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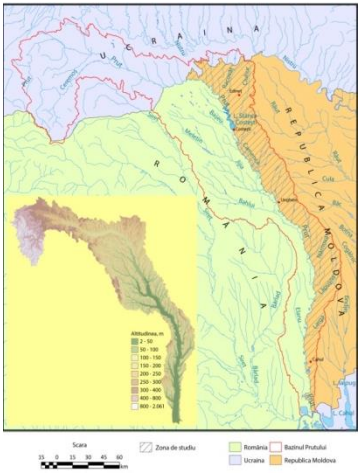
Contract No 2011/279-666, EuropeAid/131360/C/SER/Multi

THE PRUT RIVER BASIN MANAGEMENT PLAN
Cycle I, 2017 – 2022
Executive summary



Prepared by Institute of Ecology and Geography of the Academy of Sciences of Moldova

Chișinău, 2016

Approved by the Scientific Council of the Institute of Ecology and Geography of the Academy of Sciences of Moldova.

The protocol Nr. 4 of 10.09.2015

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Contents

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For the preparation of this River Basin Management Plan for **Prut River basin, Republic of Moldova**

Specific contributions and support for the elaboration of the document have been provided by the TA Team:

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- Agency of Geology and Mineral Resources
- State Hydrometerological Service
- SE "Hydrogeology Expedition from Moldova" (EHGeoM)

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The Objective and Approach of the Draft Plan

The River Basin Management Plan (RBMP) for the Prut River Basin was prepared according to the approaches and methodology proposed in the EU Water Framework Directive (WFD) and Water Law no. 272 of 23.12.2011. The aim of the Management Plan is to improve the proper use of water resources. The plan is intended for all authorities responsible for water management – Ministry of Environment and its subdivisions, local public authorities, water users, etc.

The core of this plan is the Programme of measures (PoM), which aims achieving the environmental objectives established for all bodies of water (good status). The Programme of Measures on the analysis of the initial conditions of the basin, the significant human pressures and their impact on water resources are based. A key component of the RBMP represents analysis of main pressures and impact on water bodies, which results from the identification of specific problems and their origin, what can include the water bodies at risk of failing to achieve the established environmental objectives. According to EU WFD three major types of pressure are distinguished: point source pollution; diffuse source pollution and hydro-morphological alterations. The PoM proposes the measures for each water body at risk of not achieving the environmental objectives, resulting from the identified pressures.

When setting up the environmental objectives, identified significant pressures as well as exemption of achieving "good ecological and chemical status/potential" for the next cycle (2017-2022) in accordance with WFD were taken into account. Thus, it was proposed that environmental objectives to be achieved for all water bodies in future planning cycles, with the beginning from the first one which is till 2028 (2023-2028).

In the RBMP considerable attention is given to the economic analysis of water use. The use of water resources directly contribute to their impairment.

In RBMP developing, some gaps in data and information were identified. The main problems face during development of RBMP were: the lack or access to data base regarding volumes and quality of waste water discharges, the lack of monitoring data (quantitative, hydromorphological, ecological and hydrobiological information) for all water bodies, delineation and mapping of protection areas for water abstractions points, poor collaboration and cooperation between national institutions involved in the management and monitoring of water resources, poor experience is development of RBMP and necessity in water management experts, etc. Some of these problems have been partially solved in the EPIRB project, by organizing of three expeditions and the contributions to improving of existing monitoring system. The River Basin Management Plan for the Prut River Basin Project some recommendations for the data complement and lack of information provides.

The plan was developed with the support of EU regional project "Transboundary River Basin Environmental Protection". The work team thanks to team leader Mr. Tim Turner, National Coordinator - Mr. Victor Bujac, as well as experts Mr. Zurab Jincharadze, Mrs. Birgit Vogel and others for their support.

The Prut River Basin

The Prut River is one of the largest rivers in Western Ukraine, Moldova and Romania, one of the main tributaries of the Danube River. The Prut River basin is transboundary and is shared by three countries (fig.1). Of the total basin area, 28% of the Prut River Basin is located in the territory of Moldova, 33% in the territory of Ukraine, and 39% in the territory of Romania. The Prut River originates on the south-western slope of the Hoverla mountain, at about 15 km south-south-east of Vorokhta village in the Chornogora massif of the Carpathian forest massifs, and discharges into the Danube River south of Giurgiulesti village, at about 164 km from the Danube mouth. Prut River has length of 967 km and a catchment area – 27 540 km^2.

Within the limits of the Republic of Moldova, the Prut River has a length of 695 km and the basin area of 8226 km^2 (tab.1). Basin is a relatively narrow band, with a length of 340 km and a width up to 70 km, with average width of 51 km. The absolute maximum elevation of the basin is 429,5 m, and the minimum - 2,6 m. Main tributaries, on the Moldovan territory, are: Camenca, Ciuhur, Racovăț, Gîrla Mare, Nîrnova, Lăpușna, Sărata, Larga rivers.

Prut River water resources

Average annual flow volume of the Prut River is equal to 2,7 km^3, and varies from 1,2 km^3in years with insufficient humidity up to5 km^3, values achieved in the years with the heights insurance of water resources. Average annual flow is equal to 78 - 87 m^3/s, fluctuations are from 40 up to 162 m^3/s.

The water resources of the Prut River have a non-uniform monthly distribution. The months with the highest values of flow are April, May, June and July. The highest average flow is registered in June and is equal to 124-127 m^3/s, and the minimal flow, under 60 m^3/s, is registered during winter months. In the planning process of water resources use, especially at the construction of new abstraction systems from surface sources, must necessarily take into account the degree of assurance of water resources (fig. 2 and 3).

Table 1. General information of the Prut River Basin

Characteristics	The Prut River Basin in the limits of Moldova	Characteristics	The Prut River Basin in the limits of Moldova
Basin surface, km^2	8 226	Number of towns	15
Maximal altitude, m	429,5	Number of water bodies	RWBs – 83 LWBs – 7 GWB- 9
Minimal altitude, m	2,6	Average length of river water bodies	26 km
Number of population, ths. inhab.	798,7	Average basin area of river water bodies, km^2	99 km^2
Number of villages	447	Number of Heavily Modified Water Bodies	63

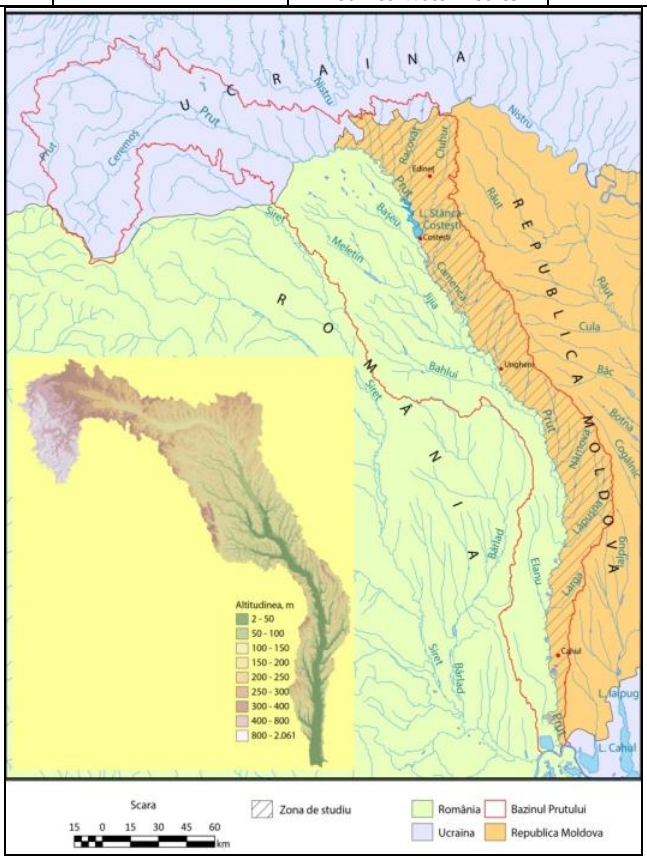


Figure 1. Geographic position of the Prut River Basin

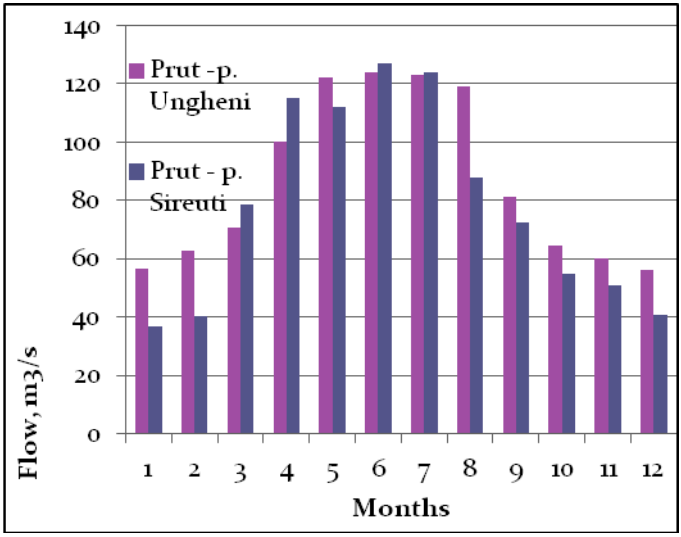


Figure 2. The monthly distribution of average flow (m^3 / s)

The average annual **precipitation** in the Prut basin in Moldova is 524-636 mm. A minimum amount of precipitation is observed during the colder and a maximum during the warmer months of the year. Table 2 shows the average monthly and annual precipitations based on long-term observation at meteorological stations of the State Hydro meteorological Service.

