistru is attested in the municipality of Bălţi (8.5 million m ^{3}) and the districts of Briceni (2.6 million m ^{3}), Orhei (1 million m ^{3}) and Soroca (757 thousand m ^{3}). Apart from Soroca district, which evacuates all residual water without treatment, Căuşeni district also stands out, evacuating 167 thousand m ^{3} of insufficiently purified wastewater, which constitutes 52% of the total volume of wastewater discharged in this district. Also, the reports of the "Apele Moldovei" Agency provide inaccurate data, which cannot be subjected to an adequate analysis, in a spatial or branchial profile, and in many districts the use and evacuation of household water includes data only from the urban localities served by AMAC enterprises.

The total volume of wastewater discharged into DBHN through the centralized sanitation networks is 65.4 million m ^{3}, including 49 million m ^{3} or 75% in the municipality of Chisinau. Public sanitation systems in DBHN, but also at the level of the republic, are practically only present in urban localities, with the exception of a few districts such as Anenii Noi, Criuleni, Orhei and Donduşeni where some rural localities also have access. The total length of the sanitation systems in the DP of DBHN is 4159 km, of which 69% are located in the municipality of Chisinau. The municipality of Bălţi (156.6 km) and the districts in the central region of the Republic, such as Anenii Noi (143 km), Orhei (126 km), Criuleni (106 km), Călăraşi (115 km) and Străşeni (92 km), and the minimum length, in addition to the districts that partially fall within the district, is recorded in the smaller districts such as Dubăsari (8.1 km), Donduşeni (23.4 km), Şoldăneşti (25.8 km) and Rezina (28.1 km). It should be noted that the districts with the shortest length of sanitation systems are districts bordering the Dniester river, which has a negative impact on it through the uncontrolled discharge of wastewater, especially since Rezina district lacks a wastewater treatment plant.

According to the data of the National Bureau of Statistics, in the PD of DBHN 65 waste water treatment plants are connected to the sanitation systems, of which 60 are functioning, most of them being located in the cities of the study area. In addition to the Rezina district, there is also no wastewater treatment plant in the Soroca district, and the more than 750 thousand m ^{3} of untreated wastewater ends up directly in the Dniester river. At the same time, according to the data of the Environmental Protection Inspectorate, 155 water evacuation and treatment complexes are located in the PD of DH Dniester, of which 113 are functional, including the water treatment stations or installations from various enterprises, kindergartens, social centers, thus there are also sewage treatment plants in the districts of Soroca (which serves the Temporary Placement Center for people with disabilities in the village of Bădiceni) and Rezina (from the cement factory and Penitentiary No. 17).

Due to the presence of the municipalities of Chisinau and Balti, about 43% of the population present in the PD of DBHN has access to public sanitation systems, but if we exclude these municipalities - the share of the population with access to these systems will constitute only 12%. At district level, the maximum access to public sanitation systems can be seen in Soroca and Rezina districts (over 20%), including Călăraşi and Râşcani (over 15%), while in 8 districts the share of the population connected to public sanitation systems does not even reach 10% The reduced access of the population to these systems has a negative impact on the health and quality of life of the population, but also on the quality of the environment, especially of the water resources that are most frequently the recipients of untreated wastewater discharged uncontrolled.

7.6. Tariffs for water supply and sanitation services

Tariffs for water supply . The average amount of tariffs for water supply to the enterprises of the "Moldova Water-Canal" Association located in the Dniester basin was, on average, 14.1 lei/m ^{3} or 1.1 lei/m ^{3} less than the average for the Republic . The average share of the tariff is conditioned, above all, by the share of the tariffs for water delivered to household consumers (the population), because, as mentioned, with the exception of the ÎS Acva Nord enterprise, more than 80% of the total volume of water delivered by AMAC enterprises is intended this category of users. In the analyzed period (2010-2022), the average amount of general tariffs registered an increase of over 30% or by 3.7 lei/m ^{3} , including by 45% (4.2 lei/m ^{3}) for household consumers, by 18 % (4.7 lei/m ^{3}) – for budgetary organizations and by 20% (5.2 lei/m ^{3}) – for the rest of the consumer categories. Therefore, tariffs for budgetary organizations and economic agents grew more slowly, which is explained by the gradual removal of " cross-subsidization" of tariffs.

The increase in the average amount of the approved rates for water supply is recorded in the absolute majority of AMAC enterprises in DBHN, with the exception of those in the cities of Criuleni and Drochia, where the average share of the rates has not been changed, and that of the city of Cricova, the municipality of Chisinau, which was reduced in 2022 by 3.2 lei/m ^{3} . The maximum increase in the average share of approved tariffs for water supply is observed in Şoldăneşti (3.5 times), Teleneşti and Soroca (1.6 times), Donduşeni and Ocniţa (1.5 times), and the insignificant increase ÷ in the cities of Chisinau and Râscani (+4%).

In the years 2020-2022, the average quotas of the approved tariffs for delivered water were increased only at the AMAC enterprises in Soroca, Floreşti, Şoldăneşti, Călăraşi, Străseni and Anenii Noi. At the same time, purchase prices for electricity and fuel, installations and equipment, operational costs, as a whole, have increased significantly. As a result, the application of the principle of "recovery of usage costs" of water from the respective tariffs, stipulated in article 9 of the Water Framework Directive 2060/EC and article 35.9 of the RM Law no. 303 regarding the public service of water supply and sewerage, becomes very difficult. In addition, the increase in the costs of these services in the conditions of the non-adjustment of the tariffs will significantly decrease the investment expenses, which will have a negative impact on the quality of the delivered and purified water, as well as on the effectiveness of the respective services.

In 2022, the maximum rates (≥20 lei/m ^{3}) of the average tariff were applied in the cities of Floreşti, Ocniţa, Şoldăneşti, Rezina, Teleneşti and Călăraşi and are due to the use of water captured from underground sources, the small volume of water delivery, local conditions of more fragmented relief and distribution of drinking water in these localities. Average values (15-20 lei/m ^{3}) of the tariffs for water supply are applied in the cities of Donduşeni, Drochia, Soroca, Sângerei, Orhei, Străşeni and Anenii Noi. The minimum quotas (≤ 15 lei/m ^{3}) are set by SA Acva Nord Soroca (4.1 lei/m ^{3}) and SA Apa-Canal Chişinău (9.2 lei/m ^{3}), as a result of the massive withdrawal of water from the bed of the Dniester river and obtaining "economies of scale" , as well as in smaller localities with a more difficult economic situation, including the towns of Sângerei (12.1 lei/m ^{3}), Râşcani (13.9 lei/m ^{3}) and Criuleni (10.7 lei/m ^{3}), as well as in the communes of Cricova, Ciorescu and Floreni near the capital.

Rates for the provision of sewerage and waste water treatment services. In the years 2010-2022, the average amount of tariffs for the evacuation and purification of waste water at the AMAC enterprises in DBH Nistru was 11.8 lei/m ^{3} or 2.3 lei/m ^{3} less compared to the tariff environment for water supply. The lower rates compared to those for water supply are largely due to the fact that the current methodology for calculating waste water discharge rates does not include the ecological damage caused to the waters and the public expenditure on restoring and maintaining them in satisfactory and good condition of aquatic objectives receiving waste water. Also, similar to the average amount of tariffs for water delivery, the tariffs for the evacuation and purification of waste water at the AMAC enterprises in DBH Nistru is lower (by ≈2 lei/m ^{3}) compared to the average for the Republic.

During the analyzed period (2010-2022), the average amount of approved tariffs for 1 m^3 of waste water discharged and received by AMAC enterprises in DBHN increased by 28% or by 2.8 lei/m^3, including by 46% (2 .7 lei/m^3) – for household consumers, by 20% (3.7 lei/m^3) – for budget organizations and by 24% (4.8 lei/m^3) – for the rest of the consumer categories. Overall, rates of increase in rates for centralized waste water disposal services are almost identical to rates for water supply. The increase in the average amount for centralized sewerage services is recorded at all AMAC enterprises in DBHN, except for those in the cities of Criuleni and Drochia, which remained unchanged, and in the city of Soroca, which decreased in the years 2010-2012, remaining constant thereafter . The highest increase in the respective tariff can be seen in the cities of Soldăneşti (3.1 times), Sângerei (2.3 times), Ocniţa (1.9 times), Călăraşi (1.8 times), Chişinău and Floreşti (1.7 times), and the smallest increase – in the cities of Balti (+7%), Cauşeni and Donduşeni (+22%). In the years 2020-2022, the average tariff rates for receiving waste water were increased only at the AMAC enterprises in Floreşti, Sângerei, Aanenii Noi and Căuşeni and Edineţ , and in the cities of Teleneşti and Străseni they were reduced in 2022. Despite the unique methodology calculation of the tariff, there are large differences (5 times) between the minimum rates of 5.2 lei/m^3 in Soroca and Rezina, where there are no sewage treatment plants) and the maximum rates (of 25 lei/m^3 in Floreşti and Anenii Us), approved by local councils, which is explained not only by the differences in operational costs, but also by the obvious influence of the political factor. The recent significant increase in costs due to the non-adjustment of the respective tariffs will have a negative impact on the degree of purification of waste water and the ecological state of the receiving water bodies, the health of the human population in the area.

