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### EUWI+: Thematic summary of DPBS River Basin District Characterization

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Acronyms

AGRM   Agency for Geology and Mineral Resources  
AWB    Artificial Water Body  
BOD    Biological Oxygen Demand  
COD    Chemical Oxygen Demand  
CORINE Coordination of Information on the Environment  
DPBS RBD Danube-Prut and Black Sea River Basin District  
EHGeoM Moldavian Hydrogeological Expedition  
EUWI+ European Union Water Initiative Plus for the Eastern Partnership  
GDP    Gross Domestic Product  
GWB    Groundwater Body  
HMWB   Heavily Modified Water Body  
HPP    Hydropower Plant  
MARDE Ministry of Agriculture, Regional Development and Environment  
PoM    Program of Measures  
RBD    River Basin District  
RBMP   River Basin Management Plan  
SHS    State Hydrometeorological Service  
SWB    Surface Water Body  
TAU    Territorial Administrative Units  
WFD    Water Framework Directive
1.1 Characterization of the Danube-Prut and Black Sea River Basin District

Natural Conditions in the River Basin District

Location and Geographic Overview: The total surface of the Danube-Prut and Black Sea River Basin District (DPBS RBD) is of 14 770 km$^2$ within the borders of the Republic of Moldova, what represents 43.6% of the country's surface. From the administrative-territorial perspective, DPBS RBD lays over 18 administrative rayons. In a meridian direction, from North to South, the district continues on a length of approximately 350 km, with variable width (from 25 km to 120 km). The geographical position and the configuration of the district determine a noticeable diversity of the geological structure, geomorphologic characteristics and climate conditions. The specifics of these environmental components determine, significantly, the characteristics of the biota, soils, hydrological and hydro-chemical characteristics of the ground and surface water. The average value of the absolute altitude of the district landscape is of 142 m, a typical value for the plain regions.

The Prut hydrographic basin is part of the Danube river basin, representing its eastern border. The Danube river basin crosses the territory of 19 European countries. The Republic of Moldova is member of the International Commission for the Protection of the Danube River and directly manages 0.94% of its total area. The Prut river basin is situated on the territory of three countries (fig. 1), the Republic of Moldova has 28% (39% is for Romania and 33% is for Ukraine) of the total area of 27 540 km$^2$.

![Figure 1. The Transboundary Danube-Prut and Black Sea River Basin District](image-url)
**Climate:** The DPBS RBD has a continental climate, with short winters, mild with little snow, with long summers and with reduced humidity. Atmospheric precipitations are the most important element in the formation of water reserves in DPBS RBD, the structure of the hydrographical network and, to a certain extent, of the water quality. The distribution of the annual average rainfall in the DPBS RBD, over the period of 1980-2017, is generally characterized by a spatially differentiated distribution, with 616 mm in the north (Briceni meteorological station) and 506 mm in the south (Comrat station). Air temperature, one of the key elements with influences on climatic conditions, is determined directly by solar radiation and atmospheric circulation. The annual average values during the 1980 - 2017 period are 8.1°C in Briceni (North part) and, respectively 10.8°C in Cahul (South part). It is necessary to mention that the heating phenomenon characterizes the entire hydrographical district.

**Flora:** The natural vegetation is predominantly represented by steppe associations (14.7%) and forests (9.5%). The composition and spatial distribution of the vegetation are determined by the zonal and azonal areas of the DPBS RBD.

In the Northern region of the Prut basin, in the North Moldavian Plateau and in the middle half of the Middle Prut Plate, especially on the interfluvial peaks, there are forest landscapes, represented by cherry oak forests, with pear trees on the second floor, wild apple trees, solitary maple dart, jugastrum, hornbeam. In the meadow of the isolated Prut, meadow forests are preserved. In the forests' ecosystems in the south of the district, there are representatives of the Mediterranean fluffy oaks (*Quercus pubescens*), which is the north-eastern boundary of the area with fluffy oak forests.

The lower Prut lakes region was included into the List of Wetlands of International Importance, as Ramsar area No. 1029 "Lower Prut Lakes" (especially as a habitat for aquatic birds).

**Land Cover:** Land cover of DPBS RBD was analysed using recent Landsat imagery classification of 30 m resolution. Land cover was classified using the second Level of CORINE system (table 1 and fig. 2).

The operational structure of the modality of land use within the district is changing from north to south. In the northern part the lands have an agri-forest use and agri-pastures. Within the limits of The Codri Plateau it changes into forest-vine-orchard, while towards south dominates the arable land.