Table 2. Monthly and annual average rainfall in the Prut River Basin

Meteorological stations	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Briceni	34	35	30	49	68	83	92	63	52	33	42	38	618
Cornești	39	37	36	51	61	92	80	59	59	35	47	40	636
Leova	31	29	28	41	53	70	59	57	46	31	41	37	524
Cahul	32	33	31	39	54	76	58	56	47	31	40	38	535

The absolute daily maximum precipitation is quite high: e.g. 138 mm at the Cornesti meteorological station in 1969. The Prut River basin belongs to the zone of insufficient humidity. Precipitations decrease from North to South and the spatial distribution of precipitations is significantly affected by the terrain. The wind direction is north-west and west, the highlands receive higher precipitations compared to downwind slopes. The regime of precipitation is highly irregular in time. In some years, the annual amount can be over 900 mm (in the northern and central parts of the basin), or less than 270–300 mm (in the southern part).

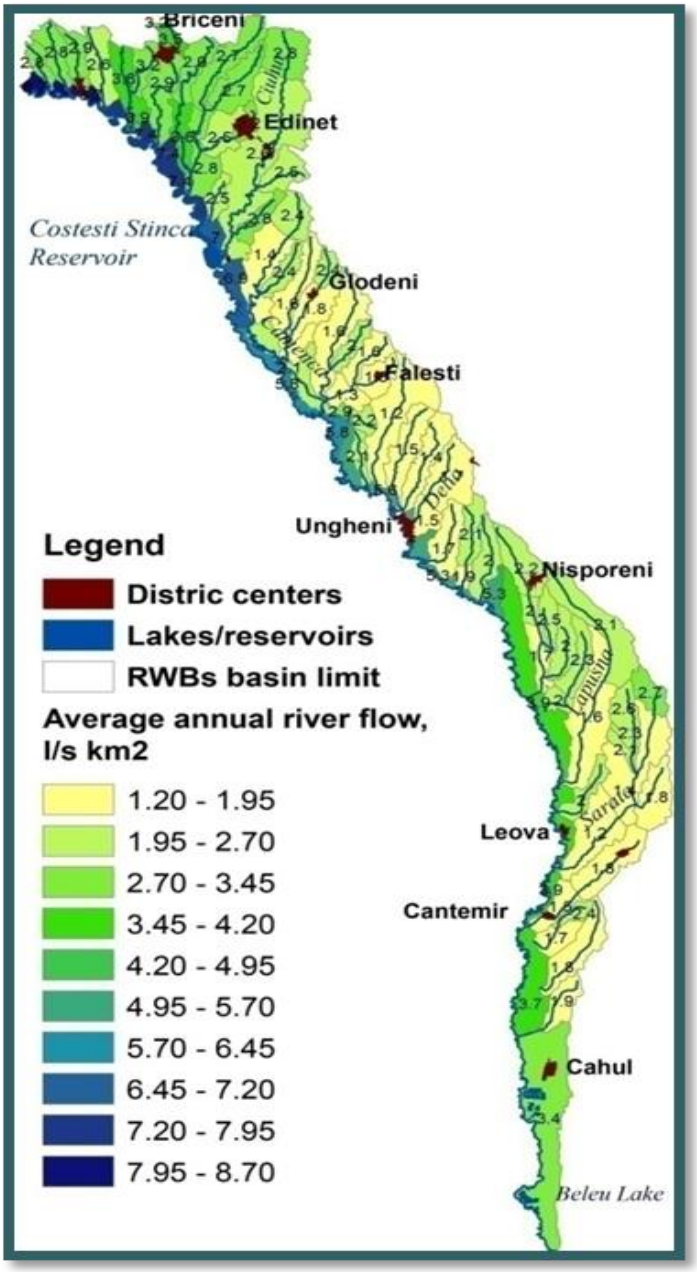


Figure 3. The spatial variation of average effective flow

Identification of water bodies

Within the Prut River Basin 83 river water bodies have been delineated, 7 lake water bodies. One of them (ponds of the Cahul fish farm) has been identified as an artificial water body (fig. 6).

Six main aquifers have been analyzed for identification and delineation of groundwater bodies: Holocene alluvial, Pontian, Meotian, Middle Sarmatian (Congerian), Badenian-Sarmatian, Cretaceous-Silurian. Middle Sarmatian represents transboundary water body, shared by the Republic of Moldova and Romania (fig. 7).

Economic activity

Agriculture

Agriculture is a traditional economic sector in the Republic of Moldova. The Prut River Basin is a typical agrarian region. Agricultural areas occupy 76.8% (fig. 4 and 5). More than a half of the basin's area is arable (52.5%). Share of the arable area is higher in the northern part of the basin with a mean value of 57% decreasing slightly in the middle part of Prut river, within the Codrii heights where the terrain is more drained. Pastures cover over 16% of the total area and are spread actually all over the basin. Generally, they located the river floodplains. The predominance of agricultural lands on the one hand, influences the high demand of water for irrigation, and on the other, causes pollution with nitrates and other nutrients.

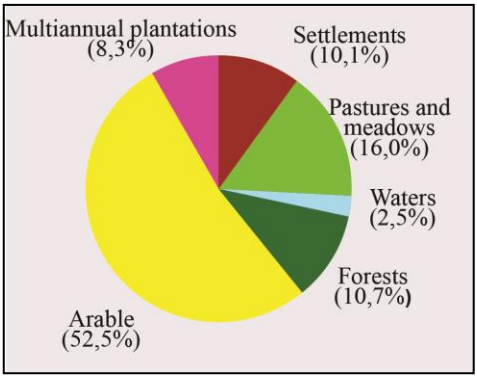


Figure 4. Land use in the Prut River Basin

Industry

The largest water users are the cities with large factories. There are highlighted sugar factories of Glodeni, Fălești towns and wineries of Cahul, Nisporeni and Cantemir, baking and dairy products industry, etc. The biggest problem is that most of these companies do not have wastewater treatment plants (except sugar factories) and discharge untreated wastewater directly into water bodies.

