Study

Framework for Water Treatment Technologies in Moldova

Republic of Moldova

presented by

aqua consult, Hanover, in cooperation with Spelleken Assoc. Moldova, Chișinău

sponsored by

Federal Ministry of Environment, Nature Conservation, Construction and Nuclear Safety

This project was funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety with means of the Advisory Assistance Programme for Environmental Protection in the Countries of Central and Eastern Europe, the Caucasus and Central Asia. It was supervised by the Federal Environment Agency (Umweltbundesamt, UBA).

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Umwelt Bundesamt

Spelleken Assoc.

aqua consult Ingenieur GmbH

CONTENT

Tables

Figures

Photos

CHAPTER 1. LAWS AND NORMS/STANDARDS ABOUT WATER SUPPLY AND SANITATION INCLUDING TRIGGER VALUES

1.1. Legal framework

Republic of Moldova got independent in 1992 after almost two hundred years of belonging to the Russian Empire. From 1920 to 1941, the country was part of Romania, and from 1941 to 1992, it was a Soviet Republic. After Republic of Moldova became independent, the new legislation was developed. During the last years the legislation of the Republic of Moldova started to be approximated to EU legislation. This process should accelerate after signing the Association Agreement, but still there is a lot of work to do. Still, many of the national standards are from Soviet times.

Theoretically, the juridical system in Moldova was modernised though it is not so independent from political influence. Practically, many laws are very general and not yet sustained by decrees or regulations that help to apply certain legal paragraphs.

One of the most important documents which regulate the water and sanitation sector is the *Strategy for Water Supply and Sanitation*, adopted by the Government of the Republic of Moldova, at 20th of March, 2014 (Government Decision no 199). The Strategy for Water Supply and Sanitation aims to present updated and detailed directions for the development of water supply and sanitation sector for medium-term (until 2018), as well as for long-term (until 2028) and to ensure the human right of access to safe drinking water as a fundamental right.

The **overall objective** of the Strategy *is to ensure gradual access to safe water and adequate sanitation to all localities and Moldovan population, thus contributing to improving the health, dignity and quality of life and economic development of the country.*

It is worth to mention that this objective could be achieved only by implementing some specific other objectives, included in the strategy:

1. *Decentralisation of public services of water supply and sanitation.* Local public authorities have the exclusive control on setting up, organizing, coordinating and controlling the operation of municipal services and the creation, management and use of goods which are public property of administrative-territorial units of municipal infrastructure.
2. *Extension of centralised water supply and sanitation systems and increasing the level of access of the population to these services.* Ensuring the supply of drinking water in required quantity, will be achieved by extending the existing water supply systems (Nistru–Soroca–Bălţi and Nistru–Vadul lui Vodă–Chişinău–Străşeni-Călăraşi), planning the construction of a new aqueduct (Prut–Leova–Cimişlia–Basarabeasca–Ceadîr-Lunga) and maintaining the grouped aqueducts. The target for the first five years is to cover with water and sanitation infrastructure up to 30 % of population from urban areas who are not connected and up to 20 to 25 % of population from rural areas.
3. *Promoting the principles of market economy and attracting private capital.* Water supply and sanitation public services monopoly is determined by the situation of the beneficiaries who became captive customers being connected to the centralized systems. In order to ensure the competition, there will be implemented a series of competing measures for operators' services, capital financing and management as follows:

a) Conducting tender procedure for all cases where the operator has financial losses or cannot ensure adequate quality of water and sanitation services;

b) Withdrawal of operating licenses for providers who do not meet performance criteria;

c) Reorganisation of municipal enterprises which are subordinated to public authorities;

d) Ensuring transparency in managing public services of water supply and sanitation.

Also, the strategy states that due to budgetary constraints, public funding is insignificant. Therefore, to attract private capital is a stringent necessity, which will be developed by long term partnerships between local public authorities and private investors.

Besides, this strategy outlines a vision of the organisation of water supply and sanitation system in Moldova. There are several important laws and regulations governing the operation of water supply and sanitation system. These are:

- The law of the Republic of Moldova No. 303 from December 13, 2013, on "*Public services for water supply and sanitation"* which regulates the legal framework on the establishment, organization, management, financing, operation, monitoring and control of the functioning of public services of water supply and sanitation from household sector;
- The law of the Republic of Moldova No. 1402-XV from October 24, 2002, *on "Public municipal services"*, which sets the legal framework regarding the establishment and organization of public municipal services in administrative-territorial units, including their monitoring and operation control;
- The law of the Republic of Moldova No. 272-XIV from February 10, 1999, on *"Drinking water"* establishes requirements to ensure safe operation of the water supply service and needs to be revised in accordance with the Directive 98/83/ EC on quality of water for human consumption;
- The law of the Republic of Moldova No. 272 from December 23, 2011, *on "Water*" developed in accordance with EU Directives. The law aims to protect water against pollution and sets up quality standards for the environment.
- The law of the Republic of Moldova No. 10-XVI from February 3, 2009, on *"State supervision of public health"*, which aims to ensure optimal conditions for protection and promotion of health and improvement of life quality;
- The law of the Republic of Moldova No. *436-XVI from December 28, 2006, on "Public administration",* which determines and establishes the organisation and functioning of public administration in administrative-territorial units. This law states that the local public authorities are responsible for providing public services for water supply, sanitation and waste management;
- Government Decision No. 950 from November 25, 2013, on "*Regulation regarding requirements for collecting, treating and discharging waste waters into sewerage system and/or water bodies in urban and rural settlements";*
- Government Decision No. 802 from October 10, 2013, on *"Regulation regarding conditions for waste water discharge into water bodies";*

- Government Decision no. 934 from August 15, 2007, on *„Setting up the Automated Information System «State Register of Natural Mineral Water, Drinking Water and Bottled Soft Drinks»"*, which regulates the quality of drinking water and establishes monitoring and reporting programs for quality of drinking water.