<table>
<thead>
<tr>
<th>Land Cover Type</th>
<th>Area, km²</th>
<th>Percentage, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land</td>
<td>8441.3</td>
<td>57.7</td>
</tr>
<tr>
<td>Pastures and grasslands</td>
<td>2157.7</td>
<td>14.7</td>
</tr>
<tr>
<td>Forests</td>
<td>1385.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Vineyards</td>
<td>859.2</td>
<td>5.9</td>
</tr>
<tr>
<td>Orchards</td>
<td>257.2</td>
<td>1.8</td>
</tr>
<tr>
<td>Water</td>
<td>273.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Urban areas</td>
<td>1262</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Figure 2. Land Cover Types Distribution within DPBS RBD

---

Natural Hazards: Hydrological and geodynamic risks with a higher frequency include floods, landslides and erosion, processes generated by the position of the district in the temperate zone, with the region of the Prut hydrographical basin, located in the area of the Eastern Carpathians. Research shows a twofold increase in flood frequency over the last 40 to 50 years, compared to the previous one hundred years. The Prut river basin is the most exposed area to flood risk from the entire DPBS RBD. Floods in the Prut River Basin, mostly, are generated by the heavy rains, commonly occurring in the basin mountain sector, as recorded, for example, in the years of 1988, 2008, 2010. Significant flood events were recorded in the second half of the twentieth century and the first decade of the 21st century (1959, 1965, 1969, 1970, 1971, 1975, 1991, 1996, 1998, 2008, 2010). On small water courses, heavy torrential rains in some years cause flash floods as recorded, for example, in June 2016 on the Lunga River in Ceadar-Lunga. The floods in the lower course of the Prut river, during the summer period, are generated by the high levels of the Danube, which, due to the reclaimation phenomenon, lead to the blocking of Prut's waters. Thus, as an example, on July 7, 2010, during an extensive flood in the lower Prut River, the Danube water level at Galati Station was of 581 cm, a value that exceeded the historical maximum, registered on April 26, 2006. The entire Prut River is characterized by a high flood risk in the Prut valley, with more extensive areas in the Criva – Lipcani-Drepcauti (upstream Costesti-Stinca reservoir), Movileni - Pruteni, Zagarancea - Ungheni, Nemteni - Costul Morii – Obileni, Gotesti – Ghioltosu, Cahul – Roșu (downstream Costesti-Stinca reservoir) due to the poor conditions of dykes. Areas of the rivers with medium flood risk are much more extensive, they almost fully occupy the courses of the small and medium rivers and the majority of the Prut river meadow.

Surface water resources

The surface water resources of the Prut river are evaluated based on the database of monitoring network of SHS of Moldova. The average annual flow volume of the Prut River is equal to 2,7 km$^3$, and varies from 1.2 km$^3$ in years with insufficient humidity up to 5 km$^3$, values achieved in the years with the heights insurance of water resources. The average annual flow is equal to 78 - 94 m$^3$/s, fluctuations are ranging from 40 up to 162 m$^3$/s (table 2 and fig. 3).

Table 2. The parameters of surface water in the Prut River, Moldova

<table>
<thead>
<tr>
<th>Quantitative characteristics</th>
<th>Sirauti</th>
<th>Costesti HPP</th>
<th>Ungheni</th>
<th>Leova</th>
<th>Prut mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment area, km$^2$</td>
<td>9230</td>
<td>11800</td>
<td>15200</td>
<td>23400</td>
<td>27540</td>
</tr>
<tr>
<td>Discharge, in m$^3$/s</td>
<td>77.7</td>
<td>83.0</td>
<td>86.7</td>
<td>90.8</td>
<td>93.7</td>
</tr>
<tr>
<td>Specific discharge, in l/s*km$^2$</td>
<td>8.42</td>
<td>7.03</td>
<td>5.71</td>
<td>3.88</td>
<td>3.40</td>
</tr>
<tr>
<td>Flow, in mm</td>
<td>266</td>
<td>222</td>
<td>180</td>
<td>122</td>
<td>107</td>
</tr>
</tbody>
</table>
The information about water resources on tributaries of the Prut river within the limits of the Republic of Moldova are insufficient due to the lack of monitoring data. Relatively comprehensive data exists only for six tributaries. Multiannual average flow of Prut river’s tributaries are ranging from 1.21 m$^3$/s (Girla Mare) to 2.64 m$^3$/s (Camenca). The largest volume of water is characteristic for the river Camenca, exceeding 83.38 mln. m$^3$, and the lowest - 10 mln. m$^3$ - for Girla Mare. Table 3 shows the estimated values for the main tributaries of the Prut within the territory of Moldova.
Table 3. Water resources of the main tributaries of the Prut river (in the limits of Moldova)