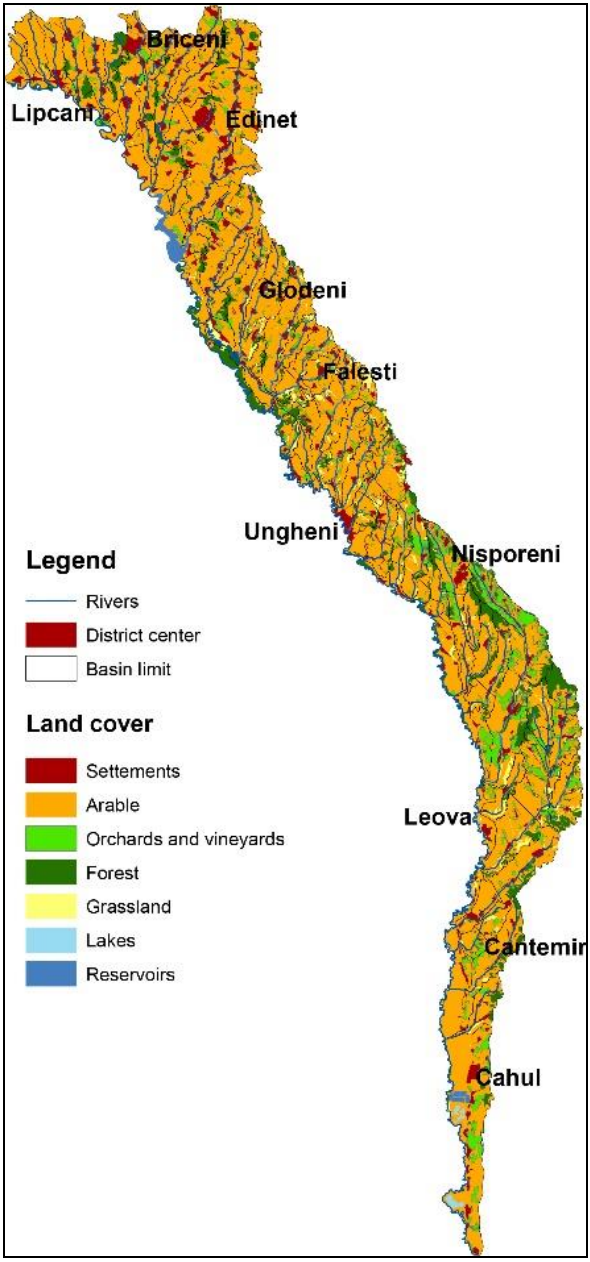


Figure 5. Land Use within the Prut Basin

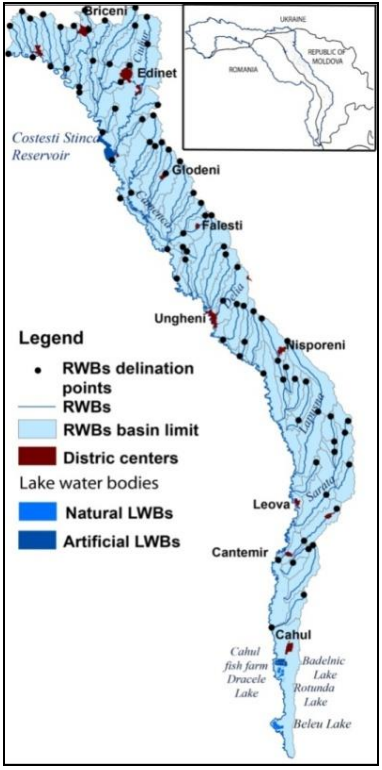


Figure 6. Surface water bodies in the Prut River basin of Moldova

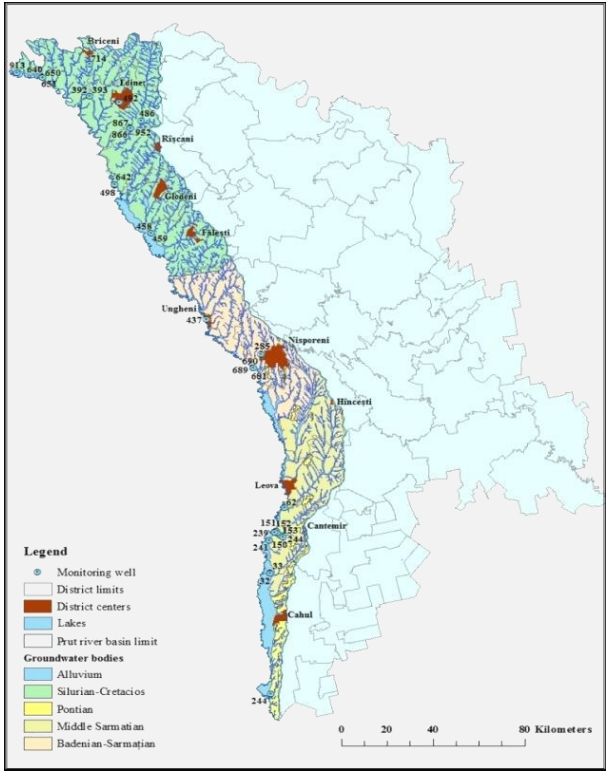
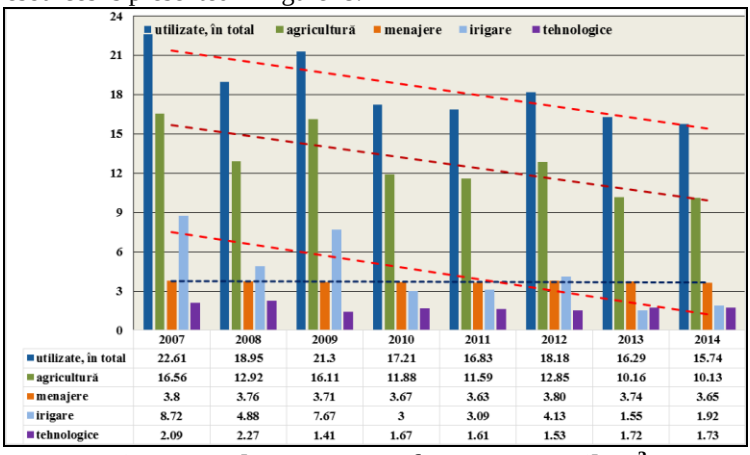


Figure 7. Groundwater bodies and monitoring wells in the limits of the Prut River Basin

Water abstraction

The main source of fresh water is the surface waters of the Prut River. Briceni, Edineţ, Cupcini, Glodeni, Ungheni, Leova, Cantemir and Cahul are supplied from the Prut river. The water abstraction decreased by almost 5 times during the last 20 years to 26,8 mil. cub. m. The best public water supply is in the northern districts where the water quality is better. The main source of water is groundwater. Ground water supply becomes more and more important due to decreasing availability of surface water resources and increasing of pollution. The use of water resources is presented in figure 8.



	2007	2008	2009	2010	2011	2012	2013	2014
utilizate, în total	22.61	18.95	21.3	17.21	16.83	18.18	16.29	15.74
agricultură	16.56	12.92	16.11	11.88	11.59	12.85	10.16	10.13
menajere	3.8	3.76	3.71	3.67	3.63	3.80	3.74	3.65
irigare	8.72	4.88	7.67	3	3.09	4.13	1.55	1.92
tehnologice	2.09	2.27	1.41	1.67	1.61	1.53	1.72	1.73

Figure 8. The structure of water use, mil. m^3

Hydropower plant

Within the Prut basin in Moldova, there is a single 32000 kW Hydropower Plant (HPP) located near the Costeşti town, to 576 km away from the river Prut spring. It was built on the Prut river in cooperation with Romania in 1978 and put into operation in 1979. Costeşti-Stânca HPP was designed to control the flood discharge and electricity production, as well as to provide water supply to irrigated agriculture, processing industry, etc.

Significant pressures and impact estimation

The assessment of human pressures and impact on water bodies was performed with the aim to evaluate the status of water bodies and identify those water bodies with risk of failing the EU WFD objectives and included following important stages: identification of water uses and related pressures and risk assessment of possible failure of environmental objectives (tab. 3).

Table 3. The main types of pressures within the Prut river basin

The type of pressure	Basin/Water body	Comments
Wastewater discharge	Ciuhur, Racovăț, Șovăț, Prut (downstream of Ungheni)	Discharges of untreated or insufficiently treated waters
Agricultural activities	All the water bodies	The agricultural lands occupy 76.8%. Over 50% of the basin is occupied by arable lands. Riparian protection strips lacking in most water bodies.
Unauthorized dumps	All the water bodies	The lack of authorized dumps in most settlements. Riparian protection strips lacking in most water bodies.
Interruption of longitudinal continuity of rivers	Racovăț, Camenca, Garla Mare, Șoltoaia	The construction of reservoirs and ponds on water streams.
Dams and irrigation channels	The lower course of Prut River	Construction of flood protection embankments near the Prut minor riverbed and the high density of irrigation canals.
Fishery	Fishery Cahul Lakes, Manta	water resources abstraction from Prut river in artificial water body, Cahul fishery lakes limit water intake in Manta Lake.
Water abstraction	All the water bodies	One of the main problems are unauthorized abstraction of water from small and medium rivers. Another problem associated with the impact on water resources are violations of sanitary protection zones of catchment points of both surface water and groundwater as well.

The main sources of pollution are (tab. 4):

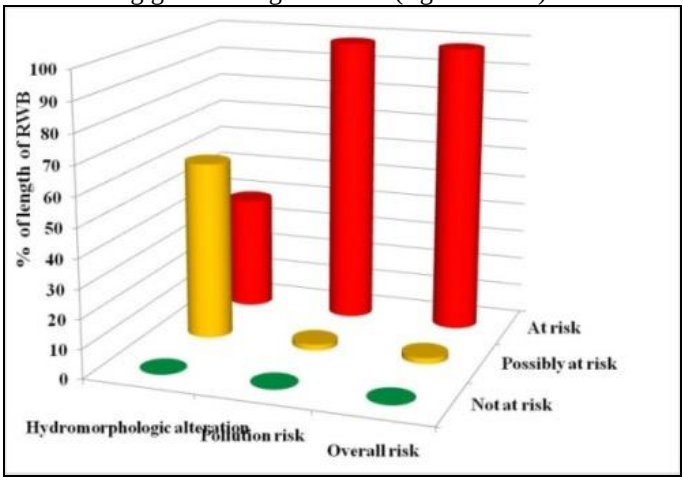
- point source pollution (wastewater discharge);
- diffuse source pollution (agricultural activities, unauthorized dumps);
- hydro-morphological alterations (interruption of river continuity by the dam construction, density of irrigation and abstraction canals).

Table 4. Risk assessment results - Hydromophological alterations and pollution (Principle: One-Out-All-Out)

Type	Not at risk		Possible at risk		At risk	
	Number of RWBs	Total lengths, km	Number of RWBs	Total lengths, km	Number of RWBs	Total lengths, km
Hydromorphological alterations	-	-	57	1317	26	835
Percentage	-	-	69	61	31	39
Pollution impact	-	-	1	50	82	2102
Percentage	-	-	1	2	99	98
Overall impact	-	-	1	50	82	2102
Percentage	-	-	1	2	99	98

Identification of water bodies at risk of failing the environmental objectives was made using the principle One-Out-All-Out. This approach is based on the principle that each pressure that exceeds one of the risk criteria has a decisive effect on the overall risk status of the entire water body. The overall risk is quantified as being the worst situation established between all categories of risk (pollution with organic substances, nutrient pollution and morphological changes).

From 2152 km water bodies length, 85 km or 26 water bodies are at risk to fail the environmental objective due to hydromorphological alterations when others 1317 km (57 water bodies) were assessed as possibly at risk. The pollution impact on water bodies is even greater, especially pollution from diffuse sources. Thus, the 2102 km of rivers or 98% of total length of RWBs are at risk, the other being possibly at risk. Respecting the principle of "One-Out-All-Out" all these 98% are at risk of not achieving good ecological status (fig. 9 and 10).