Other legislative acts that regulate public services of water supply and sanitation are: *the Government Decision No. 932 from November 20, 2013, on "Regulation for monitoring and evidence of the state of surface and underground waters", the Government Decision No. 931 from November 20, 2013 on "Regulation for underground water quality requirements", the* Government Decision No. 656 from May 27, 2002, on *"Regulation for use of water supply and sanitation systems",* the order of the Ministry of Ecology, Construction and Regional Development of the Republic of Moldova No. 163 from July 7, 2003, on *"Approving methodology on the environmental impact assessment in case of non-compliance to water legislation".*

Also, there are several laws that are related to the water sector, like: the Law of the Republic of Moldova No. 440-XIII from April 27, 1995, *on "Riparian Buffer Zones for Rivers and Reservoirs",* the Law of the Republic of Moldova No. 1540-XIII from 25th February 1998 on *"The Charges for Environment Pollution",* the Law of the Republic of Moldova No.1102-XIII from February 6, 1997 on *"Natural Resources",* the Law of the Republic of Moldova No. 851-XIII from May 29, 1996 on *"The Ecological Expertise and Environmental Impact Assessment".*

The waste management sector is governed by the *"Waste Management Strategy in Moldova for the years of 2013-2027",* adopted by the Government of the Republic of Moldova on April 10, 2013 (No. 248). This strategy outlines the vision of the sector, which is currently governed by the following laws and regulations: the Law of the Republic of Moldova No. 1347-XIII from October 9, 1997, *on "Production and Household Waste",* the Law of the Republic of Moldova No. 1236-XIII from July 3, 1997 on *"The Regime of Hazardous Products and Substances",* the Law of the Republic of Moldova No. 40-XV from February 19, 2004 on *"The Ratification of the Stockholm Convention on Persistent Organic Pollutants",* the Government Decision No. 1296 from November 20, 2008, on *"Ecological taxes at the import of goods which causes environmental pollution in the process of use, and at the import of goods with plastic and / or tetra-pack packages"*.

1.2. Institutional framework

In practise, the following institutions are responsible for the implementation of policies of water and sewerage installations and operations:

The Ministry of Environment is the key resort responsible for management of water resources. The Ministry consists of the following departments:

a. Department of analysis, monitoring and evaluation of the policies;
b. Department of natural resources and biodiversity;
c. Department of water management;
d. Department of pollution prevention and waste management;
e. Department of finances and accounting;

The Ministry has been mandated to deal with broad environmental protection issues, and it has primary responsibility for the supervision of environmental laws, norms, programs, and decrees in the Republic of Moldova. Therefore, the Ministry has the attribution to elaborate, promote and implement the state policy on environment protection. The Ministry's basic responsibilities are set

out in the Law on Environmental Protection and its Regulations. It covers environmental management, protection and monitoring. Also, the Ministry of Environment manages the National Environment Fund. The Fund was established by Government Decision no. 988 of 26.09.1998 in accordance with the Law on Environmental Protection (no. 1515 of 16.06.1993), Law Amending and Supplementing the Law on Environmental Protection (no. 1539-XIII of 25.02.1998), the Law on Taxes for Environmental Pollution (no. 1540-XIII of 25.02.1998) in order to accumulate additional resources for financing environmental activities. Therefore, the Ministry decides which projects to be funded in different localities based on those proposed by local authorities. The areas of funding are different. Based on a Report on the activities of the National Environment Fund most projects approved for funding were in the field of water supply and sanitation. In 2013, the number of approved projects for this sector was 177, which represents a proportion of 54.3 % from the total amount of funded projects. The amount of money for the above mentioned approved projects was 15.9 million €.

The Ministry of Construction and Regional Development is responsible for the development, promotion and implementation of the state policy for regional development, territorial arranging and planning, architecture, technical design, urban planning, construction, production of materials for construction and household. The State Construction Inspection is one of the subordinated institutions of the Ministry of Construction and Regional Development. It is the only body empowered to control the application of the legislation and normative documents in construction and urban planning.

Also, one of the responsibilities of the Ministry is to manage the National Fund for Regional Development. The Fund is the main tool to finance regional development projects according to priority areas towards disadvantaged areas in developing regions. It is formed from annual allocations from the state budget. The amount of the fund is 1 % of the revenues of the state budget approved by the State Budget Law for the particular year.

The State Ecological Inspectorate (SEI) is a public authority subordinated to the Ministry of Environment established as a separate legal entity. It is not an autonomous institution. The SEI is an environmental protection regulatory and enforcement institution and performs the state control over the rational use and protection of all natural resources. Its basic responsibilities include monitoring of environmental pollution and carrying out regular inspections for environmental violation and protection, as well as provision of monitoring data and information.

The main role of the SEI is to control and enforce the implementation of environmental legislation. We distinguish the following divisions of the inspectorate:

a. Division on general control, divided in two sections: a) on control of soil, waste, chemical substances; b) on control of water resources, air;
b. Division on control of flora and fauna
c. Division on ecological expertise and environmental authorisation

The Ministry of Health (MoH) is the central authority for development, promotion and implementation of the state policies on protecting populations' health, and assuring sanitary and epidemiological supervision in Moldova. In the field of water, the main responsibilities lie with the National Centre for Public Health (NCPH), which is subordinated to the MoH as well as District and Municipal Centres for Public Health.