In 2022, the maximum rates (≥20 lei/m^3) of the average tariff were applied in the cities of Floreşti and Anenii Noi (25 lei/m^3), Ocniţa (23.2 lei/m^3). The minimum rates (≤ 10 lei/m^3) are established in the municipalities of Chisinau (5.4 lei/m^3) and Balti (8.3 lei/m^3), as a result of economies of scale, in Soroca, Rezina (each 5 .2 lei/m^3) and Criuleni (9.2 lei/m^3), where there are no sewage treatment plants, and the operational costs do not include waste water purification expenses, in smaller towns with a more difficult socio-economic situation , including in the cities of Donduşeni and Şoldăneşti (each 9.5 lei/m^3), as well as in the communes of Cricova, Ciorescu and Floreni near the capital.

8. Program of measures

The program of measures (PM) is the basic component (core) of the Management Plan and is drawn up based on the analysis of pressures / impact, risk assessment and assessment of the state of water resources based on monitoring data.

The program of measures is primarily aimed at achieving environmental objectives, in particular good water status, and therefore provides regulatory actions to achieve, maintain and/or improve water status.

The main categories of measures set are intended to reduce the impact:

- **waste water discharges;**
- **diffuse pollution from agriculture (from agricultural land and livestock);**
- **hydromorphological alterations ;**
- **the pressures caused by climate change;**
- **pressures caused by droughts and floods;**
- **etc.**

Measures considered / proposed specifically for sewage discharges

The establishment of the measures that will reduce the impact of pollution from point sources is done on the basis of strategic and legislative documents, authorization documents and on the basis of information collected from public water service operators, economic agents, which relate in particular to the volume of discharged waste water and of the efficiency of treatment plants.

The measures that can be applied to reduce these point pressures (with calculated costs and concrete implementation periods) must take into account the following:

- The national, regional and local strategies, programs with reference to the measures applied for the implementation of Directive 91/271/EEC on the treatment of urban wastewater and other associated European directives. For human agglomerations, where they exist, the Master Plans developed at basin , district and/or regional level will be taken into account, as well as the measures recommended by them, including funding sources;
- The national, regional and local strategies, with reference to the measures applied to industrial activities, for each European directive (purification of urban wastewater, hazardous/priority hazardous substances, waste, etc.) and sources of financing;
- National, regional and local strategies with reference to measures applied to agricultural activities. For point pressures (wineries, livestock farms), the establishment of measures must take into account the categories of existing farms, and these measures must lead to compliance with the environmental legislation in force.

The measures to reduce the effects of the pressures caused by the effluents from human agglomerations have been established considering the reduction of pollution from pollution sources to comply with the legislation in force. The measures are associated with the implementation of the requirements of European directives in the field, namely those that refer to drinking water, wastewater treatment and sludge from treatment plants. The works required for the collection and purification of wastewater from human agglomerations consist in the rehabilitation, modernization and expansion of the wastewater sewerage networks, as well as the wastewater treatment stations and installations, in order to achieve compliance, from a technical point of view, with the provisions Directive 91/271/EEC. The effluent produced by the application of these measures must comply with the waste water quality standard provided for in the Regulation on the requirements for the collection, purification and discharge of waste water into the sewage system and/or into water bodies for urban and rural localities, approved by GD no. 950 of November 25, 2013.

Among the main problems existing within the DBHN are listed the low degree of connection of the population to the sewage system and the deplorable condition, but also the outdated technologies, from the sewage treatment plants (SEAU) (figs. 11 and 13).

Based on the provisions of the EU Directive on the treatment of urban waste water (91/271 / EEC), the following activities were carried out:

Analysis of the current state of public sewerage systems within DBHN (fig. 11);

Analysis of the current state of the sewage treatment plants within DBHN (fig. 13);

Designation of sensitive areas (fig. 61);

Consultation of the technical and investment program for the collection and treatment of urban wastewater (where possible).

These studies were taken into account in accordance with the provisions of the EU UWWT Directive, which provides measures for the treatment of wastewater based on sensitive areas. In particular, the following measures are proposed with regard to sewage treatment plants and sewage systems:

- Construction of new wastewater treatment (purification) stations (Soroca town, Criuleni town, Otaci town, etc.);
- Rehabilitation of non-functional sewage treatment plants. In total we have 39 non-functional stations (fig. 13);
- Modernization of treatment technologies in existing treatment plants (Chisinau, Cioreseu , Rezina, etc.). 85 stations treat wastewater insufficiently;
- Control of industrial sources of pollution (reduction of pollution at the source reduces costs associated with clean-up and produces benefits for the environment). There are 6 economic agents that operate without a sewage treatment plant, and another 13 have plants that function insufficiently;
- Construction of Constructed Wetlands (ZUC) for localities with less than 10 thousand inhabitants;
- Construction of individual sewage treatment systems for agglomerations with less than 2000 equivalent inhabitants;
- Construction (expansion) and modernization of sewage systems;
- Inventory actions (control) of the Environmental Protection Inspectorate of the sources of discharge of wastewater into rivers;
- Implementation of the water resource monitoring program;
- More rigorous controls by the Environmental Protection Inspectorate at wastewater discharge points (in particular, at economic agents).

It should be noted that public (municipal) administrations and AMAC enterprises (Water-Canal municipal associations), as well as the Ministry of the Environment together with the Environmental Protection Inspectorate and the Environment Agency under its subordination, are the authorities responsible for the construction, rehabilitation and renovation of the systems of sewage and purification.

Measures considered / proposed specifically for agricultural pollution (from agricultural land and livestock)

When developing the measures to prevent the pollution of water resources from agricultural activities, the restrictions provided by the legislation in force were taken into account, including the one regarding the maintenance regime of the surface and underground water protection zones, the sanitary protection zones of the use of water, as well as the technical rules regarding the protection of the environment and the soil.

The measures below have been defined for diffuse pollution from agricultural land:

- Implementation of the Code of Good Agricultural Practices for the protection of waters against nitrate pollution from agricultural sources (regulation of the use of fertilizers in agriculture);

- Mandatory possession in agricultural holdings of fertilization plans and the register of records of the use of fertilizers, and the amount of mineral and organic fertilizers applied per surface unit must not exceed 170 kg N/ha per year.
- Delimitation of riparian protection strips (in accordance with the provisions of Law no. 440-XIII of 27.04.1995) and planting of protection strips;
- Development and implementation of the Action Program for nitrate-vulnerable areas (for nitrate-vulnerable areas delimited in accordance with the methodology adopted by HG 736/2020 of 07.10.2020);
- Development and implementation of a guide to inform, train and advise farmers and local public administration authorities in order to promote and apply the Code of Good Agricultural Practices and the Action Program for the Protection of Waters Against Nitrate Pollution from Agricultural Sources.
- Elaboration of rules / standards regarding the optimal number of animals relative to a certain area of pasture (in accordance with the EU Nitrates Directive (91/676 / EEC);
- Implementation of the water resources monitoring program (Environmental Agency) and the controls carried out by the Environmental Protection Inspectorate.

These **categories of measures apply to the entire territory of the district** (except drainage systems).

The following measures have been designed for diffuse pollution generated by livestock:

- Implementation of the Code of Good Agricultural Practices for Animal Husbandry;
- Avoiding grazing within the water protection riparian strips.

Measures considered / proposed specifically for water intakes (for irrigation and drinking water supply)

Water impoundments can affect natural runoff in most surface water bodies. The official data presented by the "Apele Moldovei" Agency regarding the volumes of water captured do not indicate any pressure. Natural runoff indicators (flow and water level) are used as benchmarks for managing the impact of catchments on surface water bodies. The following measures have been designed and proposed for water capture:

- Improving the system for monitoring the volume of captured waters;
- Use of efficient irrigation technologies to save water;
- Setting up the sanitary protection zone against pollution;
- Regulations for captures and facilities in order to prevent deterioration of the state of water bodies (control system of water use licenses);
- Elaboration of the regulation (rules) for the efficient use of water resources;
- Control (monitoring, metering) of the volume of water that can be captured (licenses, permits).

These measures are designed for the entire DBHN territory, both for surface and underground water bodies. The data on the official volume of captured water were analyzed, and no pressures were detected. However, violations and illegal captures are very common.

Measures considered / proposed especially for hydromorphological alterations

Most of the small rivers within the DBHN have undergone straightening and flow regulation works (through the construction of lakes). River water bodies may be at risk of not meeting their environmental objectives due to hydromorphological changes , leading to worsening ecological status (e.g. negative influences on the biological component). Measures to improve ecological status cannot always be clearly linked to a single use or modification. In practice, the relationship between use, change, state and measure can be complex. The following measures have been identified for water bodies at risk due to hydromorphological alterations :

Measures to reduce flow pressures:

- Consolidation of the dialogue with Ukraine for the adoption and implementation of measures to ensure the ecological functioning of the Nistrean Hydrotechnical Complex (Novodnestrovsk) in accordance with international standards of ecosystem protection;
- Ensuring ecological flow in rivers (for example, controlled discharge from lakes and ponds of the flow required for optimal ecological conditions downstream);
- Creating optimal conditions for ensuring the continuity of the water course, especially for the transport (management) of sediments.
- Increase in forest areas
- Reducing the number of water accumulations

Measures for pressure category – sediment dynamics:

- Improving the continuity of sediment transport through the proper management of dams;
- Removal of alluvium and regulation of sediment extraction;
- Liquidation of clogged ponds / lakes.