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Length, km</th>
<th>Catchment area, km²</th>
<th>Specific discharge, l/s/km²</th>
<th>Annual flow volume, mil. m³</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vilia</td>
<td>50</td>
<td>298</td>
<td>2.3</td>
<td>21.40</td>
<td>MD1116</td>
</tr>
<tr>
<td>Lopatnic</td>
<td>57</td>
<td>265</td>
<td>2.3</td>
<td>16.00</td>
<td>MD1116</td>
</tr>
<tr>
<td>Racovat</td>
<td>67</td>
<td>795</td>
<td>2.3</td>
<td>57.40</td>
<td>MD1115</td>
</tr>
<tr>
<td>Draghiste</td>
<td>70.7</td>
<td>279</td>
<td>2.04</td>
<td>17.97</td>
<td></td>
</tr>
<tr>
<td>Ciuhur</td>
<td>90</td>
<td>724</td>
<td>1.93</td>
<td>60.86</td>
<td>MD1114</td>
</tr>
<tr>
<td>Camenca</td>
<td>93</td>
<td>1230</td>
<td>2.64</td>
<td>83.38</td>
<td>MD1113</td>
</tr>
<tr>
<td>Caidarusa</td>
<td>40</td>
<td>318</td>
<td>1.87</td>
<td>58.93</td>
<td>MD1112</td>
</tr>
<tr>
<td>Gileoanea</td>
<td>30</td>
<td>147</td>
<td>1.3</td>
<td>41.00</td>
<td></td>
</tr>
<tr>
<td>Girta Mare</td>
<td>40</td>
<td>285</td>
<td>1.21</td>
<td>10.72</td>
<td>MD1110</td>
</tr>
<tr>
<td>Delia</td>
<td>30</td>
<td>219</td>
<td>1.62</td>
<td>51.08</td>
<td>MD1109</td>
</tr>
<tr>
<td>Nyrnova</td>
<td>49</td>
<td>358</td>
<td>1.66</td>
<td>18.79</td>
<td>MD1106</td>
</tr>
<tr>
<td>Lapusna</td>
<td>70</td>
<td>483</td>
<td>1.64</td>
<td>24.91</td>
<td>MD1105</td>
</tr>
<tr>
<td>Sărata</td>
<td>59</td>
<td>716</td>
<td>1.2</td>
<td>27.12</td>
<td>MD1104</td>
</tr>
<tr>
<td>Tigheci</td>
<td>43</td>
<td>205</td>
<td>1.8</td>
<td>11.67</td>
<td>MD1103</td>
</tr>
<tr>
<td>Larga (2)</td>
<td>33</td>
<td>150</td>
<td>1.8</td>
<td>8.5</td>
<td>MD1102</td>
</tr>
</tbody>
</table>

The surface water resources of the Danube - Black Sea basin are rather modest (table 4). The Region focuses only about 1% of the all available surface water resources of the country.

Table 4. Water resources of the rivers in the Danube-Black Sea reference area

<table>
<thead>
<tr>
<th>Tributary</th>
<th>Length, km</th>
<th>Basin area, km²</th>
<th>The annual average flow, m³/s</th>
<th>Specific average flow, l/s/km²</th>
<th>Annual average flow, mil.m³/year</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cahul</td>
<td>44.8</td>
<td>577.9</td>
<td>0.27</td>
<td>0.46</td>
<td>8.5</td>
<td>MD1201</td>
</tr>
<tr>
<td>Salcia Mare</td>
<td>30.1</td>
<td>563.2</td>
<td>0.2</td>
<td>0.31</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Ialpug</td>
<td>113.3</td>
<td>1595.5</td>
<td>0.64</td>
<td>0.4</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>Lunga</td>
<td>77.5</td>
<td>1030.0</td>
<td>0.3</td>
<td>0.26</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>Lunguta</td>
<td>48.5</td>
<td>173.6</td>
<td>0.5</td>
<td>0.27</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Cogilnic</td>
<td>104.2</td>
<td>1031.1</td>
<td>0.7</td>
<td>0.63</td>
<td>22.1</td>
<td>MD1301</td>
</tr>
<tr>
<td>Sacca</td>
<td>12.2</td>
<td>30.5</td>
<td>0.02</td>
<td>0.56</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Ceaga</td>
<td>17.8</td>
<td>339.9</td>
<td>0.2</td>
<td>0.53</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Sarata</td>
<td>19.4</td>
<td>101.3</td>
<td>0.03</td>
<td>0.3</td>
<td>0.95</td>
<td>MD1302</td>
</tr>
<tr>
<td>Copceac</td>
<td>23.2</td>
<td>112.9</td>
<td>0.04</td>
<td>0.32</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Bebei</td>
<td>27.2</td>
<td>178.6</td>
<td>0.06</td>
<td>0.31</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Hadjiider</td>
<td>7.8</td>
<td>201.9</td>
<td>0.06</td>
<td>0.28</td>
<td>1.9</td>
<td>MD1303</td>
</tr>
<tr>
<td>Caplani</td>
<td>17.9</td>
<td>123.6</td>
<td>0.04</td>
<td>0.29</td>
<td>1.26</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6060</td>
<td></td>
<td></td>
<td>76.54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Groundwater Resources

Following the hydrogeological prospects, total groundwater reserves were estimated to be 3478.9 m³/day on 01.01.2014. The area between Prut and Nistru is a complex aquifer, in which aquifers and water horizons are interconnected. At present, the study and exploitation of groundwater for drinking and technical water supply is carried out in the following aquifers:

- The aquifer horizon of the alluvial deposits of the meadows and river terraces - a, adA₃;
- The aquifer complex of alluvial deposits - aN₂-A₁₋₂;
- The pontian aquifer set - N₂p;
- The aquifer complex of the Superior-Meotian Sarmatian - bN₁S₃-m;
- The aquifer complex of the Middle Sarmatian deposits (Basarabian) (Congerian horizon) - N₁S₂;
- The Badenian-Sarmatian aquifer complex - N₁b-S₁₋₂;
- The Silurian-Cretaceous aquifer complex - K-S.
Protected areas

Currently, the identifying and mapping protected areas in accordance with the WFD phase is in implementation process. The project is financed by ADA-SDC Programme. The following protected areas have already been mapped in the DPBS RBD:

- 32 protected areas of water abstractions for drinking purposes;
- 2 areas for the protection of economically important aquatic species;
- 3 protected areas for habitats and species where water is an important factor;
- All DPBS RBD as vulnerable zones to nitrates and nutrient sensitive areas.