The National Centre for Public Health is responsible for state sanitary and epidemiological supervision, for sampling and testing water quality in water bodies and groundwater used for

drinking water; and for control over the observance of sanitary, epidemiological and hygienic regulations. Its district subdivisions perform periodic testing of water from centralized water supply systems, artesian wells and shallow wells.

The National Centre for Public Health NCPH (see above) is institution subordinated to the Ministry of Health, it also covers monitoring of quality of drinking water control, of compliance to health legislation and sanitary standards; public awareness.

State Agency Apele Moldovei is a state institution established under the Ministry of Environment. The institution is responsible for water management in Moldova. There are specialists in the field of water use, flood prevention, design and investigation of surface and underground water sources.

Based on the new Law on Water (in force since 26th of October 2013), within the Agency "Apele Moldovei" were created entities/directions that should manage Nistru and Prut River Basins. At this moment, there is under development the Management Plan for the Nistru River Basin. In practise, "Apele Moldovei" is the institution which should know the situation and problems regarding the water supply and sanitation system and should attract funds for its management. The institution is in charge of implementing strategic national projects. Actually, the capacity of the institution is not strong and their activity consists mainly in strengthening dams and building big water supply and sanitation systems.

State Hydrometeorological Service is also the subdivision of the Ministry of Environment, responsible to monitor the state of the environment in the country, The Service monitors the quality and the quantity of surface waters in Moldova.

State Agency for Geology of Moldova (AGeoM) is also the subdivision of the Ministry of Environment and is responsible to manage underground natural resources including underground waters. AGeoM manages the artesian wells in the country which supply with drinking water a part of the rural population.

Institute of Ecology and Geography of Moldova is the subdivision of the Ministry of Environment, which carries out scientific research in the field of environment, and also approves new technologies of waste water treatment in Moldova.

The National Agency for Energy Regulation (NAER) is institution responsible for the development of the methodology for calculating, approval and implementation of tariffs for public services on water supply, sanitation and wastewater treatment. A new regulatory department of public services for water supply and sanitation was recently created within NAER and it has the following attributions:

a) Establishing regulations, taking decisions and developing recommendations on the functioning of water supply and sanitation area;

b) Granting the operating license for „Apa-Canal" companies based on a series of documentation which would determine how to improve the financial and technical targets, business plans, balance sheets, etc.;

c) Monitoring the establishing and approval of tariffs to ensure an optimal balance between the needs for modernization of networks and quality of provided services.

Some of the institutions mentioned above create an ambience of unclear and sometimes conflicting priorities. In terms of flow and exchange of information, the structure of the reporting

process is inefficient and leads to misunderstandings. For example, the Agency "Apele Moldovei" subordinated to the Ministry of Environment, doesn't report on water to the Direction of Water Management within the Ministry of Environment, but reports directly to the Minister.

Ministry of Environment and other key organisations associated with WSS, such as "Apele Moldovei" and "Moldova Apă-Canal" promote staff with very long work experience which do not encourage young specialists. However, there are no offers to the staff for new opportunities to increase their qualification, especially in the use of software to collect, manage, monitor and analyze accurate and reliable data. This situation creates lack of managerial planning and increases risks faced by these institutions.

In the table 1 were identified the organisational strengths and weaknesses of the above mentioned institutions.

Table 1. SWOT analysis for state authorities responsible for water supply and sanitation and waste management issues

Strengths	**Opportunities**
Ministry of Environment subordinates all the State Agencies responsible for water supply and sanitation and waste management, such as State Ecological Inspectorate, State Agency Apele Moldovei, AGEOM.	**Ministry of Environment** could improve the operation of its subordinated institutions such as State Ecological Inspectorate, State Agency Apele Moldovei, AGEOM.
Ministry of Environment is responsible to draft environmental legislation and make necessary improvements and modifications if necessary.	**Ministry of Environment** could propose necessary improvements to enforce the new Law on Water of Moldova form 26th October 2013. If Moldova continues to integrate in EU, it will learn from the positive experience of EU in the field of environment.
Ministry of Environment manages the State Environmental Fund, which finances and co-finances primarily projects on water supply and sanitation.	**Ministry of Environment** could finance and co-finance projects on creation of sewerage system and waste water treatment systems, by complementing the operation of the National Fund for Regional Development which deals primarily with water supply systems. The main goal of the Ministry of Environment should be environmental pollution prevention, this is way sewerage and waste water treatment plants should be the priority of the fund. It is also important to mention that water pollution and scarcity is the main environmental problem of Moldova.
Ministry of Environment does not collect necessary data to develop qualitative Management Plans of Dniester and Prut river. To develop the Plans the Ministry collaborates with Millennium Challenge Account (MCA in Moldova), Apele Moldovei Agency and other relevant structures.	**Ministry of Environment** could collect necessary data to develop qualitative Management Plans of Dniester and Prut river in collaboration with local public authorities and decentralized competent authorities.
State Ecological Inspectorate is responsible for the environmental compliance and enforcement in the Republic of Moldova, having almost 300 environmental inspectors in the country and decentralized District Ecological Agencies in each district of Moldova.	**State Ecological Inspectorate** should be reformed, created of professional staff, and not be subordinated to the Ministry of Environment, like it is in Romania (Environmental Guard of Romania). The staff of the Inspectorate could be increased in the decentralized agencies, especially for bigger