Figures 9. Risk assessment results

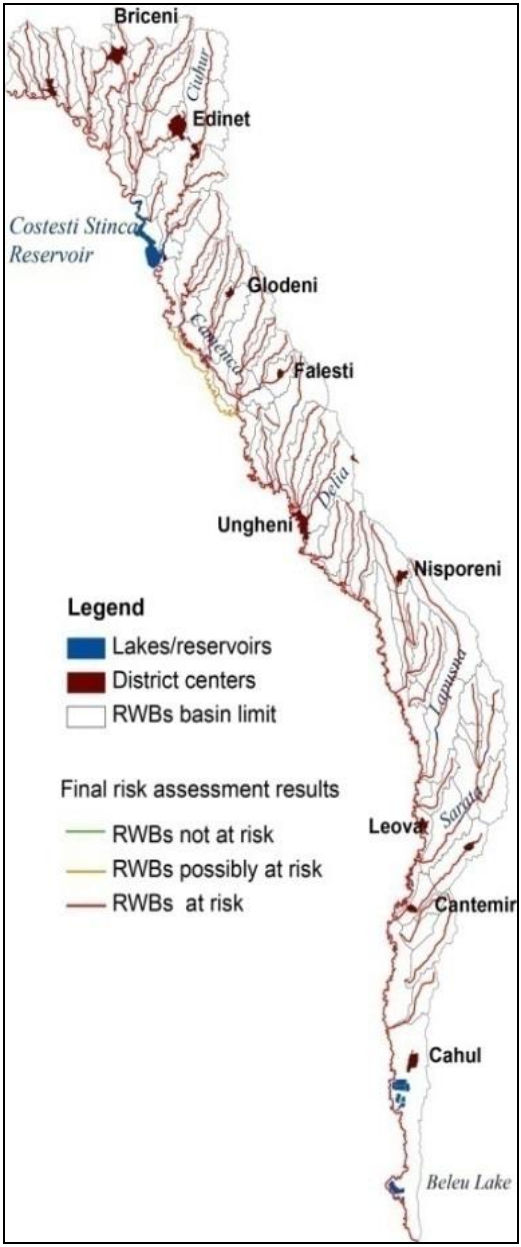


Figure 10. Risk assessment results

Lake water bodies, based on identified morphological changes (the origin: natural, artificial, HMWB; siltation, interruption of connectivity, etc.) and the chemical quality of water in southern lakes all water bodies are assigned to risk (tab. 5).

Table 5. Risk assessment of lake water bodies

Lake	Position	Genesis	Type	Area, sq. km.	Risk type
Costesti-Stinca	Riverbed	HMWB	Reservoir	42,56	At risk
Badelnic	Floodplain	Natural	Lake	1,443	At risk
Dracele	Floodplain	Natural	Lake	2,774	At risk
Rotunda	Floodplain	Natural	Lake	2,329	At risk
Beleu	Floodplain	Natural	Lake	8,538	At risk
Prut nameless	Floodplain	Natural	Lake	0,986	At risk
Cahul fish farm	Floodplain	Artificial	Reservoir	12,597	At risk

The monitoring program and network

State Hydrometeorological Service is responsible at national level for hydrological, hydrochemical and hydrobiological monitoring of rivers and lakes. Systematical monitoring of surface water quality in the Prut River Basin was carried out in 14 monitoring points until 2013 (fig. 11). Beginning of 2014 another monitoring program has been introduced for the Prut River Basin in accordance with the EU WFD 2000/60 which consists of 30 monitoring stations: 8 points situated on the Prut River, 1– artificial lake, 2 – natural lakes and 19 – on tributaries. In the process of monitoring programme development the data and information from the joint expeditions in the pilot river (JFS-I, JFS-II, JFS-III) and national monitoring programmes conducted in the Prut River basin (MD) were used.

The quality of surface waters in the limits of the Prut River Basin was assessed based on information provided by SHS for 2013-2014 years and that obtained as a result of annual expeditions (2013-2015) in the Prut river basin deployment within the EPIRB project and is presented in figures 12-14.

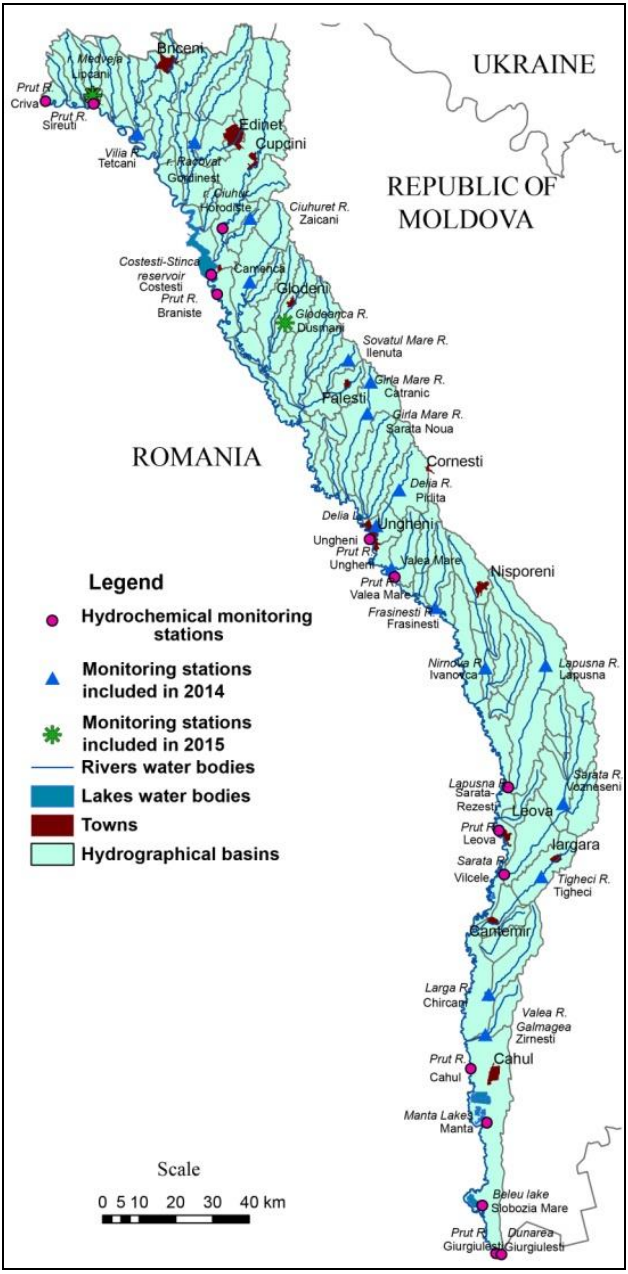


Figure 11. Hydro chemical and hydro biological monitoring stations

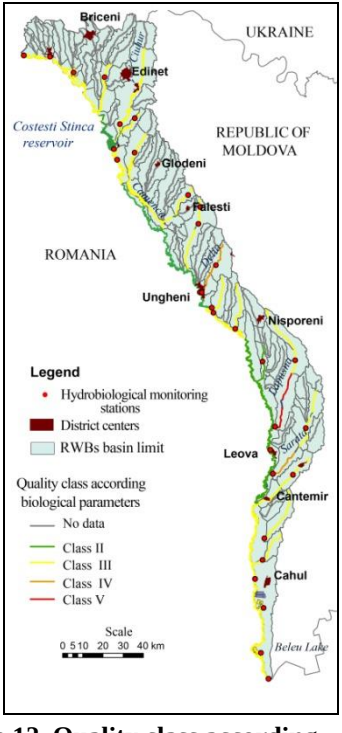


Figure 12. Quality class according hydrobiological elements for Prut HB

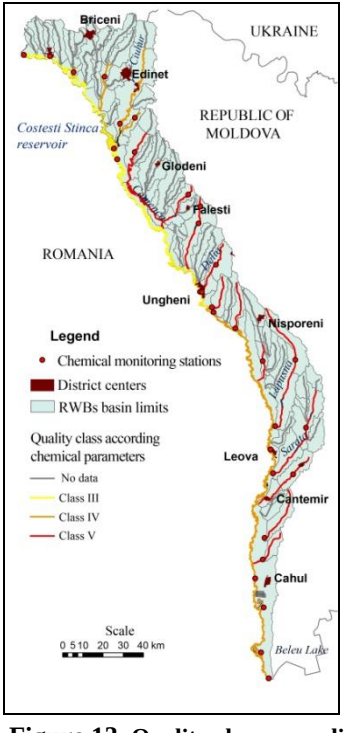


Figure 13. Quality class according physico-chemical parameters for Prut HB

Figure 14. Final quality class for Prut HB

According to expert comments (Paul Buijs), the river water bodies with water quality parameters that qualify as Class III or worse could be regarded as being 'at risk'. In this regard, figure 15 shows the water bodies at risk according to ecological status.

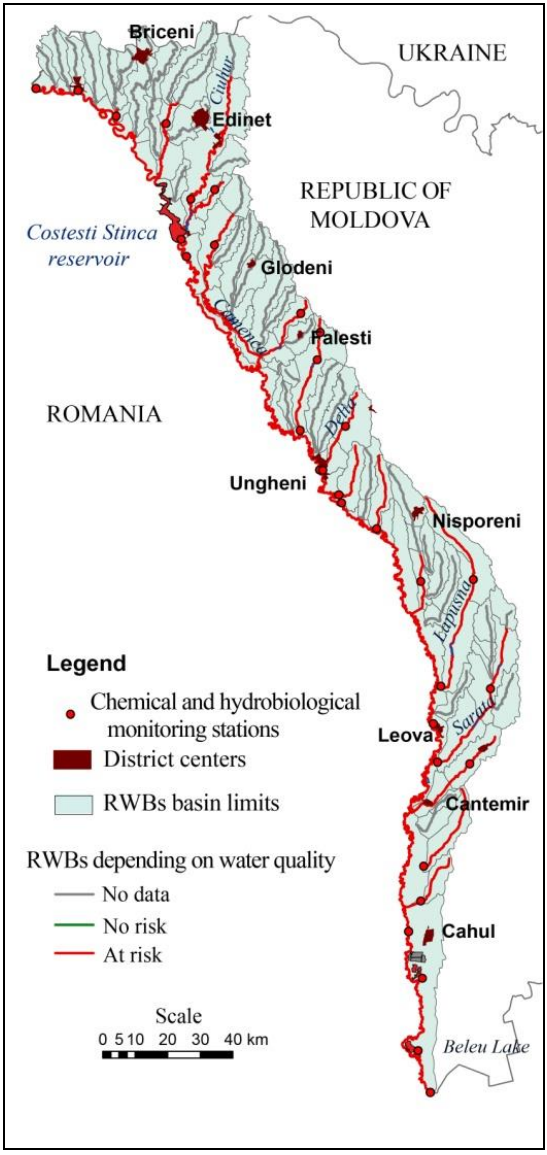


Figure 15. Water bodies at risk from Prut HB

The ecological status of LWBs

Analysis of water quality for LWBs was executed using the same principles as in case of RWBs: analysis of annual averages and percentiles was quality parameters with comparison of 5 quality classes.