Driving forces

Population and Demography: Demographic analysis is conducted based on the data obtained from the National Bureau of Statistics (http://statistica.gov.md).

The total number of the population of DPBS RBD is of 1,025.3 th. inh., which represents 36.5% of the country population. The district territory is a typical rural area, about 76% of the population lives in the rural area. The average density of the population in the district is of 69.4 inh./km². In the last 25 years the population in the basin was reduced with circa 67 thousand inhabitants. The size of towns, by the number of population, varies from circa 2.0 th. inh. (towns of Cornesti and Costesti) up to 30.8 th. inh. (town of Ungheni) (fig. 4). The average size of towns is of 10.6 thousand inh. The rural population represents circa 790.5 thousand inh. and is concentrated in 634 villages. The size of villages varies from 9 inh. (v. Popovca, Cantemir rayon) up to 11,123 inh. (v. Congaz, TAU Gagauzia). The average size of the village is of 1,231 inh. In total, there are 12 localities with a population of over 10 th. inh and 126 localities with a number of population between 2 th. and 10 th.

Taking into consideration the evolution of the main demographic indicators, can be mentioned that in the region is noticed a trend for the decrease of population number. This trend shall stay until essential progress shall be registered in the economic development of towns. In the context of the reduction in the number of population and preservation of the current level of economic development, we may foresee a decrease of the human pressure on water resources and a stagnation of the amount of water consumed.

Agriculture is a traditional branch of the economy of the Republic of Moldova. The agrifood sector ensures now circa 25% of the total GDP value and which engages now about 1/3 of the active population. The high share of arable land (57.7%) within DPBS RBD, the domination of the hoed crops in the structure of seeded surfaces (over 90%) and the intense use of chemical fertilizers (average 52 kg/ha), cause an intensive contamination of water resources with nutrients Nitrogen, Phosphorus and Potassium, clogging of the surface water, as well as other negative processes.

In recent years, the Republic of Moldova has been practicing, on a large scale, the rehabilitation and expansion of irrigation systems. Within DPBS RBD there are 37 centralized irrigation systems. Most of them require rehabilitation. The total surface area designed for irrigation is 52 thousand ha, of which about 11 thousand ha have been rehabilitated.

Fish farming. The total surface of the natural fishing basins fund of R. Moldova represents 9570 ha; within the limits of DPBS RBD the following are found:

- The Manta marshes – surface - 2200 ha, dominating depths – 1-3 m. Almost on all marshes surface are pits for the fish wintering and over 750 ha de spawning places (places for the producing or depositing of eggs), with a depth varying between 0.5 and 1 m. The main species of fish are: carp, bream, crucian, roach;
- The Beleu Lake (now part of the scientific reservation “Lower Prut”), surface – 950 ha, depths vary between 0.5-3 m, surface spawning places represent 350 ha;
- The Prut River, within the limits of the territory of the Republic of Moldova has a surface of 2600 ha. The main fish species: bream, crucian, pike, carp, catfish.
- The Costesti – Stanca reservoir, within the limits of the territory of the Republic of Moldova, with a surface of 2500 ha, average depth – 10 m is a multiple use water body including some fish farming. The main fish species: bream, roach, hake, zander, crucian, rapacious carp;

**Hydropower Plants (HPPs):** Within DPBS RBD there is only one hydro power plant – Costesti-Stanca. The power is exploited by 2 plants with an aggregate of 16 MW (for each part – Moldavian and Romanian) at the flow rate of 2 x 65 m³/sec, with an average annual power of 2 x 65 GWh. Electricity production is distributed equally between R. Moldova and Romania.

**Mining:** Mineral deposits are predominant among construction materials. In the DPBS RBD there are 22 quarries (sand, clay and limestone). The impact of the mining on the water resources is specifically big. The extraction of mineral raw materials using the "up to date" method (quarries) causes perforation of groundwater horizons, respectively, lowering water levels in nearby rivers, in wells, springs etc. Extraction of sand and gravel (silts) from the river meadows (especially, from the meadow of Prut River in the limit of Glodeni, Ungheni, Cahul rayons etc.) has many negative consequences: decrease of water level, increase of slope of water, increase of river course rate, etc.

**Industry.** The highest water abstractions from the Prut River are recorded in the most populated rayons and, respectively, the most industrialized ones – Edinet (sugar factories), Ungheni and Cahul (beverage productions).

**Tourism** is a perspective branch in the sustainable use of natural and anthropogenic resources, existing in the area of the basin. Here, rural, ecological, cultural, spa and viti-vinicol tourism can be developed.
The river basin in the future

The main priorities of the territorial development strategy for DPBS RBD are:

1) Adapting water consumption to climate change and diminishing surface water resources.
2) Expansion of aquatic ecosystems, including wetlands.
3) Extension of the aqueduct, sewage and sewage network.
1.2 Pressures and impacts of human activities

Water use

Water abstraction and allocation in the DPBS RBD is carried out for drinking-household, agricultural (mainly irrigation) and industrial purposes. In the period of 2007-2017 years, in the DPBS RBD were abstracted, on annual average, 33.7 million m$^3$ of water. Over 60% (21.1 million m$^3$) of abstracted water comes from underground sources. Thus, the volume of abstracted and used water is determined by the surface of these rayons and by size of its urban centers, as well as by the volume of water used for agriculture and households purposes (fig. 5). Basically, all the water used in agriculture due to the specific consumption is only very partially returned to the water basins and is attributed to losses.