	settlements.
State Agency Apele Moldovei is responsible for the integrated water resources management through its two Enterprises for Dniester river basin and Prut river basin	**State Agency Apele Moldovei** should be also reformed, the staff of the Agency should be professional, the number of staff should be increased, the Agency should promote the creation of River Basin Councils on bigger rivers of Moldova (tributaries of Dniester and Prut rivers).
State Agency for Geology of Moldova (AGeoM) is responsible for the management of artesian wells with underground water built to supply the population with drinking water in many small towns and villages of Moldova	**State Agency for Geology of Moldova (AGeoM)** should be reformed and hire professional staff, the number of hired staff should be increased.
Ministry of Health through the National Centre for Public Health controls the environmental pollution and its impact on the population's health (especially bacteria and viruses in drinking water used from the water pipe or from shallow wells). National Centre of Public Health has decentralized District Centres of Public Health in each district of Moldova	**Ministry of Health through the National Centre for Public Health** should control the environmental pollution and its impact on the population's health (not only bacteria and viruses in drinking water used from the water pipe or from shallow wells, but also toxic substances, which we find in the food products raised or produced in Moldova with toxic water).
Ministry of Regional Development and Constructions supports through the National Fund for Regional Development construction of water supply and sanitation and waste management systems **(through Regional Development Agencies North, Centre and South)**	**Ministry of Regional Development and Constructions** should support only those project on water supply which have co-financing from various sources for sewerage and waste water treatment plants
Weaknesses	**Threats**
There are only 51 people hired in the **Ministry of Environment**, and only 5 in the Department of Water responsible for Water Supply and Sanitation systems, there are other 3 people responsible for integrated water resources management in the Department of Natural Resources of the **Ministry of Environment**	Necessary reforms will continue in the field of environment in Moldova and within the **Ministry of Environment** if Moldova will continue to choose European integration during the Parliamentary election of November 2014 and local election of June 2015; in case of electing pro-Russian parties, things could remain the same for many many years with the same level of corruption in the field of environment
Ministry of Environment is not improving the operation of the subordinated structures, which usually do not fulfill their responsibilities, such as the State Ecological Inspectorate, Agency Apele Moldovei, AGEOM. Directors of these structures are political figures as the Minister, so there is a lot of influence form political parties, though these structures should be managed by professionals.	**National Ecological Fund** could not belong to the Ministry of Environment but be a part of the state Budget, in this case environmental issues will not be priority for the Government but social issues first of all (salaries, pensions, other social assistance etc.)
State Ecological Inspectorate is a corrupt structure and is not executing its primary responsibility – environmental compliance and enforcement. Even environmental legislation in the field of water was harmonized to EU directives in the field of water, still, Moldova is far from European standards, and at the moment the majority of settlements in Moldova do not have operational waste water treatment plants and the Inspectorate is	If the **State Ecological Inspectorate** will not be reformed and will continue to be a political structure (with the director appointed from a political party) no changes will occur in environmental compliance and enforcement in Moldova. The same statement is relevant for the **State Agency Apele Moldovei and for AGeoM**. If the **National Center for Public Health** continues not to measure impact on the population's health as

not putting penalties to mayoralties, private sector or physical persons which discharge waste waters in rivers, on soils, instead bribes are perceived from the persons which do not comply with the legislation **State Agency Apele Moldovei** though is responsible to improve the water management in the Dniester and Prut river basin, is far from executing its responsibilities. Apele Moldovei is involved in the development of the Dniester Management Plan guided by the Ministry of Environment, though all the data used to develop the plan is more than 30-40 years old and is not anymore relevant to the process. Still the Ministry of Environment and State Agency Apele Moldovei continue to use the old data, even receiving critics from civil society and finally will develop a Plan which will not correspond to the reality. For example the Agency does not know how many water supply systems were built by the villages during the last dozens of years from springs, there is not data on this and it will be not taken into consideration in the plan which deals both with water quality and water quantity. Capturing springs of the river influences on the water volume in the river, this data should be definitely included in the Plan. The staff of the Agency is not professional and there are only 30 people hired in the Agency. **AGeoM** even is responsible for the management of artesian wells in the country, still it does not have all the data on how many are used at the moment, how many have been abandoned, how many are polluted from the fact that they were not closed properly after not have being used by the communities **National Centre of Public Health** though is responsible to control the state of environment and its impact on the population's health, still is not controlling the impact of the polluted food products (agricultural products irrigated with polluted water, milk products produced from cows which were watered from polluted rivers, shallow wells, and meat of domestic animals which were watered with very polluted water). Hereby the population does not know anything about the real risks of consuming this kind of food products	a result of consuming toxic food products, the percentage of diseases from polluted food products will substantially raise during the next years **Ministry of Regional Development and Constructions** will continue to support water supply projects without assuring the creation of sewerage and waste water treatment system at the same time, this situation will create a lot of pollution problems for the future

Source: elaborated by the author

According to the legislation in force, the population is also involved in development of important legislative and normative acts (draft laws, national programs, regulations, etc.).

According to the Law on transparency in decision making process, the interested groups are consulted during the development of national legislation, strategies, feasibility studies, strategic environmental assessment, etc. The most recent and eloquent participatory processes in developing state policy on water supply and sanitation were public consultations on Strategy for water supply and sanitation for the years 2014 to 2028, approved by the Government Decision no 199 from 20th of March 2014 and the Law on Public service for water supply and sanitation no. 303 from 12th of December 2013.

The procedure follows all the main stages to ensure transparency in decision-making process:

a) Informing the public about the elaboration of decision;
b) Providing draft decision and its related materials to stakeholders;
c) Consultation of citizens, associations, other stakeholders in accordance with the law;
d) Reviewing the recommendations from citizens, associations and other stakeholders in accordance with the law, and in the development of draft decisions;
e) Inform the public about the decisions taken.