Overall, it is observed that the ecological status of Costesti – Stinca reservoir corresponds to quality class III that is "moderately polluted". According to hydro-biological parameters the Costesti – Stinca reservoir quality of water can be attributed to class II, but physico-chemical indicators indicate a moderate water lake pollution after chemical oxygen demand, content of total iron, phenols and petroleum products.

As regards the other lakes within Prut river basin monitored - Manta and Beleu - natural lakes situated in the southern part of the republic, the water quality corresponds to the IV class, that is "polluted".

Existing groundwater monitoring network

National groundwater monitoring network in the Prut River Basin consists of 32 monitoring stations installed into unconfined and artesian aquifers and is used for the routine observations of quantity and quality of impacted by abstraction underground aquifers.

It is proposed to maintain all existing monitoring wells as it will be difficult from the economic point of view to drill new monitoring wells in Moldova in the nearest future. It is recommended to install (rehabilitate) 7 additional monitoring points to make at least five surveillance monitoring stations in each delineated groundwater body. Total number of surveillance monitoring wells for the WFD compliant programme will then be 39.

Specific feature of Moldovan aquifers is elevated mineralization (total dissolved solids) which is related to availability of soluble gypsum minerals in water bearing sediments. Due to the increased salinity in all productive aquifers the content of dry residue reaching 1,5 g/l is approved in the Moldavian drinking water standard (EU norm is 1,0 g/l). It is assumed that groundwater abstraction accelerates saline water intrusion and this has to be monitored. Investigative monitoring is proposed for detecting of the reason of such salinity

.

Environmental objectives

Among the environmental objectives, which will be practically impossible to achieve in the next 6 years there are mentioned enhancing and restoring of all surface water bodies, including Heavily Modified Water Bodies, and groundwater bodies in order to maintain a "good status".

Essentially, achieving the environmental objectives for the Prut River Basin until 2021, suppose:

1) **Prevention of further deterioration of current state of surface and ground waters**. This objective is applied for the surface water bodies, for which several risks and pressures have been identified (fig. 16), and achievement of good *"quality"* and *"quantity"* is practically impossible for the next 6 years, namely in the first planning cycle 2016-2021.
2) **Progressive reduction of pollution** with priority substances and cessation of priority hazardous substances discharges into surface waters by implementation of necessary measures. The objective is applicable to the water bodies, where both point sources pollution (municipal and industrial wastewater discharges) as well as an evidence of the volume and quality of discharged wastewater (to perform monitoring) is present (fig. 17) in accordance with Directive no. 91/271/EEC regarding urban wastewater treatment, harmonized by the Government Decision of the Republic of Moldova no.950 from 25/11/2013 for approving the Regulation on requirements for collection, treatment and discharge of wastewater into the sewage system and/or in water bodies in urban and rural areas.
3) **Ensuring sustainable management of water resources** is applied for lakes water bodies (the Costești-Stânca reservoir; complex of the natural lakes Manta and Beleu) and for surface water bodies of the Prut river (located on the river bed). This objective is valid for those surface water bodies, which currently have sufficient water resources and for the next 6 years, represents a potential source of expansion of drinking water supply system for population (fig. 18).
4) **Achieving the standards and objectives for protected areas** established by Community legislation. In the case of protected areas, at the moment, it is necessary, first of all, to make a correct delineation and mapping for all abstraction sources (both surface waters and groundwater) and creation of respective register. Assigning the protected area status to these territories, with all advantajes that will result, represents an achievable objective for the next 6 years (fig. 19).

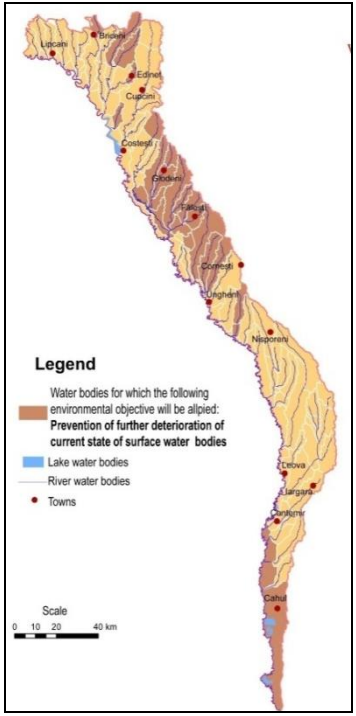


Figure 16. Water bodies for application of the environmental objective „Prevention of further deterioration of the current state of surface WB”

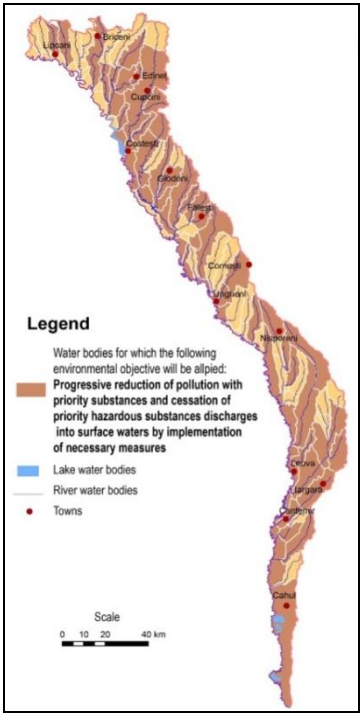


Figure 17. Water bodies for application of the environmental objective „Progressive reduction of pollution”

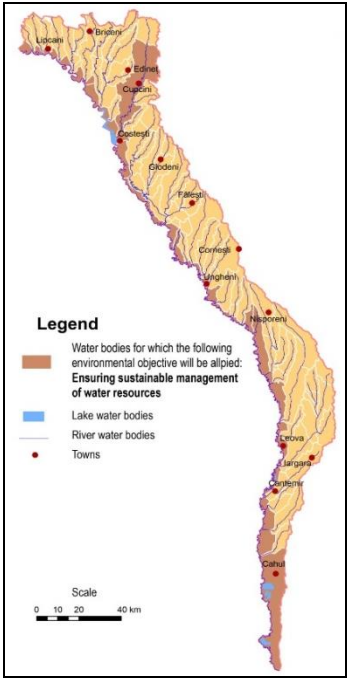


Figure 18. Water bodies for application of the environmental objective „Ensuring the sustainable management of water resources"

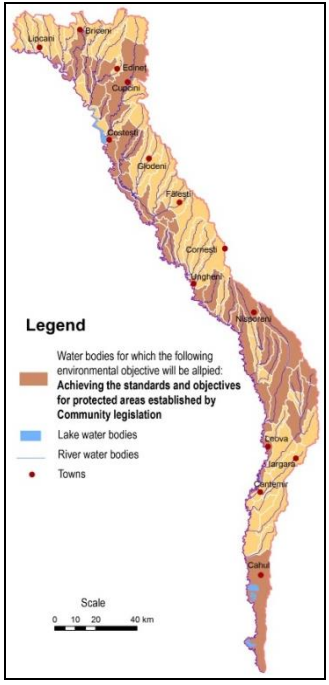


Figure 19. Water bodies for application of the environmental objective „Achieving the standards and objectives for protected areas"

Achieving the environmental objectives depends directly on the value and the type of pressure identified. Some types of pressure, such as diffuse pollution from agriculture can be relatively easier to be solved by planting the protection of riparian strips, reduction of agricultural lands and greening of agricultural activities; other pressures exercised by the discharge of untreated wastewater from cities are more expensive to resolve. Classification of water bodies, in relation to the possibility of achieving environmental objectives, has been achieved by indexing the categories of pressure versus status of water bodies. The total pressure was calculated by adding all types of pressure with specific risk criteria by assigning water bodies a coefficient depending on the type of risk, from 1 (low risk) to 3 (at risk). The resulting values, which range from 10 to 22 points, were classified into 3 classes, each class corresponding to a cycle of the management plan implementation (figures 20 - 23).

Thus, in the first cycle (2017-2022) 19 water bodies with a total length of 461.2 km (of the total 2152 km) will achieve the environmental objective quality/good status (fig. 20); in the the second cycle (2023-2028) – 37 water bodies with a total length of 1120.8 km (fig. 21); and in the third cycle (2029-2034) – the latest 27 water bodies with a length of 570 km (fig. 22).