Measures for the pressure category – morphological changes:

- Improving the state of aquatic and riparian habitats (re- naturalization);
- Support of hydraulic engineering measures for the morphological restoration of the water course.
- Reducing the number of hydrotechnical structures: dams, reservoirs, canals, dykes
- Reducing the pressure within the localities

It is important to emphasize that the proposed measures to reduce hydromorphological changes will be analyzed (and possibly many of them will not be implemented) in terms of costs disproportionate to the benefit obtained.

Measures considered / proposed specifically to reduce the pressures caused by climate change

Climate change represents one of the biggest threats to the environment, social and economic framework, with consequences and direct impact on water resources. Thus, the need arose in the development of a set of mitigation measures and rational use of water resources. By implementing these measures, the aim is to reduce water consumption and eliminate water losses.

Among the measures to mitigate and prevent the consequences of drought with a lasting effect, the most important is the complex of natural water retention measures. Broadly speaking, this complex of measures includes:

- Restoration of floodplains and wetlands;
- Forests;
- Promotion of conservation agriculture (increasing the water retention capacity of agricultural land) – applies to the entire DBHN territory.

Figure 78 shows the surface water bodies to which these measures apply.

Considered / proposed measures for good governance and potential efficiency in the field of integrated management of water resources

- Control of domestic waste water in terms of its environmental impact (eg low phosphorus detergents or removal of phosphates from detergents);
- Introducing an efficient system of fees for the collection and treatment of wastewater;
- Promotion by non-governmental organizations of the code of good agricultural practices to reduce pollution;
- Organization of trainings in the field of sustainable animal breeding ;
- Training farmers on efficient use and storage of water resources;
- Promoting the efficient and sustainable use of water;

- Advertising campaigns promoting the efficient use of water by individual households;
- Revising the water usage payment system to recover all costs;
- Elaboration of technical regulations for the exploitation of water basins;
- Elaboration of a technical guide / normative act regarding the management of clogged lakes/ponds;
- Consolidation of the hydrological monitoring system;
- Conducting research to assess the current and possible effects of climate change on water bodies;
- Competitive funding of target programs in research institutes to study the impact of climate change on different ecosystems and economic sectors;
- Ensuring institutional support through technical assistance;
- Updating the normative acts in the field.

9. Impact

For the implementation of the provisions of the Association Agreement between the Republic of Moldova and the European Union, with the advantages and respective obligations , the costs and burden assumed are recognized , however, these investments will be fully justified by the benefits obtained . The full implementation of the acquis in the field of water resources protection is a solid investment both for the environment and and for human health and economy.

In rural areas, the majority of the population is supplied with water from mine wells of poor quality, and equipping them with modern equipment will allow automatic water sampling and information on the requirements for the use of these waters.

Groundwater and surface water are undervalued, especially those that are used for drinking and household purposes by the population.

The development of the infrastructure for the treatment and supply of drinking water will lead to a reduced risk of pathogenic infections and , respectively, to the reduction of expenses for public and private healthcare . Rehabilitation of the existing drinking water distribution infrastructure, even if it requires an initial capital investment , will reduce losses from the networks and , respectively, the operational costs of drinking water supply. In the long term, these benefits could be equivalent to 0.21% - 0.39% of GDP.

The benefits that will be obtained as a result of the improvement of the sewerage, collection and purification systems of waste water are more difficult to quantify. It is obvious that they would improve the health of aquatic ecosystems, which could produce benefits in terms of recreation and tourism development.

Also, a better quality of water in aquatic ecosystems would reduce the costs of its treatment and determine the achievement of an acceptable standard regarding the quality of drinking water. In the long term, the economic benefits would constitute around 0.44%, up to 1.73% of GDP.

The growth biodiversity and the better protection of the forested areas will contribute to the conservation of the species, to the maintenance and to improvement the potential of ecosystems, mitigating the risk of floods , reducing the rate of land degradation and strengthening the environment's resistance to the effects of climate change.

successful implementation of this Plan, major changes will take place, first of all , in the field of environmental protection , including the economic and social environment. In order for the social benefits to become evident, considerable investments are needed both in the environmental infrastructure and and in the environmental institutional framework.

General objective 1 aims to improve the quality of water resources by reducing the amount of pollutants discharged into the water bodies of DBHN. In order to achieve this objective, specific objectives are established regarding the prevention, reduction and reduction of pollution of water resources from point and diffuse sources/agricultural activities.

The implementation of the measures will contribute to the reduction of pollutant discharges into water resources and will improve water quality. Projects will be implemented from FNM and FNDR for the construction and reconstruction of wastewater treatment plants in 19 localities, and 2.7 million people will have adequate sanitation conditions, as well as social and public institutions in these localities.

In order to reduce the pollution of water resources from point sources/agricultural activities, the Code of Good Agricultural Practices for the protection of waters against nitrate pollution from agricultural sources will be implemented, which will allow the prevention of eutrophication of surface waters. The eutrophication of surface waters is characterized by the accelerated growth of algae and other aquatic plants as a result of the increased content of nitrogen and phosphorus compounds in the water. As a result of this process, the balance of aquatic organisms deteriorates, reducing in this way the quality of the waters.

The main effect of nitrate pollution of groundwater is represented by the reduction of water potability .

The delimitation and afforestation of the riparian protection sheets will establish rules by which the use of fertilizers of any kind will not be allowed:

- in the areas of protection of water intakes and constructions and installations intended for drinking water supply;
- to the detriment of drinking water sources intended for bottling;
- in the protection zone of lakes and therapeutic muds;
- other protected areas.

The development and implementation of the Program for the protection of areas vulnerable to nitrates from agricultural sources will allow:

- the development of norms and standards in order to establish regulations in vulnerable areas;
- evaluation of the pressures exerted by organic fertilizers at the locality level ;
- identifying the optimal stock of animals for a certain area of pasture;
- identification of the amount of animal waste at livestock farms and individual households;
- the development of animal waste management plans (the system of their collection and storage at the locality level : individual platforms/deposits or joint deposits at the administrative-territorial unit level).

The implementation of the measures established for General Objective 1 will improve the provision of water supply and sewerage services to the population by the canal water operators, who manage these systems. The population of DBHN will benefit from adequate living conditions through the construction and expansion of water supply and sewage systems.

General objective 2 provides for adaptation to climate change regarding the management of water resources and the reduction of pressures generated by hydromorphological alterations . In order to achieve this objective, specific objectives are determined with provisions for the management of rainwater, which currently causes natural calamities. Flood and drought risk management requires effective regulatory enforcement and remains an international challenge.

In order to improve the management of rainwater and minimize the anthropogenic impact on water resources, measures are established that will regulate the methods of collection, purification and use of rainwater in order to prevent pollution of water resources with waste washed from atmospheric precipitation. The use of rainwater capture/retention technologies for irrigation requirements will enable the rational use of water resources and the application of green infrastructure. The treatment of rainwater collected in sewage systems with their subsequent treatment in domestic wastewater treatment plants will considerably reduce the discharge of pollutants into water bodies.

Effective drought risk management consists in reducing the phenomenon of hydrological drought within DBHN. Establishing the water balance in water bodies with water deficit will regulate the use of water for the population and economic agents. Estimating the minimum flows and the ecological spring flood will allow planning and provision of sufficient water volumes to the river bed and will guarantee the stability of ecosystems and fish reproduction. Reducing the phenomenon of drought can be achieved by afforestation of riparian slopes , degraded lands and lands affected by landslides

The implementation of flood risk management will improve the situation in the natural ecosystems of the sub-basins of the watershed district. The development and implementation of territorial and local flood risk management plans in priority areas, hazard and risk maps on the hydrographic sub-basins will allow the identification and monitoring, notification of interested parties , warning of the population , evaluation, limitation, removal or countering of risk factors .

Improving the hydromorphological status of water bodies is possible by regulating flows in DBHN rivers and presents a priority in the efficient management of water resources, being important for ensuring the sustainability of managing everyone's access to resources.

Strengthening the capacity of (reference) laboratories with equipment and creating a database will strengthen the hydrological and hydromorphological monitoring system . Unclogging ponds and water bodies will improve the condition of aquatic habitats.

The implementation of the measures established for General Objective 2 will minimize the anthropogenic impact on water resources in the DBHN. The normative framework aligned with international standards will be updated, including with reference to climate change, which represents one of the biggest threats to the environment, social and economic framework, with consequences and direct impact on the water resource.

General objective 3 provides for good governance and the efficiency of the potential in the field of integrated management of water resources. The specific objectives established will contribute to the improvement of the normative framework and the determination of the application mechanisms in the management of water resources in accordance with European standards. The measures established for the monitoring of the quality of surface and underground water will align the monitoring programs with the standards of the Water Framework Directive 2000/60/EC and will allow the improvement of the analysis reports of the quality of water resources.

Implementation of the measures established in General Objective 3 will determine the efficiency criteria in the water resources management process by creating an available data platform, access and involvement of all parties involved in the field of water management for participation in development activities and projects.