The described process is unavoidable, since any strategy document is not allowed to the State Chancellery without passing public consultations, and the Government members will not even review it. In a way the authority who is in charge for the document is forced to consult representatives of civil society

Also participatory process is observed in case of decisions on projects related to the development of water supply and sanitation systems. For example, the public is consulted regarding plans to build water supply system in Nisporeni rayon (Nisporeni town and Grozeşti, Vărzăreşti villages). The public was also consulted in decision making process for construction and extension of water supply and sanitation systems in Soroca, Floreşti, Hînceşti, Orhei, Leova, Ceadîr-Lunga rayon's and other 30 rural settlements.

Consultations with population are also organized thought the political level structure at village and, towns and rayon level. Each city council is composed by council members that have close communication with the population. Since every infrastructure project has to be approved by the council, a consultation with population is supposed to have happen (in a more or less formal way). It is clear that involvement of population in decision making process is not a widely spread practice in Moldova, where political parties have a strong vertical orientation and many decisions are being taken at central level. That's why the population should be really involved in the process of planning and creation of the new infrastructure such as water supply, waste water treatment and waste management in their communities.

1.3. Trigger Values

In 2013, the Parliament of Moldova approved a new regulation on trigger values:

No. 950 *"About the approval of requirements toward the collection, treatment and discharge of waste waters in sewerage system and/or in water bodies for urban and rural settlements".*

This Regulation transposes partially the provisions of the Council's Directive no 91/271/CEE from 21 May 1991 on urban waste water treatment. This regulation has to:

1. Establish requirements to exploit systems of waste water collection in urban settlements and to exploit waste water treatment plants, which should contain provisions on:
   a. the method and treatment level which should be assured depending on the number of inhabitants/size of the settlement where the sanitation system exists or should be built and/or by the quality of waters into which the treated waste waters are discharged;
   b. identification and classification of such waters, into which the treated waste waters are discharged, defined as sensitive areas;

c. discharge of industrial waste waters into a sewerage system is mandatory in urban settlements, which should be performed according to an agreement with the exception of cases explained from technical, environmental and economic point of view;
d. conditions of sludge management which result from the treatment process;
e. monitoring of discharge of liquid waste and its impact, as well as reporting requirements is mandatory;

2. Establishing waste water treatment requirements in rural settlements on collection, storage, treatment and discharge of household waste waters, including the maintenance requirements of rural sewerage systems, waste water treatment plants and alternative treatment processes, technologies and adequate processes.

For the establishment of limit values for heavy metals it is important to note that the total concentration of heavy metals should not exceed 2 mg/dm^3. Concentration of Mercury cannot exceed 0.05 mg/dm^3 even if it is the only heavy metal in waste waters (See Table 2).

For those substances which do not have fixed limit values in the existing standards or regulations, those are established according to developed studies by specialized institutions at the request of water user. Studies will also comprise qualitative and quantitative analysis methods of those substances, as well as on adequate treatment technologies. Limit values will be approved by the central competent authority in the field of environment and water.

These will be approved by environmental authorizations for special water use, depending on the features of the natural water body, of its self-treatment capacity, of the features of other waste waters discharged in the same water body, of the requirements of the water users on the capacity and efficiency of the waste water treatment plant and necessity of environmental protection.

The values for concentration or for the percentage of reduction will be applied in the following way:

Table 2. Limit values for pollutants in industrial and urban waste waters discharged into water bodies (is applied to all influents which come or do not come from waste water treatment plants)

Nr.	Indicator/ quality parameter	Measure units	Limit values	Analysis methods
1	**2**	**3**	**4**	**5**
A. Physical indicators				
1.	Temperature[1)]	C^0	30	
B. Chemical indicators				
2.	Concentration of hydrogen ions (pH)	Units of pH	6.5 – 8.5	SR ISO 10523-97
3.	Solid substances	mg/dm^3	35.0	STAS 6953-81
4.	Biochemical oxygen demand in 5 days (BOD_5)	mgO_2/dm^3	25.0	SR EN 1899-2/2002
5.	Chemical oxygen demand (COD_{Cr})	mgO_2/dm^3	125.0	SR ISO 6060-96
6.	Ammonia N (NH_4^+)[5)]	mg/dm^3	2.0	SR ISO 5664:2001 SR ISO 7150-1/2001
7.	Total nitrogen Kjeldahl (NTK)[5)]	mg/dm^3	10.0	SR EN ISO 13395:2002