![Figure 5. Water Abstraction in DPBS RBD (annual average 2007-2017)](image_url)

In the last 10 years, there has been a decrease in the volume of captured water, especially from surface sources (fig. 6).

![Figure 6. Dynamics of the abstracted water volume (in mil. m$^3$) in the DPBS RBD](image_url)

The medium amount of tariff for water supply in DPBS RBD is, on average, 17.2 MDL/m$^3$. Tariffs for public water supply were, on average, 11.5 MDL/m$^3$. Water supplying tariffs for the economic agents were, on average, 35.8 MDL/m$^3$ in 2018.
Point Sources of Pollution

Wastewater discharge: In the DPBS RBD there are only 48 wastewater treatment plants, from which 39 are working. Total capacity of wastewater treatment plants is 126 thousand m³/day. The usability of treatment plants in the DPBS RBD is only 14%, which is conditioned both by economic and demographic decline of serviced cities and the very high level (over 40%) of wear and tear of the wastewater sewerage and treatment installations. Very poor technical condition and superficial control of pollution sources, very low pollution payments and episodic punishment for contraventions generate an increased impact on water and the human health.

In the DPBS RBD there are 60 centralized wastewater discharge systems (fig. 7), only 51 sewerage network are operating. 75% of sewerage networks have sewage treatment plants. The total length of sewerage network is 750 km from which 701 km (93%) are functional. In 2017, the total volume of wastewater discharged was 7 million m³, of which: 1.85 million m³ from industry, 1.71 million m³ from agriculture and 3.44 million m³ from municipal waste.

Most urban settlements within DPBS RBD are connected to sewage treatment plants (but in a different proportion). The average population connection to sewerage systems within the district is 11%, while population access to sewage treatment plants is only 4.7%. In most rural settlements, treatment plants are missing, respectively, becoming a potential source of pollution for aquifers.

Organic pollutants in the DPBS RBD from point source pollution in 2017 accounted for 2 316 tons of BOD and 3 937 COD. The main sources of pollution with organic substances are municipal sewerage enterprises (domestic waters) and enterprises in the food industry (wine, milk and meat processing, etc.). The primary role in organic pollution is attributed to the main cities (agglomerations) within the district (Ungheni, Cahul, Hancesti, Edinet, Comrat), which together with the municipal wastewaters removes about 65% of organic substances according to BODs and 70% of the organic substances according to COD. There are still a very large number of cities where a large proportion of the population is not connected to sewage systems or the status of treatment plants is not in line with the requirements. From all settlements with wastewater treatment plants, only the one in the city Cantemir meets all criteria.

Nutrient pollution, especially nitrogen (N) and phosphorus (P), can contribute to eutrophication of surface waters. It was calculated that 424.6 tons of N_{tot} and 77.2 tons of P_{tot} were discharged from all point sources during 2017. The main source of pollution were the domestic sewage. Among the hazardous substances discharged during the 2017 were registered: detergents - 0.08 t/year, oils and fats - 0.42 t/year.

General tariff quota for sewerage services at the enterprises of AMAC in DPBS RBD is 16.9 MDL/m³. Tariff quota for the sewerage and wastewater treatment services provided to population is 11.75 MDL/m³, for budgetary organizations – 29.47 MDL/m³ and economic agents – 28.70 MDL/m³.

Diffuse Sources of Pollution

Cultivation of agricultural crops and use of fertilizers: Within the DPBS RBD, about 80% of the land is used for agriculture, of which 57.7% are arable land (fig. 7), most of them are used for the growth of cereals and technical plants; in the regions where irrigation is practiced, vegetables are grown on these lands. According to the information obtained from the National Bureau of Statistics, 36321 tons of mineral fertilizers were used for agricultural crops in the DPBS RBD in 2017. About 65 kilograms of mineral fertilizers were applied for one ha of arable land in this year. The quantity of the organic fertilizers used in 2017 were 5931 t. The intensive use of chemical fertilizers contributes to the intensification of nitrification processes in aquatic basins.
Livestock production: The quantity and size of animal waste, manure are influenced by the size of animals, and they are stored in special cesspools, which later on are either used as organic fertilizers in agriculture or washed by rainwater, becoming a source of pollution.

Within the district, livestock productivity has dropped considerably due to the privatization and division of land in small plots, the disappearance of large livestock farms, poor food supply and low quality, the acute shortage of investments for the creation of new farms with high-performance technologies based on private ownership, but also the prices increase for energy resources.

The structure of livestock in the year 2017 was as follows: sheep and goats - 583 thousand heads, pigs - 156 thousand heads, cattle - 76 thousand heads, horses - 15 thousand heads. Even though the animal population has fallen in recent years, their impact on the quality of water resources remains considerable.