10. Costs

The total cost of the measures selected for implementation is estimated at around 6.1 billion lei. Most of the planned actions have been analyzed in terms of policies, rights and financial charges used for implementation, their distribution by sector, regardless of whether they are basic or supplementary and when they are planned to become operational. Investments are allocated:

For general objective 1, which concerns the improvement of the quality of water resources by reducing the amount of pollutants discharged into water bodies, needs were assessed in the amount of approximately 2871.8 million lei; external sources 468.2 million lei according to ongoing projects and those that are in the negotiation process; uncovered budget 772.7 million lei, which represents about 26.9% of the total cost of implementing the Plan. This objective includes measures to reduce pollution from point and diffuse sources, improve the sewage system.

For the general objective 2 related to the adaptation to climate changes of water resources and the reduction of the pressures generated by the hydromorphological alterations , costs were assessed in the amount of about 3119 million lei, of which for the improvement of the hydromorphological state - 3015.5 million lei; improvement of surface and underground water bodies about 60.4 million lei; reducing the effects of drought and efficient management of rainwater about 0.7 million lei; reducing the risk of natural hazards around 33 million lei; improving the state of biodiversity around 9.4 million lei.

for the general objective 3 related to good governance and the efficiency of the potential in the field of integrated management of water resources, of which 16.1 million lei are planned for modern sampling equipment.

The specialists of the ministry and the institutions with attributions in the field of water responsible for the development/implementation of the action plan will ensure the activities related to the review of the normative framework, will carry out training courses and seminars, information campaigns on the national policies for the development of DBHN, for the implementation of the measures established for cycle II during the years 2024-2029, including the promotion of the provisions of the Water Law no. 272/2011 and other normative acts related to the management of water resources on the basin principle

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Uncovered sources will be negotiated with international institutions and requested from the state budget through CBTM.

Synthesis of policy proposals and sectoral priorities for CBTM 2024-2026 in the field of environment (16 SECTOR "ENVIRONMENTAL PROTECTION")

Subprogramme 7004 "Protection and management of water resources, floods and droughts" provides the indicators:

Implementation of policies in the field of water resources management - for the maintenance of the "Apele Moldovei" Agency;

Implementation of projects in the field of environmental quality financed from the National Environmental Fund - 120 million lei, 64 projects are being implemented.

The repair and maintenance of hydrotechnical constructions and the consolidation of banks (Apele Moldovei Agency), depends on the implementation of the measures regarding the implementation of the Flood Risk Management Plans approved by HG 562 of 31.07.2020.

The APC proposals at the total cost/impact of the policy (thousands of lei) revised for the years 2024-2026 show – 145.3 million lei.

Subprogram 5108 "Irrigation and drainage systems" provides the indicators:

- Maintenance and operation of irrigation and drainage systems ("Apele Moldovei" Agency) - 31.3 million lei;

D. New policy measures

Subprogramme 7004 "Protection and management of water resources, floods and droughts" provides the indicators:

Maintenance of surface water bodies, areas and protection sheets ("Apele Moldovei" Agency) - 19.6 million lei.

Maintenance and repair of reservoir dams/ponds ("Apele Moldovei" Agency) - 314.1 million lei.

The execution of these indicators will allow the implementation of the Management Plans.

17 "HOUSING HOUSEHOLD" SECTOR

Subprogramme 7503 "Water supply and sewerage" provides the indicators:

Implementation of water supply and sanitation projects, with the support of the National Environmental Fund - 279.2 million lei.

Implementation of water supply and sanitation projects, with the support of the National Fund for Regional and Local Development – 510 million lei.

The "Improvement of water infrastructure in Central Moldova" project – 816.3 million lei.

LOCAL BUDGET

Subprogram 7503 "Water supply and sewage" provides the indicator:

Construction and maintenance of main water supply pipelines – 1,951.5 million lei.

To implement the action plan, there is a lack of funding for the following measures, the allocation of investments for which they will be requested from local budgets and external support (69,446 thousand lei):

Construction of Constructed Wetlands (ZUC) for localities with less than 10 thousand inhabitants (3 ZUC) – 162 million lei.

Elaboration of the technical and investment program for the implementation of the requirements regarding the treatment of urban waste water - 577.8 thousand lei.

Sludge treatment at wastewater treatment plants in the municipalities of Chisinau and Balti – 112.4 thousand lei.

Performing a modeling using the MONERIS software in order to determine nutrient pollution from agricultural land - 500 thousand lei.

Updating the delimitation (revision) of areas vulnerable to nitrates - 200 thousand lei.

Training of economic agents / farmers regarding the requirements of the Code of Good Agricultural Practices regarding the protection of waters against nitrate pollution from agricultural sources - 300 thousand lei.

Implementation of the Code of Good Agricultural Practices for the protection of waters against nitrate pollution from agricultural sources (regulation of the use of fertilizers in agriculture) – 500 thousand lei.

The implementation, in agricultural holdings, of fertilization plans and the record of the use of fertilizers, and the amount of mineral and organic fertilizers applied per surface unit must not exceed 170 kg N/ha per year, provided for in MADRM order 160/2020.

Development and implementation of the Action Program for nitrate-vulnerable areas (for nitrate-vulnerable areas delimited in accordance with the methodology adopted by HG 736/2020 of 07.10.2020) – 500 thousand lei.

Development of a guide for informing, training and advising farmers and local public administration authorities in order to promote and apply the Code of Good Agricultural Practices and the Action Program for the protection of waters against nitrate pollution from agricultural sources - 500 thousand lei.

Elaboration of rules / standards regarding the optimal number of animals relative to a certain area of pasture (in accordance with the EU Nitrates Directive (91/676 / EEC).

Development of the methodology for identifying surface water bodies with hydromorphological changes - 500 thousand lei.

Development of the methodology for classifying the ecological state of water - 500 thousand lei.

Development and approval of the Methodology for the identification of lakes and ponds to be liquidated - 500 thousand lei.

Development and approval of the Methodology regarding the analysis of pressures and the assessment of anthropogenic risks - 500 thousand lei.

hydromorphological changes - 500 thousand lei.

Development and implementation of national projects regarding the unclogging of strategic lakes - Dubăsari and Ghidighici - 1.5 billion . lei.

The development and realization of the national project "Cleaning the Bâc river bed" in order to reduce the anthropogenic impact, to prevent the risk in case of floods and the risk of bank erosion, in order to create protected natural and cultural areas in the Bâc river basin - 10 million lei.

Development and approval of the Methodology regarding the condition of underground water bodies and the evaluation of the trend - 200 thousand lei.

Assessment of the condition of underground water bodies - 500 thousand lei.

Carrying out the feasibility study for the pilot project to restore the water balance in a selected water body, in order to calculate the share of water that can be used sustainably - 500 thousand lei.

Ensuring the regular assessment of the water use balance at basin / sub-basin level by using modern modeling tools (WEAP, HEC-HMS, etc.) – 1.9 million lei

Increasing the level of water reuse for household and industrial needs; promoting cleaner production practices, etc., taking into account the EU Regulation on water reuse 741/2020 – 2.75 million lei.

Implementation of measures regarding the control of the authorized use of water – 3.5 million lei.

Drafting and approval of the Regulation regarding the restriction of water use in drought conditions - 180 thousand lei.

Carrying out an assessment and investments regarding the use of controlled floods (polder type) – 33 million lei.

Development of the feasibility study for the creation and restoration of a wetland - 5.7 million lei.

Revitalization of the Lower Dniester wetland and re-naturalization of small rivers (meandering, re-vegetation of banks) – 3 million lei.

Classification of water bodies, including heavily modified ones (digital format) – 35 million lei.

Digitization of climate and meteorological data available at SHS and other climate data holders and their publication – 2.1 million lei.

Development of the Atlas of the Dniester Hydrographic Basin - 200 thousand lei.

Facilitating the efficient functioning of the Dniester District Committee and the committees for the management of hydrographic sub-basins 1 million lei.

Updating the Regulation regarding the operation regime of the Dniester Hydropower Complex node in collaboration with the Ukrainian Side - 200 thousand lei.

basin committee seminars regarding the management of the hydrographic basin during drought - 250 thousand lei.

Establishing and ensuring the activity of volunteer water monitoring groups.

Promotion of alternative solutions - reuse of wastewater in agriculture, for irrigation of crops.

Synchronization of the Data Platform regarding monitoring the quality of water resources in the Dniester District with Ukraine - 1 million lei.

Realization and implementation of the early warning system of rain floods on medium and small rivers - 5 million lei

Allocation of investments and financial support for the implementation of these measures is important for improving the ecological condition in DBHN.

At the same time, the measures related to the strengthening of institutional capacities need to be carried out with international assistance, taking into account the experience in the application of European standards.

11. Implementation risks

In order to identify the risks for the elaboration of the second cycle of the Plan DBHN lessons learned from the implementation of the Plan were taken into account DBHN for the years 2017-2022, cycle I, and the political, social, economic, environmental situation and its anticipated trends during the implementation period of the given Plan (public consultations with interested parties, with international experts, group discussions, etc.).

A *high-level risk* of non-implementation of the Plan remains the lack or insufficiency of funding sources. Thus, the priority is to negotiate and request international assistance for the implementation of the actions, which do not have financial coverage, including for the implementation of the Directive 91/271/EEC on the treatment of waste water, which will have a major risk in achieving the objectives of the given Plan, related to the reduction of pollution water resources and improving citizens' health.