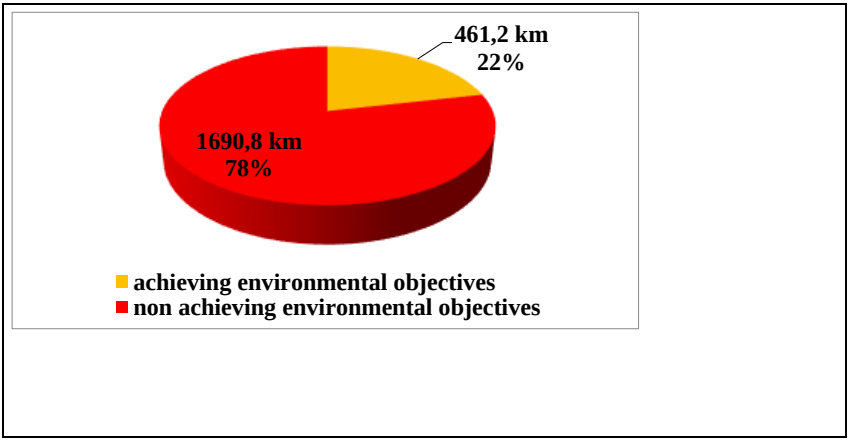


Figure 20. Achieving environmental objectives in the first cycle (until 2022)

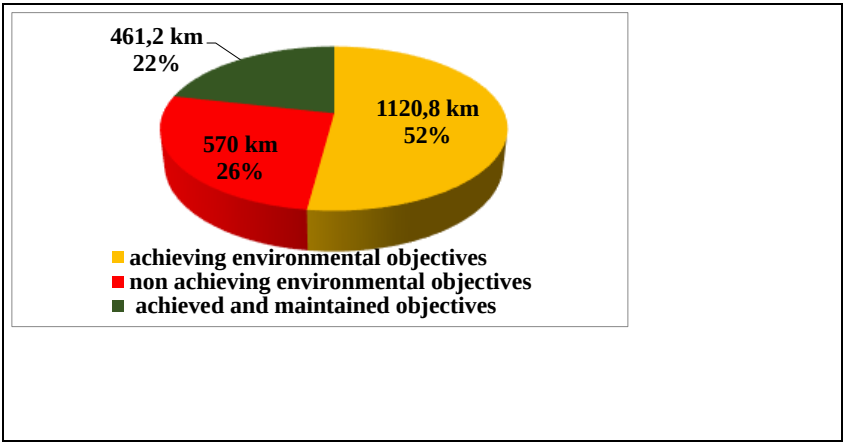


Figure 21. Achieving and maintaining environmental objectives in the second cycle (until 2027)

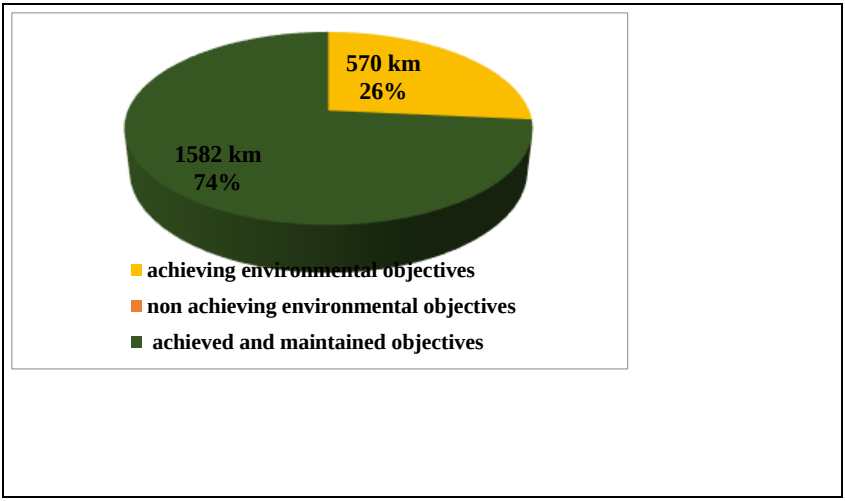


Figure 22. Achieving and maintaining environmental objectives in the third cycle (until 2032)

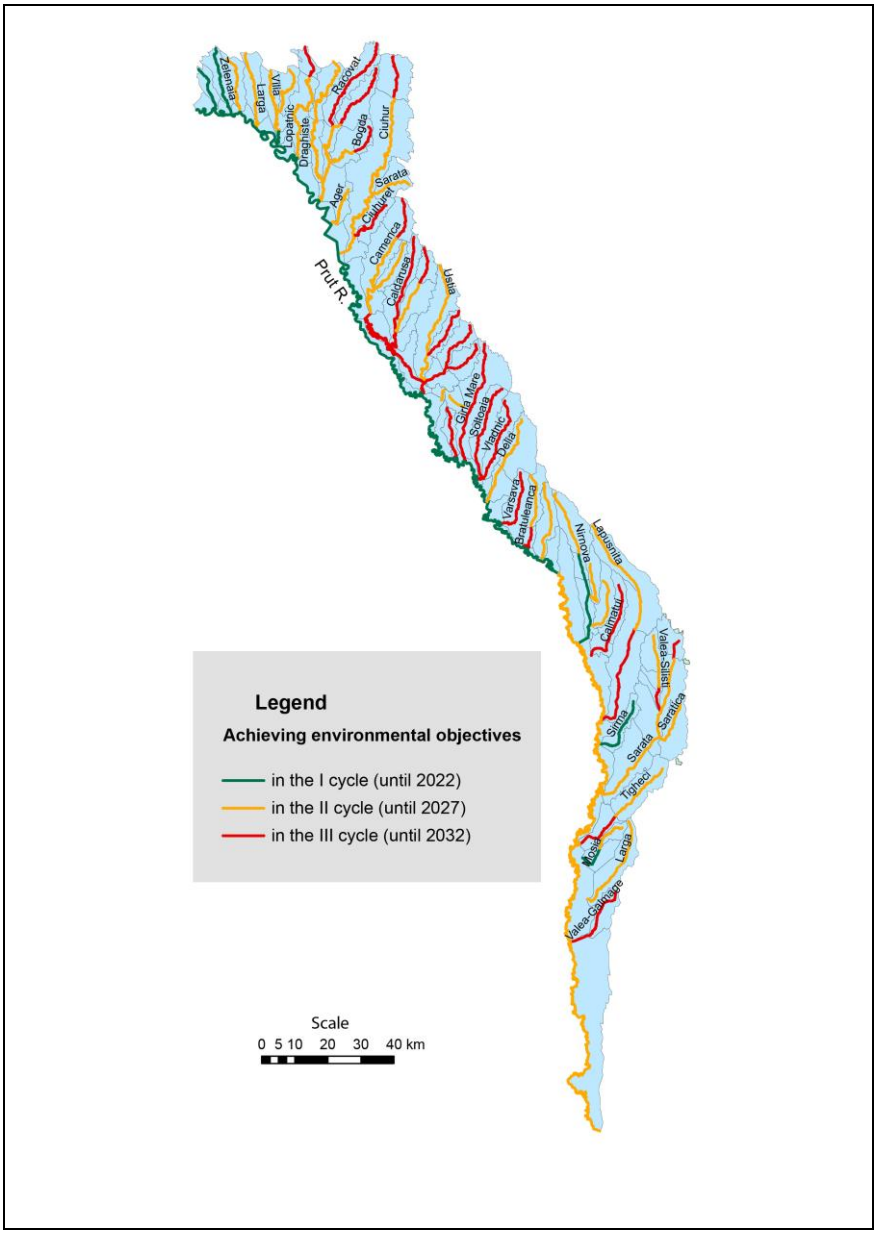


Figure 23. Achieving environmental objectives

Economic analysis of water use

Section "Economic Analysis of Water Use" is developed in accordance with the WATECO Guidelines on the methodology of economic assessment of water use for the implementation of the Water Framework Directive 2000/60 /EC, with River Basin Management Plans implemented in neighbouring states, and the economic mechanism of use and protection of water resources applied in the Republic of Moldova.

The Prut river basin has a primary role in water supply for agriculture and households from west of the country. For agricultural needs are used about 70% of the water used in this basin, including ¼ for irrigation. The irrigation in agriculture has pronounced spatial characteristics, being more widespread in northern districts with higher level of financial assurance. For domestic needs are used about 20% of the total used water, and for industry – only 10%.

In the last years, there is a pronounced tendency to reduce the volume of captured and used water. This is due to a significant reduction of the volume of abstracted water from surface sources used in agriculture, particularly for irrigation. In addition, a recent significant expansion of settlement water supply networks is based on the priority exploitation of groundwater sources, also access and consumption increase in the households. A difficult and widespread problem is the superficial and even the lack of recording of water used at mining and agricultural enterprises.

In the analysed period (2007-2014), the number of municipal water supply systems from the Prut river basin was increased from 100 to 160 units (+ 60%), and their length over 2 times (from 1055 km to 2133 km). Despite the rapid expansion of water supply networks, water consumption per capita is very low comparing the country average, which is explained by the lower degree of urbanization of Prut river basin. Unlike water supply systems, the sewerage and treatment systems do not register growth rates. As a result, the coverage of water supply with sewerage networks has decreased during this period by 2 times (from 36% to 18%).

Irrevocable losses exceed 70% of the total volume of captured water. It is due to both advanced wear of water supply infrastructure in the area of the Prut river basin and technological peculiarities of water supply in agriculture, which predominates in the branch structure of this basin.