Summarizing the situation regarding nutrient inputs from the agricultural sector, emissions from diffuse sources (such as those from mineral and organic fertilizers and manure) are significant.

Solid Waste: Waste management raises very complex problems requiring coordinated action at all administration levels. By the end of 2017, within the limits of DPBS RBD, a total volume of production waste was generated in a volume of 729.4 thousand t. Existing hazardous waste represents 793.2 t. The storage of solid household waste as a result of the activity of individual farms and small businesses is widespread and represents an additional source of groundwater pollution. Equipping solid waste collection points with a full range of environmental protection tools is usually an exception. In most cases, the layer beneath the landfill is loessoid clay (clay), which accumulates and, in the long run, allows the penetration of pollutants into the first aquifer (alluvial deposits of the meadows and river terraces - a, adA3). Nowadays, it is necessary to carry out further studies on the groundwater pollution generated by landfills.

Hydromorphological changes

The main types of hydromorphological alterations occurring within the DPBS RBD are the construction of lakes and ponds along the river courses, the regulation of rivers, the construction of flood protection dykes, etc.

The number of water accumulations (ponds and reservoirs) in DPBS RBD within the Republic of Moldova is estimated at about 2852. According to their origin, the anthropic ones predominate.

At present, within the DPBS RBD, the dyke system has a total length of about 365 km, of which about 51% is along the Prut River, and the rest on the rivers of Cogâlnic, Ialpug rivers except Camenca, Nârnova, Larga and Cahul.
1.3. Monitoring

**Surface Water Quantitative Monitoring**

The Environmental Agency is the nationally responsible institution for hydrobiological, hydrochemical and hydrological monitoring of surface waters. The current hydrological monitoring network within the DPBS RBD comprises 13 surface water quantity monitoring sites, 1 from which are on Costești-Stâncă Lake, 12 on the rivers (3 on river Prut, the other 9 – on the rivers Vilia, Draghişte, Ciuhur, Călăruşa, Delia, Salcia, Lunga – Ciadîr-Lunga, Lunga – Taraclia and Cogâlnic) *(Source: SHS, 2018).*

**Surface Water Quality Monitoring**

The systematic monitoring of surface water quality in the DPBS RBD was carried out at 58 monitoring stations (fig. 8): 9 locations on the Prut River, 4 artificial lakes, 2 natural lakes and 43 on the tributaries of the Prut river or on the internal surface waters of the Danube Black Sea basins.
National groundwater monitoring network in the DPBS RBD consists of 64 monitoring stations installed into unconfined and artesian aquifers and is used for the routine observations of quantity. The monitoring sites are situated in recharge and discharge areas as well as near water supply points. Agency for Geology and Mineral Resources (AGRM) which is subordinated to the MARDE manages routine national groundwater monitoring. Local observers employed by the AGRM measure water levels and send paper data on a monthly basis. Moldavian Hydrogeological Expedition (EHGeoM) performs monitoring activities once-twice/year depending on the available budget for the collection of groundwater samples for the chemical analysis.

The monitoring sites have an uneven distribution by the proposed GWBs (fig. 9).
1.4. Risk assessment of sub-basins level and groundwater status

For the pressure and impact analysis was used the D.P.S.I.R. methodology (Driver-Pressure-State-Impact-Response - Anthropic Activity Pressure-State-Impact-Response). Thus, it was necessary to use information / data on anthropogenic activities and changes in the state of water resources as well as the monitoring data.

Assessing the impact of different types of significant pressures is intended to provide information to be used for risk analysis and water status characterization in accordance with Annex V of the WFD.
Sub-basins delineated within DPBS RBD

In the absence of the final version of the delimited water bodies, the pressure analysis, for the surface waters, was performed at sub-basin level. Within the DPBS RBD are delimited 24 sub-basins, in accordance with the National Water Law. The risk analysis was done according to the recommendations of the Guidance on the Hydro-Morphological and Physical-Chemical Approach for Pressure Impact Analysis (EPIRB project).

Risk assessment based on point sources of pollution impact

The water quality is influenced by the discharge of untreated or insufficiently treated waste water from the wastewater treatment plants in the natural receptors. The largest volumes of untreated wastewater comes from settlements that are supplied with water, but do not have sewage systems and sewage treatment plants. All sub basins that have human agglomerations with a high degree of connection to the sewerage system are at risk of not achieving the environmental objectives for good surface water quality. From 24 sub basins, 4 are „without any risk” to point pollution, 4 - “possible at risk” and 16 “at risk” (fig. 10).

Figure 10. Sub basin status for registered point source pollution
Risk assessment based on diffuse sources of pollution impact

The most important source of diffuse pollution remains agriculture, which contributes to the pollution of surface and underground waters, including nutrients (N, P and K), pesticides and other plant protection products. In terms of land use, DPBS RBD is a typical agrarian region where all 24 sub-basins have a share of agricultural land that exceeds 50% (at risk). Animal livestock has a major impact on the state of water resources in sub basins. In addition to high nutrient emissions (over 12 thousand tons of N and about 2 thousand tons of P), they also indirectly contribute to water pollution. Applying the same “one-out-all-out” principle, all hydrographic sub basins were assessed as “at risk” by the registered diffuse pollution (fig. 11).