Also, a *high-level risk* presents the non-execution of the commitment made by the Republic of Moldova in the Association Agreement with the European Union regarding the implementation of European directives, including Directive 91/676/EEC on the protection of waters against nitrate pollution from agricultural sources. A Target 6 of the Sustainable Development Goals (Agenda 2030) regarding ensuring the availability and sustainable management of water resources for all , policy documents with attributions in the management of water resources and other commitments. In order to reduce these risks, the development of normative acts is foreseen, which will improve strategic planning in the field of efficient management of water resources.

In the risk identification process, the objectives and the activities that contribute to their achievement. A *mid-range risk* for the implementation of the DBHN Management Plan may be the delay in the design stage of the hydrotechnical facilities for environmental protection, actions established in the action plan of the Plan, and/or the documentation submitted for project approval is incomplete or not completed on time according to requests.

In the risk management process, those responsible from all the institutions responsible for carrying out the actions of the plan are determined. Annually, the process of carrying out the measures established in the DBHN Management Plan, the risks related to the implementation will be analyzed and evaluated activities and actions taken to remedy the situation at all institutional levels.

Mitigation measures do not aim to completely eliminate risks, which, in most cases, are determined by exogenous factors.

2 types of risks are also established:

Internal:

- The ineffective participation of the institutions responsible for implementing the actions of the elaborated plan to improve the ecological situation in DBHN.
- Lack of qualified staff in the reference field and uncontrolled staff turnover .
- Insufficient involvement of decision-makers in carrying out the tasks of the DBHN Management Plan.
- Institutional and inter-institutional communication deficiencies .

• The complexity of the issues addressed.
External:
• Disruption of the process of promoting the mentioned Plan in connection with possible institutional reforms at the level of central and local authorities.
• Procrastination of the process of carrying out the measures established by the relevant institutions.
• The unpredictability of political decisions.
• Lack of consistency and political support in promoting the Plan.
• Insufficient financing of the actions of the Plan.

In order to reduce and eliminate these risks, the following are established:

- measures related to the activation of the institutions responsible for implementing the strategic and operational actions of the Plan;
- training of specialists in the field of water resources and infrastructure management;
- improving communication with institutions with attributions in the water field;
- the division of responsibilities between the institutions subordinate to the ministry and the control of the execution of their basic tasks;
- the active involvement of the institutions' management in supporting the promotion of normative acts.

In the case of " *non-intervention* ", DBHN will still remain vulnerable to climate change, unadapted to drought conditions, the available water resources will not be used rationally and efficiently.

The main risks regarding the implementation of the objectives:

- lack of specialists in the field, the situation will be permanently monitored, the staff of the central public administration authorities responsible for implementing the Plan's objectives will be trained;
- challenges with a negative impact on the social, political and economic situation of the country, which may cause the non-fulfillment of the established measures, will be permanently monitored and the measures will be reviewed and alternative solutions will be identified;
- non-fulfillment of the actions in the plan and/or non-compliance with the deadlines will be monitored through the evolution of the situation, the reasons will be identified and evaluated, measures will be taken to reschedule the activities and remove the negative consequences;
- limited access to financial and technical assistance , the situation will be permanently monitored, the measures will be reviewed and alternative financial solutions will be identified, the staff of the central public administration authorities responsible for implementing policies in the field will be trained in order to access external financing;
- the low degree of implementation of the projects for the protection of water resources, the exploitation of irrigation and drainage systems, the maintenance of surface water bodies and the maintenance and repair of dams and reservoirs - the evolution of the situation will be monitored, they will also be identified once the reasons are evaluated, the representatives of the central and local public administration authorities, the owners of hydrotechnical systems and installations will be trained to apply projects according to the priority directions , established in the Plan.

The central public administration authorities responsible for the implementation of policies in the field will ensure the management of their own risks regarding the implementation of this Plan.

" *Achieving* " the specific objectives for the period 2024-2029 will ensure:

• for surface waters: achieving good ecological status and good chemical status, especially for heavily modified and artificial water bodies;
• reducing the risk of (rapid) rain floods, intense erosions and their landslides ;
• for groundwater: achieving good chemical status and good quantitative status;

- the progressive reduction of pollution from point sources and the cessation or gradual elimination of pollutant emissions;
- reducing pollutant concentrations in surface and underground waters.

In order to successfully implement the second cycle of the Plan DBHN for the years 2024-2029, a number of risks were identified with an estimate of their impact and probability, divided according to the following types of risks:

Risk Categories	Types of risks	Impact	Probability
Technological Risks	Development and implementation of environmental protection and water supply and sewerage projects	Medium	increase
	Lack of effective management and reduced capacity for the construction of hydrotechnical objects and water supply and sewage systems	Medium	Average
Organizational Risks	Rigidity of state institutions in aligning interventions with development policy in the field of environmental protection and integrated management of water resources	Medium	increase
	The lack of an integrated approach and the limitation of the policy approach in the field of environmental protection to sectoral interventions	Medium	Average
	Fluctuation of qualified personnel within public state institutions/lack of institutional memory	High	increase
Management Risks/ operational	The availability and ability to mobilize resources for co-financing projects in the field of environmental protection and the water supply and sanitation sector	Medium	increase
	Delaying the implementation of institutional reforms	Medium	increase
External Risks	The impact of the COVID-19 pandemic on economic development	Medium	environment
	Climate change and natural disasters	High	increase

Measures to reduce the risks of implementing the Program:

Types of risks *(medium and high probability)*	Mitigation measures
Development and implementation of projects in the field of environmental protection and the water supply and sewage sector	Capacity building within design institutions. Aligning standards with international requirements for the development of technical project documentation. Improvement of the verification procedure of objects under construction and built.

Rigidity of state institutions in aligning interventions with development policy in the field of environmental protection and integrated management of water resources	Strengthening the competences of state institutions, with the tangent of its duties in the field of environmental protection (especially water resources), which will ensure a unique and integrated approach of interministerial coordination of all government interventions aimed at the development of the field of the environment and the effective management of water resources
Fluctuation of qualified personnel within state public institutions/lack of institutional memory	Motivating staff employed in public state institutions , through the lens of increasing financial remuneration depending on qualification, performance and high results obtained, granting performance increases. Creating suitable working conditions. Capacity building through exchange of international experience.
The availability and ability to mobilize resources for co-financing projects in the field of environmental protection and the water supply and sanitation sector	Establishing the criteria within the project support requests. Strengthening the capacities of local public authorities to attract investments for the implementation of infrastructure projects financed from external sources.
Delaying the implementation of institutional reforms	Ensuring a dialogue between government authorities, through the lens of identifying the optimal solutions to ensure the functionality and implementation of the proposed reform actions.
Climate change and natural disasters	Strengthening the capacities of central and local institutions for the development of strategic directions for adaptation, prevention and liquidation of the consequences of natural phenomena. Raising awareness of the importance of stormwater management.

12. Responsible authorities / institutions

The monitoring and reporting of the DBHN Management Plan falls under the competences of the "Moldova Waters" Agency.

In accordance with the provisions of Government Decision no. 145/2021 regarding the organization and operation of the Ministry of the Environment, the ministry's mission is established to analyze the situation and problems in the areas of activity managed, to develop effective public policies, to monitor the quality of policies and normative acts and to propose justified interventions of the state, which will provide effective solutions in the fields of competence, ensuring the best ratio between the expected results and the expected costs.

The Ministry performs the functions established in the fields: 1) environmental protection; 2) climate change; 3) sustainable management of natural resources.

Under the ministry are the administrative authorities responsible for creating policy documents, monitoring the quality of environmental factors and reporting the measures implemented in the established action plans:

1. The Environment Agency;
2. The Environmental Protection Inspectorate;

Moldsilva " Agency ;

4. "Apele Moldovai" Agency;
5. Agency for Geology and Mineral Resources (AGRM).

The Ministry of the Environment, through the "Apele Moldovei" Agency, ensures the monitoring of the implementation of the DBHN Management Plan, cycle II (2024-2029).

agency presents to the Committee of the Dniester hydrographic basin district the information regarding the implementation of the Action Plan for the implementation of the said Plan.

AGRM manages and reports the ecological status of underground water resources according to the parameters established in the monitoring programs.

The Environmental Protection Inspectorate controls the quality and use of water resources.

The Hydrological Center, a subdivision of the State Hydrometeorological Service, is established with the status of a Center to implement /coordinate with national and international policies in the field of monitoring the state and quantitative evolution of water resources on the territory of the Republic of Moldova.

The Environment Agency (currently) carries out the monitoring program of surface water resources .

Also, within the ministry, as the founder, activates the Public Institution National Office for the Implementation of Projects in the Field of the Environment, which has the mission of providing support to the Ministry of the Environment and the organizational structures within its sphere of competence in the effective implementation of financial assistance projects and technical, external and internal in the field of environmental protection and the use of natural resources.

The " Moldsilva " agency ensures the implementation of the state policy in the fields of forestry and hunting, for the purpose of the sustainable development of the forestry and hunting sector from the forest fund, ensuring protection and forest and fauna protection , maintenance and conservation of the biodiversity of the Republic of Moldova.

The functions of protection and monitoring of the quality of drinking water, but also the record of the volumes of captured mineral water, of leisure and bathing spaces are carried out by the National Agency for Public Health and the local public health centers within the Ministry of Health.

The DBHN committee , created in 2017 , coordinates and consults the issues and actions carried out in this basin in order to effectively manage water resources. The committee is formed by representatives of central and local public administration authorities, sub-committees, water user associations, representatives of civil society and academia. The committee meets every six months.