1	2	3	4	5
8.	Nitrates (NO_3^-) [5)]	mg/dm^3	25.0	SR ISO 7890-2:2000; SR ISO 7890-3:2000 SR ISO 7890/1-98 for the sea water; STAS 12999-91
9.	Nitrites (NO_2^-) [5)]	mg/dm^3	1.0	SR EN 26777:2002 pentru
10.	Hydrogen sulphide (S^{2-})	mg/dm^3	0.5	SR ISO 10530-97 SR 7510-97
11.	Sulphites (SO_3)$^{2-}$	mg/dm^3	1.0	STAS 7661-89
12.	Sulphates (SO_4^{2-})	mg/dm^3	400.0 or the content in drinking water	STAS 8601-70
13.	Phenols with water vapors (C_6H_5OH)	mg/dm^3	0.3	SR ISO 6439:2001; SR ISO 8165/1/00
14.	Substances extracted with organic solvents (fats)	mg/dm^3	10.0	SR 7587-96
15.	Petrol products [4)]	mg/dm^3	0.5	SR 7877/1-95 SR 7877/2-95
16.	Phosphorus, total (P_{total}) [5)]	mg/dm^3	2.0	SR EN 1189-2000
17.	Synthetic detergents active biodegradable anions	mg/dm^3	0.5	SR EN 903: 2003 SR ISO 7875/2-1996
18.	Total cyanide (CN)	mg/dm^3	0.4	SR ISO 6703/1/2-98/00
19.	Free residual chlorine (Cl_2)	mg/dm^3	0.2	SR EN ISO 7393-1:2002;SR EN ISO 7393-2:2002;SR EN ISO 7393-3:2002
20.	Chloride (Cl^-)	mg/dm^3	300.0	STAS 8663-70
21.	Fluoride (F^-)	mg/dm^3	1.5	SR ISO 10359-1:2001; SR ISO 10359-2:2001
22.	Fized residue	mg/dm^3	1,500.0	STAS 9187-84
23.	Arsenic (As^+)[2)]	mg/dm^3	0.1	SR ISO 10566:2001
24.	Aluminium (Al^{3+})	mg/dm^3	5.0	STAS 9411-83
25.	Calcium (Ca^{2+})	mg/dm^3	300.0	STAS 3662-90 SR ISO 7980-97
26.	Lead (Pb^{2+})[2)]	mg/dm^3	0.12	STAS 8637-79.
27.	Cadmium (Cd^{2+}) [2)]	mg/dm^3	0.1	SR ISO 8288:2002 SR EN ISO 5961:2002
28.	Chromium, total(Cr^{3+}+Cr^{6+}) [2)]	mg/dm^3	1.0	SR EN 1233:2003 SR ISO 9174-98
29.	Chromium (Cr^3)	mg/dm^3	0.9	SR EN 1233:2003 SR ISO 9174-98
30.	Chromium (Cr^{6+}) [2)]	mg/dm^3	0.1	SR EN 1233:2003 SR ISO 11083-98
31.	Iron, total (Fe^{2+},Fe^{3+})	mg/dm^3	5.0	SR EN 1233:2003 SR ISO 6332-96
32.	Copper (Cu^{2+}) [2)]	mg/dm^3	0.1	STAS 7795-80 SR ISO 8288:2001
33.	Nickel (Ni^{2+}) [2)]	mg/dm^3	0.5	STAS 7987-67 SR ISO 8288:2001

1	2	3	4	5
34.	Zinc (Zn^{2+}) 2)	mg/dm^3	0.5	STAS 8314-87 SR ISO 8288:2001
35.	Mercury (Hg^{2+}) 2)	mg/dm^3	0.05	SR EN 1483:2003; SR EN 12338:2003
36.	Silver (Ag+)	mg/dm^3	0.1	STAS 8190-68
37.	Molybdenum (Mo^{2+})	mg/dm^3	0.1	STAS 11422-84
38.	Selenium (Se^{2+})	mg/dm^3	0.1	STAS 12663-88
39.	Manganese total (Mn_{total})	mg/dm^3	1.0	STAS 8662/1-96 SR ISO 6333-96
40.	Magnesium (Mg^{2+})	mg/dm^3	100.0	STAS 6674-77 SR ISO 7980-97
41.	Cobalt (Co^{2+})	mg/dm^3	1.0	SR ISO 8288:2001

Source: Regulation No. 950 "About approval of the Situation on requirements to collection, cleanout and discharge of sewerage in sewerage system and/or in aquatic entities for city and rural settlements"

Table 3. Requirements for Discharges from Urban Waste Water Treatment Plants

Parameters	Concentration(2)	Minimum percentage of reduction (1)	Reference method of measurement
Biochemical oxygen demand (BOD_5)	25 mg/l O_2	70 – 90	Homogenized, unfiltered, not decanted sample. Determination of dissolved oxygen before and after five-day incubation at 20 °C ± 1 °C, in complete darkness.
Chemical oxygen demand (COD)	125 mg/l O_2	75	Homogenized, unfiltered, not decanted sample Potassium dichromate
Total suspended solids	35 mg/l	90	Filtering of a representative sample through a 0.45 µm filter membrane. Drying at 105 °C and weighing, Centrifuging of a representative sample (for at least 5 min with mean acceleration of 2,800 to 3,200 g), drying at 105 °C and weighing
(1) Reduction in relation to the load of the influent. (2) The values of concentration are established by single tests			

Source: Regulation No. 950 "About approval of the Situation on requirements to collection, cleanout and discharge of sewerage in sewerage system and/or in aquatic entities for city and rural settlements"

The analyses concerning discharges shall be carried out on filtered samples; however, the concentration of total suspended solids in unfiltered water samples shall not exceed 150 % (1,5 times).

The values for concentration or for the percentage of reduction are applied in the following way:

Table 4. Requirements for Discharges from Urban Waste water Treatment Plants to Sensitive Areas

Quality parameters	Concentration[3], mg/l	Minimum percentage of reduction [1]	Reference method of measurement
Total phosphorus	2 mg/l P (10,000 – 100,000 p. e.) 1 mg/l P (more than 100,000 p. e.)	80	Molecular absorption spectrophotometry
Total nitrogen [2]	15 mg/l N (10,000 – 100,000 p. e.) 10 mg/l N (more than 100,000 p. e.)	70 – 80	Molecular absorption spectrophotometry

Source: Regulation No. 950 "About approval of the Situation on requirements to collection, cleanout and discharge of sewerage in sewerage system and/or in aquatic entities for city and rural settlements"

The Regulation corresponds to the requirements of the EU Directive, still for nitrates the limit value is 25 mg/dm^3 which is stricter than a standard for drinking water quality which sets up a limit value of 50 mg/dm^3. It requires changes of this limit value for a proper running of the waste water treatment plant. The values for concentration or for the percentage of reduction are applied in the following way:

Table 5. Discharges of Pollutants in ppm into the Natural Water Bodies, mg/l (ppm

Parameter	Ex-Moldovan Standard (Water Bodies Protection Against Pollution, nr. 06.6.3.23 dated 03.07.1997)	EU Standard (Directive 91/271/EEC)
COD	15.0 mg/l	125.0 mg/l
BOD_5	3.0 mg/l	25.0 mg/l
Total P		2.0 mg/l
PO_3^-		
Total N		15.0 mg/l
NO_3^-	40.0 mg/l	
NO_2^-	0.08 mg/l	
NH_4^+	0.5 mg/l	

In consequence, it may be observed that trigger values are still very restrictive and this can influence very much initial investment costs and further operational costs of waste water treatment facilities.