The current mechanism of fees for water consumption is focused only on getting the fiscal effects and the economic and environmental aspects are insignificant. These taxes do not stimulate water saving and are insufficient to achieve the necessary public measures related to restoration and improvement of water resources as required by national and European legislation. That tax rates need to

be adjusted to the inflation rate, the cost of maintenance and restoration of water sources.

The methodology on determination, approval and implementation of tariffs for public service of water supply, sewerage and waste water treatment is adjusted to recent normative-legal acts in the field and to the provisions of the EU Water Framework Directive 2060/EC and focuses on the "beneficiary and polluter pays" principle and cost recovery from the respective services. Tariff quotas are set only on categories of users and their ability to pay, but not on complex value (economic and ecological) of water resources and cost-effectiveness analysis and on restore the ecological status of water sources.

Despite significant growth of water tariffs (+75%), in the majority of enterprises "Apa-Canal" the expenses related to water supply and sewerage services exceed these incomes. However, despite this situation, it has registered a faster increase of income over expenditure. Also, there is an insignificant negative difference (-0,13 MDL) between tariffs and prime-costs for water supply services and there is a positive difference of about 1 MDL for sewerage services. This fact proves the start of a trend to increase the efficiency of the "Apa-Canal" enterprises after nearly two decades of decline and ruin. It is necessary that the tariffs increase and the difference between them and prime-costs not only to contribute to increased corporate profitability, optimized ratio between quality and price, but also to a more economical use, reduced harmful impact and improved quality of water.

Programme of measures

For identification of the measures there were taken into account the results of the pressure/impact analysis and established environmental objectives, Activity Program of the Ministry of Environment and existing financial possibilities. The Programme of Measures also refers to the national legislation (the Water Law). In case of the Prut River Basin, the plan will be coordinated with Ukrainian part and partially with be adjusted with Romanian.

The Programme of Measures includes “basic” and “supplementary” measures. "The basic measures" are minimum requirements that must be fulfilled (Water Framework Directive, 60/2000 / EC and other directives which are harmonized in Republic of Moldova). Supplementary measures are those measures designed and implemented in addition to the basic measures in order to achieve objectives. Prioritization of measures has emerged from the economic importance of the measure and existing opportunities (tab. 5).

Table 5. Programme of Measures on the implementation of the Prut River Basin Management Plan (2017-2022)

No.	Measure	Priority class	Estimated cost, thousands MDL
Basic measures			
1	Improving the monitoring program for the surface water bodies	2	9000
2	Improving the monitoring program for the groundwater bodies	2	2300
3	Progressive reduction of pollution from point sources	1	685759
4	Extending and restoration of natural habitats	2	26474
5	Sustainable use of water resources	1	Within the available budget
6	Progressive reduction of pollution from diffuse sources	2	Within the available budget
7	Improvement the population accesss to water and sanitation	1	738567
Supplementary measures			
8	Flood risk management measures	1	317300
9	Adaptation to climate changes	1	1050
	Total expenses		**1780450**

MEASURES 1 AND 2. IMPROVING THE MONITORING PROGRAM FOR SURFACE AND GROUNDWATER

Monitoring program for surface and ground waters for the next six years was developed by the Department of State and Hydrogeological respectively Hydrogeological Expedition, with the assistance of experts of EPIRB. The estimated costs are EUR 9 mil. lei for surface waters monitoring and 2.5 mil. MDL for the groundwater

MEASURE 3. PROGRESSIVE REDUCTION OF POLLUTION FROM POINT SOURCES

It involves improving of sewage treatment system, developing of technical solutions regarding the use of sludge from sewage plants, etc. Most cities do not have wastewater treatment plants (exceptions are the Glodeni and Leova towns), and existing ones are worn. Priority for the next six years will be construction of these stations in major cities within the basin (Ungheni, Cahul, Leova, etc.). These measures are specified in the Strategy for Water and Sanitation (2014-2028).

MEASURE 4. EXTENDING AND RESTORATION OF NATURAL HABITATS

The territory of the Prut River Basin, as all over the country territory, is vulnerable to flooding and drought. These natural hazards were quite frequent in recent years, often dry years succeeding those with excess rainfall (as they were 2007 and 2008

years). One of the solutions that would reduce the negative effects of these hazards represents the creation (or restoration) of wetlands – „Prutul de Jos" and „Pădurea Domnească". In some sectors, on the rivers, which in the past have been subjected to the regularization, naturalization activities are required, particularly of floodplain rivers lands.

In order to conduct an effective afforestation works it is necessary to review the current delimitation of lands, in particular there where it fall into the protection riparian strips. For this purpose, in order to avoid the possible disagreements from the population in these areas, information and awareness activities are required, but also the develop a system of economic and fiscal stimulation of the landowners.

MEASURE 5. SUSTAINABLE USE OF WATER RESOURCES

In the environmental institutional protection scheme seems organized and functional a number of constraints and problems in its work is attested. It highlights the lack of clear delimitation of attributions principle (and sometimes conflicts of interest is observed). For example, The State Ecological Inspectorate issued authorizations for the use of water resources and also monitored compliance with the provisions of this authorization. The identified problems will be resolved with the establishment of the Environment Agency and respectively, division of responsibilities and avoid future conflicts of interest.

Other measures include prevention of unauthorized use of water resources, control abstraction of water sources to uses, recovery of costs on water consumption. Also, here can be assigned measures for efficiency and reuse, including the promotion of water-efficient technologies in industry and economical irrigation techniques.

Also, for purposes of efficient planning of the extending measures of drinking water supply networks, irrigation and other water uses, hydrological modeling is needed on the amount of available water resources within the basin.

MEASURE 6. PROGRESSIVE REDUCTION OF POLLUTION FROM DIFFUSE SOURCES

The main measures to reduce nitrate pollution are the rehabilitation or the plantation of riparian protection strips along water bodies (see measure 3), but also the implementation of a code of good agricultural practice which must include at least the items listed in section A of Annex II of the Nitrates Directive. In addition of this developing code, the trening programs and information for farmers are more important in order to promote and implement the code of good agricultural practice.

In order to estimate nutrients which come from agricultural land, modeling should be carried out using MONERIS software (already used for development of the Danube River Basin Management Plan).

MEASURE 7. IMPROVEMENT THE POPULATION ACCESS TO WATER AND SANITATION

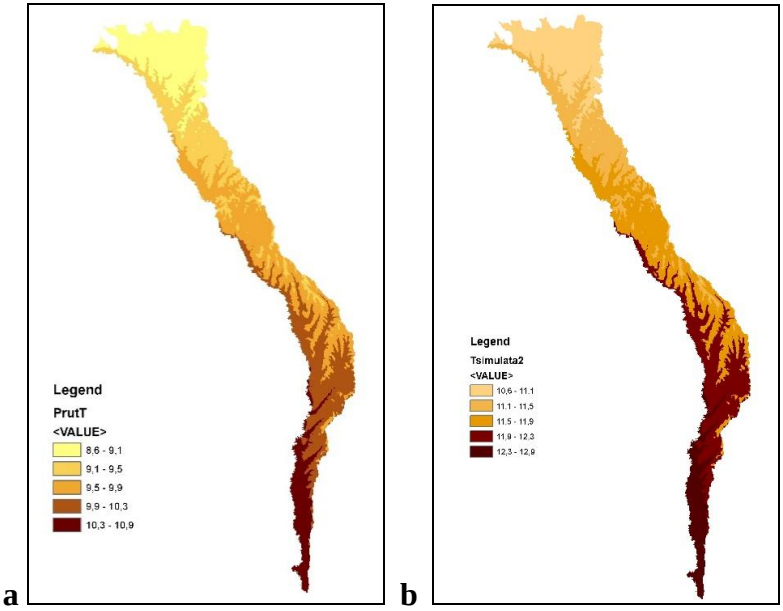
This measure is given in details in „Strategy of water supply and sanitation (**2014 – 2028)".**

SUPPLEMENTARY MEASURES

1. Mitigation of the droughts and water conservation in agriculture risks

Climate change within the Prut River basin through its accelerated pace of manifestation, has been one of the main threats to sustainable development in this area and is one of the biggest environmental problems having consequences and negative impact in terms of ensuring water resources. Thus, in the first decade 2000-2010 (fig. 24.a), within the lower Prut River Basin, the average annual temperature constituted 11.1°C, compared to 10.2°C for the last decade 1989-1999. The difference of 0.9°C between these two decades is the most significant throughout the country. In the upper basin, the difference is 0,7°C and the annual average temperature in the period 2000-2010 constituted 9.1°C compared to 8.4°C recorded during the years 1989-1999. In this context, the simulated thermal regime of the Prut basin and cartographic models developed in accordance with the requirements included in the most recent Global and Regional Climate Atlas of Projections (AR5), which reveals that in the coming years (2016-2035) annual average temperature could rise by 2°C, according to the most drastic climatic scenario (RCP4.5) and being in the upper course 10.5... 11.1°C and 12.3... 12,9°C - in the lower course (fig.24.b).