13. Reporting procedures

The monitoring of the implementation of this Plan is carried out by the subdivision of the Ministry of the Environment (Apele Moldovei Agency), which will periodically evaluate the degree of achievement of the indicators and objectives. Based on the information collected from the institutions responsible for carrying out the measures and systematizing these results, the annual progress report is drawn up.

The purpose of monitoring the given Program is to establish the degree of compliance of the actions taken with the planned ones, to identify the causes of delays , etc. The results of the monitoring are included in the progress report, which serves to prepare the annual progress report of the ministry.

The progress reports evaluate the Plan, the results obtained in the implementation process, the conclusions and the main findings according to the criteria.

The monitoring will contain quantitative data regarding the progress of the Plan's implementation (the number of actions carried out within the set deadline; the number of indicators achieved; the realization of financial investments; the elaboration of normative acts within the deadline; the number of actions that have not been initiated, although they are at the stage in which should have been in the final stages of completion).

The "Apele Moldovei" agency is the competent institution, appointed responsible for collecting information and preparing the progress report with the support of the policy analysis, monitoring and evaluation department within the ministry and presented annually to the State Chancellery. For the development of progress reports, statistical indicators provided by the National Bureau of Statistics, studies, questionnaires, information from non-governmental institutions are used , it is necessary to collect indicators from technical assistance projects implemented by development partners.

The program is monitored annually, taking into account the measures established in the action plan.

In the evaluation procedure, data and information obtained in the monitoring process are used to carry out an in-depth analysis of the progress recorded, the causes that determined some weak points in the Plan realization process or the appearance of some deviations, as well as to identify some solutions or corrective measures for the following period.

As a result of the evaluation, depending on the positive result obtained of the measures taken, the allocation of financial resources is requested for the measures not previously covered or the measures that appeared additionally for the purpose of implementing the Plan.

The evaluation is based on the achievement of the general and specific planned objectives, on the implementation of the actions, on the allocated resources, on the barriers in the process of the realization of the Plan, on the deviations from the deadlines for the achievement and achievement of the indicators. At the same time, the external and internal factors that negatively influenced the implementation of the Plan are determined.

During the implementation period of the Plan, an intermediate evaluation (years 2024-2026) and a final one (2027-2029) are provided, and the results of the intermediate evaluation will influence decisions related to the implementation of measures for the next implementation period.

The evaluation reports are elaborated by the "Apele Moldovei" Agency and are used to plan the next interventions in environmental policy documents and will be published on the official web page.

In order to correctly evaluate and report the impact of the implementation of the objectives established in the next 6 years of water resources management, it is necessary to improve the existing monitoring program. The monitoring results are used to define the state of the water bodies, their quality and to compare the recorded progress. The surface water monitoring system will be developed through the measures, which will allow an efficient evaluation and reporting of the chemical and ecological status of surface waters according to EU standards , respectively:

- Implementation of surveillance, operational and investigative monitoring ;
- Implementation of ISO EN 17025 requirements;

- Installation of new equipment and training of specialists;
- Chemical and biological data collection;
- Status Classification System (SCSE) in accordance with the Water Framework Directive for all EBCs;
- Extending the hydromorphological study to other sub-basins within the DBHN, which will allow solving the problems of medium and small rivers ;
- intercalibration exercise for biological, chemical and hydromorphological parameters and an assessment of the existing SCSE, by carrying out a joint study on transboundary rivers for Ukraine, Romania.

"Apele Moldovei" agency submits to the Government annually, until February 25 of the year following the reference year , the progress report on the implementation of the nominated Program.

14. Summary of public consultations

The public consultations regarding the presentation of the DBHN Management Plan project, cycle II, were initiated in September 2023, and their first round took place between September 29 and October 13, 2023 at the initiative of the Ministry of the Environment. The consultations took place in three regional points - Soroca, Căuşeni and Chisinau, as follows:

- September 28, 2023, 10:30 a.m., conference room of the Soroca Central Hotel, 20 M. Kogălniceanu str., Soroca municipality.
- September 29, 2023, 10:30 a.m., conference room (floor 2) of IP Ţcoala Sportivă Căuşeni, str. M. Eminescu 29A, 20, p.m. Causeni.
- October 13, 2023, 09:30 a.m., office 1015, meeting room of the Ministry of the Environment, bd. Stephen the Great and Saint, 162.

The announcement was published on the website of the Ministry of the Environment - https://www.mediu.gov.md/ro/content/4496 - through which the decision to initiate public consultations was presented, thus disseminating the draft of the District Management Plan of the Dniester hydrographic basin (cycle II) and the agenda of events. Approx. were involved in the consultations. 60 representatives of central and local public authorities, local representatives of environmental protection inspectorates, forestry enterprises, public health centers, as well as representatives of the DBHN Committee, civil society, academia, partners and other stakeholders. Also, the consultations were attended by representatives of the project "Supporting the authorities of the Republic of Moldova in the sustainable management of the Dniester River", financed by Sweden, implemented by the United Nations Development Program in Moldova, who also presented the priorities of the funder in relation to the activities carried out in DBHN limits; project that provides financial support for the implementation of all activities related to the development of the DBHN Management Plan.

In the consultation process, carried out in an amicable and friendly environment, the participants mentioned the importance of this stage of talking with the key actors, but the necessity and the contents exposed in the second cycle of the Management Plan were also appreciated, however which does not solve the problem itself, namely the efficient and responsible management of the Dniester river as the main artery. It was proposed that it is necessary to delegate an institution or organization to assign this role, and as an example, the "Apele Moldovei" Agency was presented as one of the potential institutions, but at the moment it is important to ensure the functionality of a clear mechanism that would contribute to the improvement the situation, namely the improvement of water quality within the limits of DBHN.

In this context, the representatives of the Dniester 2 Project reiterated the interest and effort of the UNDP to provide support in the institutional reform as well, including the reorganization of the "Apele Moldovei" Agency, the creation of the Water Fund with a financial self-management mechanism that will operate according to the "polluter pays" principle ". During the public consultations, concrete aspects and situations identified within the limits of the DBHN were discussed, among which the most discussed problems were:

- The high degree of clogging of small rivers, but even if there are initiatives to unclog them, some of them are privately owned, which creates difficulties;
- Tightening the fines for farmers who do not comply with the law, referring also to the Code of Good Agricultural Practices regarding the protection of waters against nitrate pollution from agricultural sources;
- Incorrect subsidization in agriculture and irrational use of financial resources obtained from subsidies, without taking into account the impact on the environment;
- Lack of sewage networks and drinking water supply through aqueduct before building the sewage system;
- The waste collection service is hampered because the residents do not pay for the sanitation fee, and in addition to this, the intensification of activities related to the ecological education of the population, the local community, is clearly required ;
- Attracting LPAs in discussions on environmental topics thus ensuring sustainable development;
- Lack of treatment plants, which in some situations have a major impact on water quality;
- The creation of constructed wetlands (following the example of the city of Orhei) near the sewage treatment plants, especially since these wetlands are not expensive in terms of maintenance, etc.

As a result of the organization of the public consultation process, the results obtained during the discussions, but also the opinion expressed in outline form through the questionnaires completed by each participant, the prioritization of measures took place , but also the inclusion of new measures that would ensure a sustainable management of water bodies within the DBHN limits and improving the water quality class. Thus, in the final version, all proposals from the participants were taken into account in order to improve the content of the DBHN Management Plan.

Appendix 1.

The program of measures of the Hydrographic Basin Management Plan

Dniester for the years 2024 – 2029 , cycle II

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
OG 1 Reducing the pollution of water bodies						
OS 1.1 Reduction of pollution from point sources						
1.1.1.	Construction of the wastewater treatment plant in the municipality of Soroca	2024 - 2029	MIDDLE, Ministry of the Environment,	Functional sewage treatment plant	approx 11 million USD	The project "Security of water supply and sanitation in the Republic of Moldova" supported by the World Bank
1.1.2.	Elaboration of the technical and investment Program for the implementation of the requirements regarding the treatment of urban waste water	2025	Ministry of the Environment, Ministry of Health, Labor and Social Protection	Developed program	577.8	Technical support
1.1.3.	Rehabilitation of non-functional sewage treatment plants (Rezina)	2024 - 2029	The Ministry of the Environment, AMAC, the Agency for Regional Development, the LPAs	Functional sewage treatment plant	18,300 (1 station)	Budget allocations – 10,500; Uncovered budget – 7,800.