Moldova has a relatively small industry, however a certain number of industrial enterprises exist, and some of them are located in small towns. Only of a few of those factories or even none are operating a pre-treatment waste water plants and the volume of industrially used waste water in

discharged in the public sewerage network or, even worse, in the water bodies. The harm to environment in this case in enormous

The situation shall be clearly communicated to the policy making authorities in order to promote at least two modifications to the legislation leading to a situation improvement:

- The planning of new waste water treatment plants shall take into consideration the satiation of industrial and insist on the lean operation of industrial pre-treatment facilities within enterprises.
- In cases when the factory in unable to set-up pre-treatment facility, a special tariff shall be applied, that will allow the WWTP to perform additional operations to the industrial waste water. Since any additional operation creates costs, the operators shall have the right to charge more and respectively to create a separate income chapter in its financial monitoring.

CHAPTER 2. INSTITUTIONAL PARTICULARITIES OF THE COUNTRY

The institutional framework of Moldova is split between Russian and Romanian traditions. The size, the structure and the constitution of the counties (districts) are from Soviet times, but important regulation bodies like the Agency of Energy Regulation ANRE are inspired by Romania.

Anyway, many institutions have been created after the independence, and some will be set-up in the next years until Moldova will be integrated into the EU, still.

On the meso-level of institutions, between population and state, there are state-satellites and bottom-up foundations, amongst the NGOs, like in most other countries. While the association of water works corporations (AMAC) is a rather self-made group of managers, the competing APSP (Public Services Employers Association of Moldova) is founded by law, comparable to the German Chamber of Commerce.

At the moment, there are many players who represent a key role in providing accurate and reliable data regarding water supply and sanitation (WSS).

Agency of Energy Regulation (ANRE) is a national regulatory authority for energy sector (electricity, gas, heating). All the water tariffs on the Moldova's territory are set by ANRE.

Association "Moldova Apă-Canal" (AMAC) was founded in 2000 as a voluntary company of non-commercial enterprises providing services of water supply and sanitation in the Republic of Moldova. Its purpose is to assist enterprises providing services of water supply and sanitation in Moldova in production, technical and scientific, commercial activities. Also, AMAC defends their interests in central and local public administration bodies or other authorities.

All "Apă-Canal" operators are members of AMAC, therefore "Moldova Apa-Canal" represents the interests of its members. Also, it provides technical and non-technical support and guidance for them. It is responsible for collecting and reporting data on member associations and their performance. The Association maintains a database of its members but these data are not available for the Ministry of Environment, even though AMAC receives funding from the Ministry.

Public Services Employers Association of Moldova (APSP) was founded on 23th of November 2000. It represents 50 enterprises in public utilities services (water supply and sanitation, heating, urban public transport etc.). The Association has the aim to assist its members by providing services and consultations, protect their economic, technical and legal rights and represent their interests in relations with different national and international authorities.

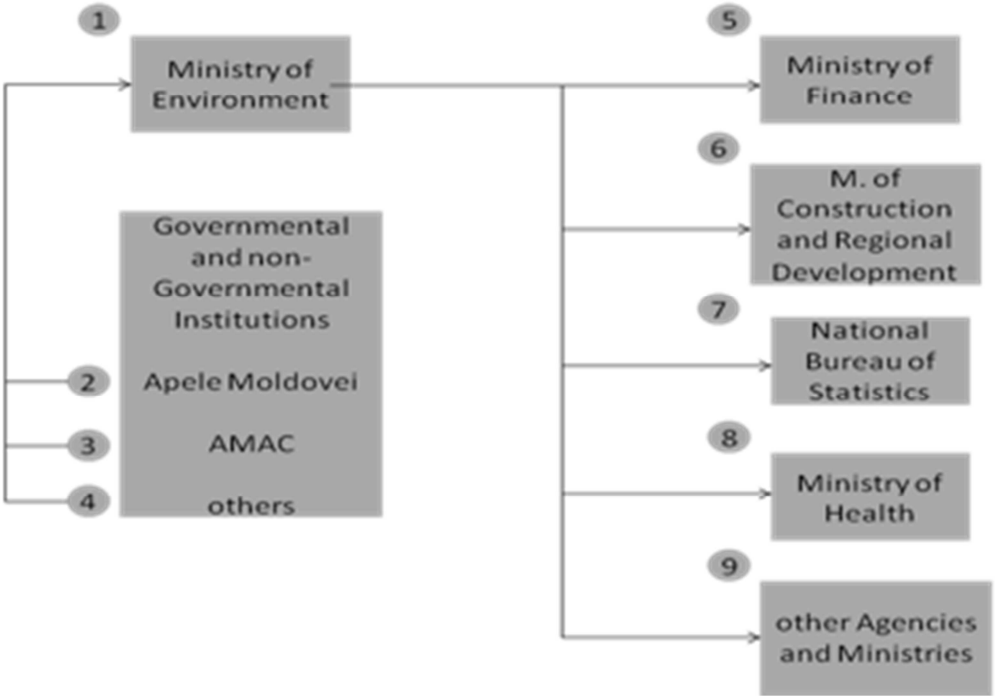
The responsibility for coordination of data collection and reporting in the NGO sector is unclear. In Moldova there are approximately 30 to 40 active NGOs, which are active in various environmental fields including in the field of water protection. According to the Catalogue of environmental NGOs from Moldova developed by REC Moldova in 2005, there were about 400 NGOs registered at that time, though at this moment many of those NGOs do not exist anymore.