Figure 11. Status of sub basins through the registered diffuse pollution
In the analysis of hydromorphological alterations, the following indicators were taken into account - water abstraction, construction of reservoirs and ponds along the river, density of irrigation channels and regulation of the main river course. According to the "one-out-all-out" principle, we obtain 13 sub basins with a "possible risk" status and 11 sub basins with a "risk" status (fig. 12).

**The overall pressure**

Based on principle „One-out-all-out”, all sub basins within DPBS RBD are considered to be in the class of those "at risk" of not achieving with the environmental objectives because one of the eight indicators used (diffuse pollution from agriculture) received the highest score ("at risk") in all 24 sub basins.

![Figure 12. Status of sub basins through the hydromorphological alterations](image-url)
Assessment of Groundwater Bodies Status

All groundwater aquifers from DPBS RBD are delineated in eleven GWBs according to the existing hydrogeological model of the territory of Republic of Moldova. Identification of pressures on the use of groundwater, and risk assessment is one of the most important objectives for an effective groundwater management and monitoring. The process of data collection and analysis would aim to identify the type and magnitude of significant anthropogenic pressures to which groundwater is liable to be subject, including the following:

- Point sources and diffuse sources of pollution;
- Groundwater abstraction;
- Artificial recharge of groundwater;
- Land use patterns and practices.

Generally, the chemical composition of the groundwater is influenced by the lithological composition of the rocks, the depth of the horizon, the drainage characteristic of the horizon by the large rivers valleys, the anthropogenic / human factor (presence of towns and cities, etc). However, measuring the extent of an anthropogenic intrusion is complex, as some groundwater bodies have naturally elevated levels of salinity due to the aquifer geochemistry. Natural background concentrations of salinity indices are quite high, because of marine origin of water bearing sediments, which still contain saline waters in their pores. In all cases, the fluctuations are close to natural, and at present, the impacts of mentioned pressures are not significant (based on existing monitoring data). Thus, the status of GWBs can be evaluated generally as good.
1.5. Governance

Latest legal development of importance for RBMP

Republic of Moldova, as an EU associated country, has the responsibility to harmonize the water legislation according to the EU WFD. The main aim of the EU WFD consists of reaching the good status of all waters through prevention of deterioration and ensuring long-term sustainability of water uses. At the same time, WFD further provides an innovative approach in terms of water resources management approach based on river basins, taking into account the natural boundaries of the watershed.

At the national level, adaptation and harmonization of the EU WFD is reflected in the Water Law of the Republic of Moldova that has been adopted on 23.12.2011 and enforced in 26.10.2013. Thus, the objectives of both the WFD and the Water Law of the Republic of Moldova lie on the RBMP development and implementation.

The first cycle of the RBMP (for the period 2018-2023) for the DPBS RBD was approved through the Government Decision Nr. 955 on October 3, 2018.

Institutions for water management & stakeholders’ involvement

For the implementation of RBMPs, the MARDE is responsible to develop action plans for each of its subdivisions. Thus, the „Apele Moldovei” Agency and District Committees “Basin Water Management Authority” are responsible for the management of surface water resources, and the AGRM is responsible for the management of groundwater resources. The implementation of the surface water monitoring (quantitative monitoring) is done by SHS, and control over the sources of pollution - by the Environmental Agency. The protection, monitoring of water quality for drinking water, abstraction, water related leisure and recreation areas are performed by the National Agency for Public Health and local Public Health Centers under the Ministry of Health, Labour and Social Protection.

At the end of 2017, it was created DPBS RBD Committee. It has a coordination and advisory function, and being actively involved in the efficient water resources management. The Committee consists of representatives of central and local public administration authorities, sub-committees, water user associations, civil and the scientific society. The Committee meets once in a half year.

Data exchange and public access to information

The primary sources of information used for the current diagnostic analysis were from the first cycle of the RBMP (2018-2023) for DPBS RBD, delineation reports, mapping and classification of groundwater bodies, cartographic material (orthophotoplans, maps at a scale of 1:50 000), statistical data collected from the National Bureau of Statistics (statistical Yearbook of the Republic of Moldova (1990-2017)), State Ecological Inspectorate (State Ecological Inspectorate Yearbooks (2007-2017)), SHS (Yearbooks with monitoring data on water quality and quantity (2012-2017)) and “Apele Moldovei” Agency (Report nr.1 on Water Management, "Apele Moldovei" Agency (1990-2017)).

All chapters were reviewed by experts, presented and discussed at the DPBS RBD Committee meetings.
2 MAIN ISSUES

A number of problems of different nature were identified during the development of draft of the diagnostic study for DPBS RBD which lead to deficiency in water resources and deterioration of their quality. The main issues identified are presented below:

2.1 Health: safe drinking water

- Only 11% of the population from DPBS RBD has access to centralized systems for discharged and wastewater treatment. Expansion of the sewerage network should be a priority in the coming years;
- Around ½ of the population from the study region has access to centralized water supply systems. However, a large part of the population, especially from rural areas, has no access to a qualitative water supply. This issue will remain a priority for the next cycle of the RBMP.
- The quality of the water supply in schools and in institutions for children is inadequate (54.4% of the samples exceed the maximum admissible concentrations for the sanitary-chemical parameters and 20.2% of the samples exceed the maximum admissible concentrations of the microbiological parameters). This situation requires additional measures to improve the drinking water pre-treatment system;
- Occurrence of dysentery is significantly lower in the south part of the basin where the access to controlled drinking water is higher. So, the underground waters should be used more intensely by the population, but they must be demineralized before;
- Establish norms for water use, especially for the household needs; there is some records related to overconsumption without applying the differentiated tariff.