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
1.1.4.	Modernization of treatment technologies in existing treatment plants (15 plants)	2024 - 2029	MM, "Apele Moldovei" Agency, AMAC, LPAs	Modernized treatment plants	758 357.7 (15 stations)	Budget allocations – 19,352.6; External sources – 465,400; Uncovered budget – 273,605.1
1.1. 5.	Control of industrial sources of pollution (reduction of pollution at the source reduces costs associated with clean-up and produces benefits for the environment). There are 6 economic agents that operate without a treatment plant, and another 13 have plants that function insufficiently	Permanent	The Environmental Protection Inspectorate, economic agents, APL	Perfect reports Minutes drawn up		Budget allocations
1.1.6.	Inventory of point sources of pollution (including priority pollutants)	2026-2027	Environmental agency, Institute of Ecology and Geography, IPM	Elaborated report	500	Budget allocations
1.1.7.	Sludge treatment at wastewater treatment plants in the municipalities of Chisinau and Balti	2024-2029	Ministry of the Environment, Ministry of Infrastructure and Regional Development	The methane tank, the pumping station, the sludge concentrator, the methane storage and combustion systems, the dehydration tank, the distribution and communication networks installed at the wastewater treatment	112.4	budget allocations, other sources

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
				plants in the municipalities of Chisinau and Balti		
1.1.8.	"Water and Sanitation" National Territorial Development Plan	Fourth quarter 2025	Ministry of Infrastructure and Regional Development	Estimated number of centralized aqueducts; estimated number of public sewage systems; number of public water supply and sewage systems designed based on the approved plan	26000	The project "Security of water supply and sanitation in the Republic of Moldova", supported by the World Bank – 26,000
OS 1.2 Reduction of pollution from diffuse sources						
1.2.1	Modeling with MONERIS software to determine nutrient pollution from agricultural land	Fourth quarter, 2027	Ministry of the Environment Institute of Ecology and Geography	Modeling performed; the Geographical Information System layer developed and introduced into the Automated Information System "State Cadastre of Waters"	500	500 - Project "EU4Environment - Water resources and environmental data", supported by the European Union
1.2.2	Update delineation (revision) of nitrate vulnerable areas	Fourth quarter, 2028	Ministry of the Environment Environmental agency; Institute of Ecology and Geography	4 delimited and updated areas; the layer of the Geographical Information System elaborated and introduced into the Automated Information	two hundred	200 - Project "EU4Environment - Water resources and environmental data", supported by the European Union

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
				System "State Cadastre of Waters"		
1.2.3	Delimitation of riparian protection strips (in accordance with the provisions of Law no. 440-XIII of 27.04.1995) and planting of protection strips	2027	Annual	15,000 ha of demarcated and wooded land	1 500 000.0	Budget allocations
1.2.4	Training economic agents / farmers regarding the requirements of the Code of Good Agricultural Practices regarding the protection of waters against nitrate pollution from agricultural sources	2025-2028	Institute of Ecology and Geography. Institute of Pedology, Agrochemistry and Soil Protection "Nicolae Dimo "	25 trainings	300	Budget allocations
1.2.5.	~~Implementation of the Code of Good Agricultural Practices for the Protection of Waters Against Nitrate Pollution from Agricultural Sources (Regulation of the Use of Fertilizers in Agriculture)~~	2024 - 2029	MM, MAIA, LPAs, Agricultural Associations, Agricultural Producers	Action plan developed and implemented	500.0	External sources
1.2.6.	~~The implementation, in agricultural holdings, of fertilization plans and the record of the use of fertilizers, and the amount of mineral and organic fertilizers applied per surface unit must not exceed 170 kg N/ha per~~	Permanent	MM, MAIA, LPAs, Agricultural Associations, Agricultural Producers	Implemented fertilizer use record plans and registers	Within the available budget	budget allocations, other sources

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
	year, provided for in MADRM order 160/2020					
1.2.7.	Development and implementation of the Action Program for nitrate-vulnerable areas (for nitrate-vulnerable areas delimited in accordance with the methodology adopted by HG 736/2020 of 07.10.2020)	2024 – 2029	MM, MAIA, LPAs, Agricultural Associations, Agricultural Producers	Action plan developed and implemented	500.0	External sources
OG 2 Protection and improvement of the state of water bodies in the context of climate change						
OS 2.1 Improved hydromorphological status						
2.1.1	Development of the methodology for identifying surface water bodies with hydromorphological changes	2024	Ministry of the Environment	Developed methodology	500.0	UNDP
2.1.2	Development of the methodology for classifying the ecological state of water	2024	Ministry of the Environment	Developed methodology	500.0	UNDP
2.1.3	Development and approval of the Methodology for the identification of lakes and ponds to be liquidated	2025	Ministry of the Environment "Waters of Moldova" Agency Environmental agency	Developed methodology	500.0	UNDP
2.1.4	Development and approval of the Methodology regarding the	2024	Ministry of the Environment	Developed methodology	500.0	UNDP

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
	analysis of pressures and the assessment of anthropogenic risks					
2.1.5	hydromorphological changes	2024	Ministry of the Environment	Developed methodology	500.0	UNDP
2.1.6	Coordination of the regulations for the exploitation of reservoirs/ponds	Permanent	"Waters of Moldova" Agency	Coordinated regulations	Within the available budget	Budget allocations
2.1.7	Elaboration and approval of amendments to Government Decision no. 977/2016 regarding the approval of the model Regulation for the exploitation of reservoirs/ponds	2025	Ministry of the Environment Agency "Apele Moldovai!	Amendments to the Government Decision approved	Within the available budget	Budget allocations
2.1.8	Carrying out the control of small rivers in order to detect dams that interrupt the continuity of the river and their liquidation	Permanent	Inspectorate for Environmental Protection, Local Public Administration	Prepared reports	Within the available budget	Budget allocations
2.1.9	Monitoring implementation hydromorphological in the Dniester Hydrographic Basin District	2024-2029	State Hydrometeorological Service	Implemented hydromorphological monitoring	Within the available budget	Budget allocations
2.1.10	Identification of surface water bodies with hydromorphological changes	2025-2029	Institute of Ecology and Geography / "Apele Moldovei" Agency / State Hydrometeorological	The information system of water resources completed with that information	500.0	Budget allocations

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
			Service / Environmental Protection Inspectorate			
2.1.11	Inventory of hydrotechnical constructions		"Waters of Moldova" Agency	Completed information system	Within the available budget	Budget allocations
2.1.12	The development and implementation of national projects regarding the unclogging of lakes and rivers in the Ciulucuril basin	Trim . IV, 2025	Ministry of the Environment "Apele Moldovei" Agency	Implemented projects	1 500 000.0	Budget allocations
2.1.13	Development and implementation of national projects regarding the unclogging of strategic lakes - Dubăsari and Ghidighici	2026-2029	"Waters of Moldova" Agency	Implemented projects	1 500 000.0	External sources
2.1.14 –	Development and implementation of the National Project "Cleaning the bed of the Bâc River" in order to reduce the anthropogenic impact, to prevent the risk of flooding and the risk of bank erosion, in order to create protected natural and cultural areas in the Bâc River basin	2027-2029	"Waters of Moldova" Agency	Project implemented	10,000.0	External sources

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
2.1.15	Optimizing the number of dams built on the tributaries of the Dniester	2024-2027	"Waters of Moldova" Agency	The number of dams to be dismantled is identified	2 500.0[13]	Budget allocations
OS 2.2 Improved status of surface and groundwater bodies in the context of climate change						
2.2.1	Reassessment of underground water reserves and resources in the Dniester District (determining the stages)	Quarter II, 2024	Geology and Mineral Resources Agency, Institute of Geology and Seismology	Stage I completed	500.0	Budget allocations
2.2.2	Execution of spring rehabilitation works	Fourth quarter, 2028	"Waters of Moldova" Agency	20 springs rehabilitated	300.0	Budget allocations
2.2.3	Inventory of all mine shafts and wells	2025	AGRM	Wells and wells inventoried	Within the available budget	Budget allocations
2.2.4	Liquidation of non-functional/unauthorized probes	2026-2029	AGRM	Liquidated wells and wells	Within the available budget	Budget allocations
2.2.5 _	Development and approval of the Methodology on the state of groundwater bodies and trend assessment	Fourth quarter, 2025	Agency for Geology and Mineral Resources	Developed and approved methodology	two hundred	External sources: "EU4Environment - Water resources and environmental data" project supported by the European Union – 200

1 [13] Idem

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
2.2.6	Assessment of the condition of underground water bodies	2026	Ministry of the Environment	Completed information system	500.0	External sources: UNDP
2.2.7	Carrying out the feasibility study for the water balance restoration pilot project in a selected water body to calculate the share of water that can be used sustainably	Fourth quarter, 2026	State Hydrometeorological Service; "Apele Moldovei" Agency; Environmental agency	Feasibility study carried out	500	External sources: "EU4Environment - Water resources and environmental data" project supported by the European Union – 500
2.2.8	Ensuring regular water use balance assessment at basin / sub-basin level by using modern modeling tools (WEAP, HEC-HMS etc.)	2024 - 2027	"Waters of Moldova" Agency	Annual hydrographic balance reports prepared and published	1 900.0[14]	Budget allocations and external sources: The project "EU4Environment - Water and Date"
2.2.9	Development of the Methodology for calculating water use limits	Fourth quarter, 2024	"Waters of Moldova" Agency	Developed and approved methodology	200.0	Budget allocations
2.2.10 _	Increasing the level of water reuse for household and industrial needs; promoting cleaner production practices, etc., taking into account the EU Regulation on water reuse 741/2020	2025	Ministry of the Environment, Ministry of Infrastructure and Regional Development	Reuse practices implemented	2 750.0[15]	Budget allocations and external sources: (EIB, WB)

2 [14]Software development cost and operational costs (information collection, water balance assessment, salaries).

3 [15]Cost estimate based on standard consulting service.