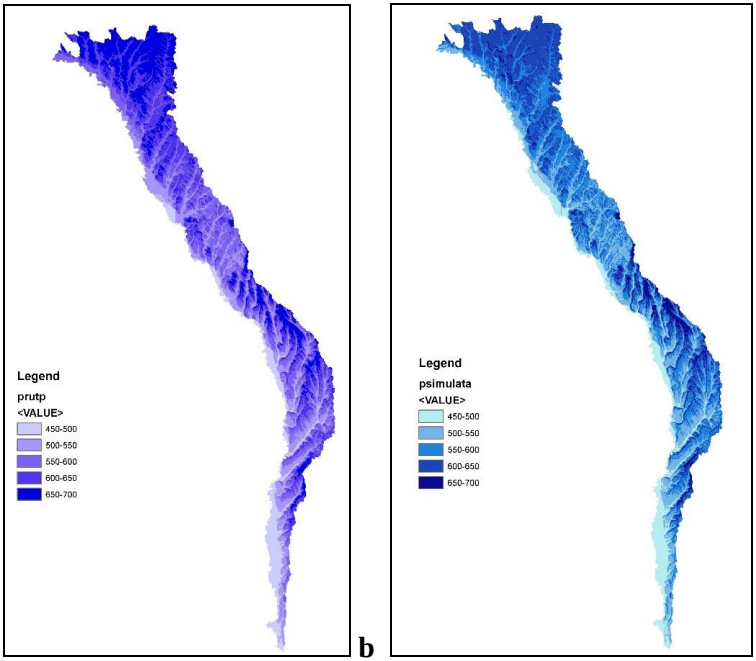
In the case of atmospheric precipitation, cartographic models developed in accordance with requirements included in the same Atlas of Global and Regional Climate Projections (AR5). It reveals that in the coming years (2016-2035) the annual amount of atmospheric precipitation will decrease by 10% in the lower course of Prut River basin and in the upper course annual atmospheric precipitation amounts will increase by 10%. In terms of value, they will decrease by 50 mm and will constitute 450 mm in the lower course, at the same time will increase by 60 mm and will constitute 680 mm in the middle and upper course (fig. 25.b). In conclusion we notice that in the lower course of Prut River basin will be recorded an aridization of the territory compared with the rest of the basin's territory, but at the same time, with a more frequent alternation of dry and rainy periods, confirmed by climate and hydrological risks manifested within this basin in recent years.



a b

Figure 24. Spatial distribution of mean annual air temperature in the period 1986-2005 (a) and the simulated one for the years 2016-2035 according RCP4.5 (b)

Mentioned climate change, prompted the Government of the Republic of Moldova to establish some measures about adapting to climate change were provide (accomplished) following actions relating to the adaptation managing waters to climate change. Thus, the Strategy of the Republic of Moldova to adapting to climate change until 2020 and the Action Plan for implementing the Strategy of the Republic of Moldova to adapting to climate change until 2020 have been set for water domain, an adaptation measures system at national, regional and local level. Among these can be mentioned: public awareness; the creating of forest strips for agricultural fields, roads and waters protection; the intensifying of the expansion process of the covered territories with forestry vegetation and ecological restoration of the forests, creating of interconnection corridors between wooded massifs; the reassessment of water resources at the basins and hydrographical sub-basins level in climate changes conditions; the use in agriculture of some species/varieties resistant to intense and persisting droughts; etc.



a **b**

Figure 25. Spatial distribution of annual amount of precipitation in the period 1986-2005 (a) and the simulated model for the years 2016-2035 according to RCP4.5 (b)

2. Flood risk management measures

Currently was finalized the project of the European Investment Bank "Management Support and Technical Assistance to Flood Protection of Moldova territory", which will contribute to the reduction of natural disasters, flooding, that affect the population and goods by implementing preventive measures in most vulnerable areas. According to this study, the Prut river basins were divided into the upper and lower Prut, as different strategic options apply in each section (tab. 6, fig. 26 and 27)

Upper Prut (upstream of Costesti-Stanca dam) has a low flood risk except for an extensive floodplain area at the towns of Criva, Drepcauti and Lipcani near the Ukraine border. Serious flooding occurred here in July 2008 and in 2010. Thus, for this sector is proposed to ***construct new flood protection dykes***. Also will be required including flood forecasting and warning for all riverside settlements where there is a flood risk.

Lower Prut (downstream of Costesti-Stanca dam) is protected by dykes. The preferred measures for **the Lower Prut** are to ***rehabilitate the dykes*** in high risk

areas and modify the operation of the Costesti-Stanca dam. Dyke rehabilitation will also require improvements to the drainage systems. The main high risk areas are Ungheni and Cotul Morii. There are also locations where the dykes should be improved to increase the standard of protection for some medium risk settlements. Also will be required including flood forecasting and warning for all riverside settlements in the flood risk area.

The tributaries of the Prut generally have narrow valleys with dams and reservoirs at some locations. Each river has medium risk settlements but there are no high risk areas (tab. 6). The Prut river tributaries, which fall within the risk of flooding are listed below. Some of the tributaries have dykes where they cross the Prut floodplain (Narnova, Calmatui, Lapusna, Tigheci, Larga and Lea Balea). These dykes form part of the Prut flood cells.

Table 6. Tributaries of the River Prut covered by flood risk

Tributary	Flood risk areas
Lopatnic	Four medium risk settlements.
Ciuhur	Six medium risk settlements.
Delia	Three medium risk settlements and a high risk area at Ungheni.
Nârnova	Three medium risk settlements.
Calmaţui	Three medium risk settlements. The village of Calmaţui is a low risk area assuming that the dams are in good coodition. This was flooded in 1994 following a cascade failure of dams. Over 30 people died.
Lapuşna	Two medium risk settlements. There is a flood storage area with control gates at Carpineni vilage.
Tigheci	Four medium risk settlements.
Larga	Two medium risk settlements.

Source: Management and Technical Assistance Support to Moldova Flood Protection Project

The preferred measures for the Prut tributaries are combinations of:

- Rehabilitating and improving dykes in high risk areas
- Providing flood storage in existing or new reservoirs
- Increasing the capacity of the river channels

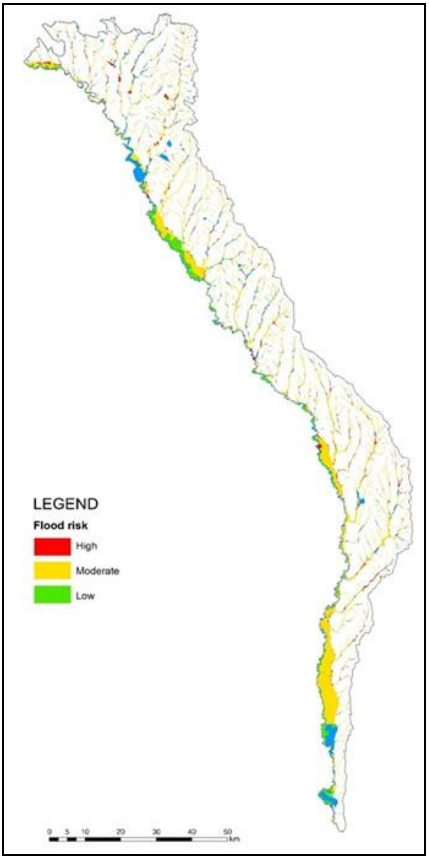


Figure 26. Susceptibility to flooding

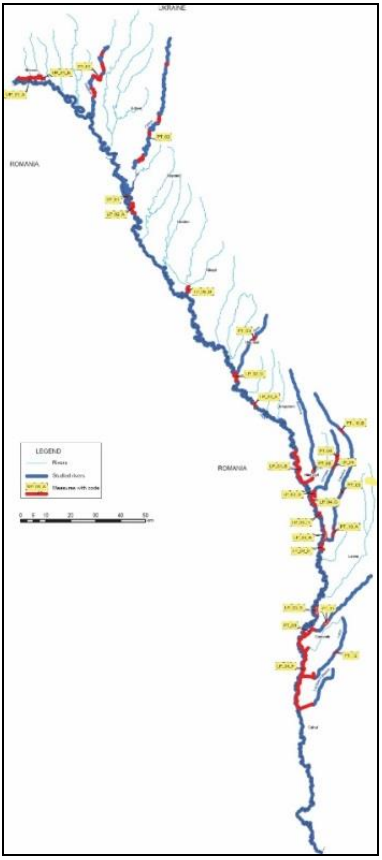


Figure 27. Map of flood protection measures

Information, consultation and public participation

In preparation of this management plan a particular importance is given to information, consultation and public participation. Each stage in the preparation of Prut River Basin Management Plan will be completed through public debates and meetings with key agencies in 2015.

In order to stakeholders support EPIRB project with the support of REC fin Hungary has developed a communication strategy and the list of interested institutions in the protection and management of water resources within Prut river basin.

The first public consultation meeting held on May 5, 2015 in Chisinau. Draft of the Prut river basin management plan was placed at the end of March on the EPIRB project website (http://blacksea-riverbasins.net/en/downloads-lib), „Apele Moldovei" Agency (www.apele.gov.md), Basin Water Management Authority (www.dbga.md), Institute of Ecology and Geography of the Academy of Sciences (www.ieg.asm.md).

On 28 May, together with the Ukrainian side in the Yaremche city, Ukraine have started discussions opposite the Prut River Basin Management Plan which were highlighted especially cross-border issues, given the fact that have been invited representatives of relevant institutions from Romania.

In August, 2015 the public consultations were held in Edinet town (4 August) to which have been invited representatives of Briceni, Ocnita, Glodeni and Rascani districts; In Ungheni town (11 August) to which have been invited representatives of fălești, Nisporeni and Hîncești districts and in Cahul town (13 August) have invited representatives from Leova and Cantemir districts.

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04/08/2015


CONSILIUL RAIONAL
UNGHENI
11/08/2015


13/08/2015

The competent authorities

Implementation of the management plan, program of measures shall be performed by the Ministry of Environment and its subordinate institutions.

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