2.2 Water resources quality: reduce pollution

- The largest volumes of untreated wastewaters come from settlements that are supplied with water, but do not have sewage systems and sewage treatment plants. In the DPBS RBD there are only 48 wastewater treatment plants, from which 39 are working. The number of sewage treatment plants, especially in human agglomerations, needs to be expanded and existing ones need to be modernized;
- Agriculture is the main source of water pollution. The implementation of the Code of Good Agricultural Practice, as well as the delineation of riverside wooded strips, would reduce the pollution from this source;
- Improving the monitoring program could increase the quality of water resources by identifying earlier the sources of pollution.

2.3 Quantity: adapt to the growing occurrence of drought and floods linked to climate change

- The Prut River is the main source of surface water. Thus, the multiannual average flow for Prut river in the period 1945 - 2016 is of 82.5 m$^3$/s. In the last 7 years, however, there has been a decrease of average flows by about 20 m$^3$/s, which can be explained by the increase of the anthropic pressure of the Prut basin in the mountain region (through deforestation, riverblocks and construction of hydroelectric power stations etc.); Surface water reserves (small rivers and tributaries of the Prut River) are estimated at 737.3 million m$^3$ and they are used as technological water at local level;
Groundwater, currently, provides 70% of the overall water needs. Following the hydrogeological prospects, total groundwater reserves were estimated to be 3478.9 m$^3$/day on 01.01.2014. Natural background concentrations of salinity indices (Cl, SO$_4$, Na, TDS, etc.) are quite high, because of marine origin of water bearing sediments, which still contain saline waters in their pores;

- Improving the institutional capacities for water resources management by creating appropriate territorial structures - Districts and basin committees, with decision-making role;
- Prioritize the water bodies with water overuse or potential flood risk and develop concrete actions to be implemented.

### 2.4 Ecosystems: to benefit from the services of an healthy environment

- Underwater land occupies only 1.9% of the district surface. The largest surfaces with lakes are in the lower valley of the Prut river (Beleu and Manta); Wetland are of great importance and need to be preserved. Beyond their crucial importance for biodiversity, they bring important services as buffer in the context of climate change;
- The lower Prut lakes region was included into the List of Wetlands of International Importance, as Ramsar area No. 1029 "Lower Prut Lakes" (especially as a habitat for aquatic birds);
- Implementation of the hydromorphological monitoring, which doesn’t exist currently;
- A special attention shall be given to permanent vegetalisation of river bank and development of trees beside the river that reduce pollution and evaporation.
- Interruption of lateral and longitudinal connectivity affects the reproduction of some fish species. The flood defense in particular and more widely the man-made infrastructures in the river bed have to be rethought and the potentiality of nature-based solution introduced.

### 2.5 Governance for efficient water resources management

- The first cycle RBMP (for the period 2018-2023) for the DPBS RBD was approved through the Government Decision Nr. 955 on October 3, 2018; It is proposed to use the opportunity to prepare an up-graded second cycle, to synchronize it with all the Danube countries and European member states. This 2$^{nd}$ plan has thus been prepared to be adopted before the implementation period of December 2021- December 2027 in line with the WFD;
- Lack of implementation mechanisms for the existing legal acts; there are not applied or enforced sufficiently;
- Implementation of the differentiated tariff in water consumption;
- “Apele Moldovei” Agency has the responsibility for the coordination of the participative RBM Planning and management of surface water resources; an improvement in data management to improve available knowledge and stakeholder awareness is key for sustainable improvement along the planning cycles.
- The monitoring of groundwater resources is under the jurisdiction of the AGRM and surface water-the Environmental Agency; In order to face the challenge of monitoring in line with EU standards, newly defined groundwater and surface water bodies has been made.
First part of the RBMP to be implemented from December 2021 to December 2027 has been drafted from July 2018 to March 2019 and is subject to first 6-months consultations on main water issues from April to September 2019.

The result of this consultation will be used for the drafting of the second part of the PoM which is planned to be developed by the end of 2019.

Second 6-months public consultations can be started in 2020 till the end of the year before starting the adoption process, after the end of the EUWI Plus Project. The option to be discussed with MARDE and “Apele Moldovei” Agency is that second cycle of RBMP could be adopted and started in parallel with EU and Danube Basin countries from 2021-2027.
First Technical Report: presents the analysis of general characterization of the DPBS RBD.

Second Technical Report: presents driving forces, types of pressures and their impact on the quality and quantity of water resources in DPBS RBD. Surface waters were analyzed at the sub-basin level, and the ground water – at the groundwater bodies’ level (according to the new delineation).

Third Technical Report: presents the description of protected areas according to the WFD (identification and mapping of protected areas).

Fourth Technical Report: presents the economic analysis of water use in the DPBS RBD.
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