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
2.2.11	Implementation of measures regarding the control of authorized water use	2024	Ministry of the Environment	Legislation drafted / revised to ensure that water usage charges are collected and channeled to finance MIRA (*in line with DCA requirements*)	3 543.3[16]	Budget allocations and external sources: P roject "EU4Environment - Water and Date"
2.2.12	Adopting measures regarding the management of water demand by reactivating the use of relevant tools (rainwater harvesting, drainage basins, etc.)	2024-2029	"Waters of Moldova" Agency	At least 100 catchment basins are built	50,000.0	Budget allocations
OS 2.3. Drought mitigation and efficient stormwater management						
2.3.1	Drafting and approval of the Regulation regarding the restriction of water use in drought conditions	Fourth quarter, 2025	Ministry of the Environment "Apele Moldovei" Agency; State Hydrometeorological Service; Environmental agency	Regulation developed and approved	180.0	External sources: The project "A green justice for a protected environment and sustainable communities in the Republic of Moldova", with the support of Sweden - 180
2.3.2 _	Promotion of conservation agriculture (increasing the water retention capacity of agricultural land)	Fourth quarter, 2026	Ministry of Agriculture and Food Industry	Number of seminars and trainings organized	500.0	Budget allocations

4 [16]Expert judgment based on estimates for similar regulatory activities.

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
			Dimo " Institute of Pedology, Agrochemistry and Soil Protection ; development partners			
OS 2.4. Reducing the risk of natural hazards						
2.4.1	Carrying out an assessment and investment on the use of controlled floods (polder type)	2023-2026	"Apele Moldovei" Agency, Environmental agency	The technical documentation prepared and the disbursements for the reconstruction of the polder carried out	33 000.0	Budget allocations and external sources: Embassy of Sweden ("Dniester-2" Project)
2.4.2	Improving/updating the hydrometeorological monitoring system to track key physical processes (eg heat or extreme precipitation) over time so that this data can be incorporated into planning processes and early warning systems	2024-2025	SHS	The recommendations regarding the improvement of the hydrological monitoring network and the meteorological observation network (developed within the PNA-2 project) are integrated into the new SHS Regulation and the new Law on hydro - meteorological activities and are implemented	Within the available budget	Budget allocations
OS 2.5. Biodiversity status improved						

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
2.5.1	Drawing up a guide - "Good practices" - regarding measures to rehabilitate protection areas, protection of water bodies	Fourth quarter, 2024	Ministry of the Environment	Detailed guide	250.0	Budget allocations
2.5.2	Carrying out rehabilitation works of damaged wetlands	Quarter IV, 2024-2026	"Waters of Moldova" Agency	Two completed projects	500.0	Budget allocations
2.5.3	Development of the feasibility study for the creation and restoration of a wetland	Fourth quarter, 2026	Ministry of the Environment The National Office for the Implementation of Projects in the Field of the Environment (ONIPM)	Feasibility study elaborated	5700.0	External sources: United Nations Development Programme , funded by the Global Environment Facility – 5,700
2.5.4	Revitalization of the Lower Dniester wetland and re-naturalization of small rivers (meandering, re-vegetation of banks)	2026	Moldavian Waters Agency, Institute of Ecology	Master plan prepared for revitalizing wetlands and restoring natural banks of small rivers	3 000.0	Budget allocations and external sources: (ADA).
OS 3.1. Improved degree of computerization of water status						
3.1.1	Classification of water bodies, including heavily modified ones (digital format)	Fourth quarter, 2024	Ministry of the Environment / "Apele Moldovei" Agency State Hydrometeorological Service	The information system of water resources completed with that information	35,000.0	Budget allocations and external sources: Project funded by the Swiss Agency for Development and Cooperation and the Austrian Development Agency

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
3.1.2	Completing the Water Cadastre with data and ensuring functionality	2024-2029	"Waters of Moldova" Agency	Operational and in-use cadastre, with budget ensured for operation	890.6 annual	Budget allocations
3.1.3	Digitization of climate and meteorological data available at SHS and other climate data holders and their publication	2024-2026	Ministry of the Environment (SHS)	Data on ASC and RRD from SHS and other climate information holders digitized and published on CCIKMP	2 126.0	Budget allocations and external sources: (USAID)
3.1.4	Development and implementation of the DniesterGIS platform	2025-2028	"Waters of Moldova" Agency	Operational platform	1 200.0	Budget allocations
3.1.5	Development of the Atlas of the Dniester Hydrographic Basin	2024	NGO	Elaborate atlas	200.0	External sources: UNDP
OS 3.2. Sustainable management of water resources and control of compliance with water legislation						
3.2.1	Facilitating the efficient functioning of the Dniester District Committee and the committees for the management of sub- basins	Quarter II, 2024	Ministry of the Environment / "Apele Moldovei" Agency	Five functional committees/commissions	1 000.0	Budget allocations and external sources: Swiss Agency for Development and Cooperation/Austrian Development Agency
3.2.2	Updating the Regulation on the operation regime of the Dniester Hydropower Complex node in collaboration with the Ukrainian Side	2027	Ministry of the Environment	Updated regulation	200.0	External sources

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
3.2.3	Consolidation of dialogue with Ukraine for the adoption and implementation of measures to ensure the ecological functioning of the Dniester Hydropower Complex node in accordance with international ecosystem protection standards	2024-2029	Ministry of the Environment	No. of organized meetings	Within the available budget	Budget allocations and external sources: UNDP
OS 3.3. Increased awareness, information and involvement of the population in the protection of water resources						
3.3.1	Organization of events dedicated to the Dniester day	annual	Ministry of the Environment / "Apele Moldovei" Agency	Organized events	Within the available budget	Budget allocations
3.3.2	basin committee seminars on watershed management during drought	Fourth quarter, 2028	"Waters of Moldova" Agency	Number of seminars organized	250.0	External sources: "EU4Environment - Water resources and environmental data" project, supported by the European Union
3.3. 3	Photo contest dedicated to Dniester Day	Annual	NGO	No. of organized events	Within the available budget	Budget allocations
3.3.4	Running information campaigns for the population regarding the risks associated with the consumption of non-compliant water in the localities affected by	Permanent	Ministry of Health, National Agency for Public Health	No. of organized campaigns	Within the available budget	Budget allocations

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
	the drought, with the indication of alternative sources of drinking water; using mass media with the involvement of Public Health Centers specialists.					
3.35	Promotion of alternative solutions - reuse of wastewater in agriculture, for irrigation of crops	2024-2026	Ministry of the Environment / "Apele Moldovei" Agency Environmental agency	Pilot project	Within the available budget	Budget allocations and external sources
OS 3.4. Improved water body monitoring network						
3.4.1	Ensuring operative and coherent monitoring of meteorological and hydrological conditions	Systematic	State Hydrometeorological Service	Prognoses and drought warnings developed and disseminated	2000.0	Budget allocations
3.4.2	Ensuring operative and coherent monitoring of surface water quality on the basis of the hydrographic district	Systematic.	Environmental agency	Pollution forecasts and warnings developed and disseminated	2000.0	Budget allocations
3.4.3	Synchronization of the Data Platform on monitoring the quality of water resources in the Dniester District with Ukraine,	Quarter III, 2024	Ministry of the Environment, Environment Agency Service	Compartment created in the Water Resources Information System	1 000.0	External sources: Project funded by the Global Environment Facility
3.4.4	Realization and implementation of the early warning system of pluvial floods on medium and small rivers	2026-2027	State Hydrometeorological Service, General Inspectorate for Emergency Situations	Early warning system created	5000.0	External sources

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
3.4.5	Expanding the hydrochemical and hydrobiological monitoring network of rivers by installing hydrochemical stations	2024-2029	Environmental agency	Extensive monitoring network	900.0	Budget allocations
3.4.6	Expansion of the underground water monitoring network	2024-2029	Agency for Geology and Mineral Resources	Extensive monitoring network	900.0	Budget allocations
3.4.7	Acquisition of equipment for monitoring surface and underground water bodies	Fourth quarter, 2024	Environmental agency	Purchased and functional equipment	3 500.0	Budget allocations
3.4.8	Equipping selected groundwater wells with automatic loggers and modern sampling equipment	Fourth quarter, 2024	Agency for Geology and Mineral Resources Local public administration	3 equipped water fountains	600.0	Budget allocations
3.4.9	Purchase of equipment for measuring water flows during floods (Q boat – 1 pc., StreamPro – 1 pc., inflatable boat with a 10 hp engine – 3 pcs., hydrometric dykes – 10 pcs., thermometer for measuring water temperature – 37 pcs. ., thermometer for measuring air temperature – 37 pcs., rain gauge – 30 pcs., GOL level – 4 pcs., snow gauge – 30 sets, portable hydrometric gauge – 37 pcs., hydrometer with scales – 30 pcs.)	Fourth quarter, 2024	State Hydrometeorological Service	Purchased and functional equipment	4000.0	Budget allocations

No.	Name of the action	Deadline	Responsible institution	Monitoring indicators	Estimated cost, in thousands of lei	Funding sources
3.4.10	Operationalizing and equipping hydrometric stations with observation equipment	Fourth quarter, 2024	State Hydrometeorological Service	Set of equipment (manual, automated, laboratory hydrometric equipment) installed	8 000.0	Budget allocations
3.4.11	Consolidation of the monitoring of water resources through the appropriate endowment of the Environmental Laboratory and its appropriate accreditation."	Trim . IV, 2025	Ministry of the Environment Environmental agency	Expansion of the national monitoring network Automation of the national monitoring system Improved monitoring system	Within the available budget	Budget allocations