During the last 10 years, NGOs implemented various project, participated in consultations on various drafts of projects and strategies in the field of environment organized by the Ministry of Environment and other organizations. The most frequent activities organized by the NGOs are planting and cleaning campaigns, raising environmental education, information and awareness, public consultations on various environmental aspects, promoting separate collection of solid municipal waste, organising seminars and training, consultancy services etc.

The most active NGOs are the National Environmental Centre (on water issues), EcoContact (environmental information, environmental legislation), Biotica (biodiversity), Ecological Movement of Moldova (environmental education and information), Gutta Club (environmental education and information, energy efficiency), MoldREC (collection of electric and electronic waste for recycling) – all these are situated in Chisinau municipality. The most active rural NGOs are Cutezatorul from Falesti town (organic farming), EcoRazeni from Ialoveni town (environmental education), ProDezvoltare Rurala from Hincesti district (environmental education), Habitat from Rezina town (environmental education, environmental tourism).

These observations show that progress in democratisation of Moldova with relatively modern political parties, with an independent Parliament and a free justice is reflected in institutional framework related to water, sewerage and waste.

Figure 1. Flow of Information in the Water Supply and Sanitation Sector



Source: elaborated by the author

In order to synthesize the flow of information in water supply and sanitation sector, the following diagram was designed (Figure 1). It presents an overview of the sources, which provide information in WSS sector to the Ministry of Environment and the agencies and organizations that receive water data from the Ministry of Environment.

The data for water sector can be received from several sources. A primary source is Department of Water Supply and Sanitation, within the Agency “Apele Moldovei”. Currently, the Agency is considered the subdivision of the Ministry of Environment (as previously mentioned) and reports directly to the Minister.

1. Ministry of Environment (MEnv) manages the general collection, processing and reporting of water supply and sanitation data.

2. Agency “Apele Moldovei” manages the collection and reporting of data from district and municipal councils to the MEnv.
3. “Moldova Apă-Canal” Association manages the collection and reporting of financial and technical data from water enterprises.

Reporting in WSS sector is a continuous process all over the year.

Although the tasks are set, the relevant structures do not have full and accurate information in the area. Therefore, there is no efficient method of coordination of activities. For example, some tasks of the Ministry of Environment and Agency "Apele Moldovei" overlap.

The Agency shall report on its activities to the Ministry of Environment (see above), but through its specialised department (Water Management). There is a lack of information about activities planned and also of analysing of the current situation.

The Agency's work was limited to the accumulation of superficial information, based on questionnaires that had not been inspected in order to confirm their truthfulness.

These issues are caused by lack of uniform methodology for conducting accumulation and analysis of data. Respectively, this situation influences the task related to evaluation of WSS sector.

The tariff policy definition and calculus methodology in Moldovan water supply and sanitation sector is based on the volume of water supplied and respectively collected, in the case of used water treatment. In the first case we have relatively simple situations, since every consumer has a water counter and he supplier has a counter for groups of users.

The problem is more difficult for WWT and sewerage network operators, even if the same company operates water supply, used water collection and WWTP. There is no exact data for the volume of discharged used water. The deviation from the supplied fresh water and collected used water can be huge depending of the location profile. Sewerage volume could be smaller in case of rural settlement, where people use water for irrigation, or cold be higher in relatively larger towns, where consumers have own water sources and in the same time septic tanks that have to be emptied once per ear of more often.

It was found that the Ministry of Environment does not fulfil the task of analysing and informing the authorities about WSS sector. Statistical forms contain general information, without specifying the number of people with access to water and sanitation and the necessary investments, which are relevant for an analysis. Each locality independently determines its water supply sources, creating this way certain risks.

Regarding further transition of water and sanitation authorities, the existing local associations for water utilities (Apă-Canal) are in a difficult financial and structural shape. Some of them work properly, due to promotion and cross-subsidising of modern town management, most of them have serious financial debts and shortages and some are practically out of work.

38 “Apă-Canal” associations operate in the Republic of Moldova with the charter of the Municipal Enterprise (31) and Joint Stock Company (7). “Apă-Canal” provides services of water supply and sanitation for households and economic entities. Except Apă-Canal Chișinău, water corporations are mainly inefficient, poorly equipped with infrastructure and financially unsustainable.

The main sources of income for “Apa-Canal” companies consist of incomes based on approved tariffs. Several typical abnormal situations often happen in this regards in Moldova.

- The town council may not be willing to approve calculus based tariffs (due to political populism reasons), in such a way forcing the operators to perform under the break even point of income.
- The population has a low rate of fulfilling its obligation in paying for the delivered services of water supply, sewerage and also waste management. A percentage between 50% and 80% is actual in different localities of Moldova for the above mentioned indicator.

The municipal infrastructure owners are forced to survive with the price and service income far below the level of cost recovery, which affected their ability to support their asset functionality and quality of services for the consumer.

WSS infrastructures that are owned by public authorities are abandoned and deteriorating continuously. The survey defined large lacks in public service administration, affecting its quality, especially with the municipalities funded operators, such as majority of “Apa-Canal” are.

In addition to the lack of capacities and efficiency of local public authorities in Moldovan towns, there are many cases when money, which is collected for waste water supply and treatment services, is used for other purposes than those related to operation and maintenance of waste water treatment plants.

Based on real facts, “Apă-Canal” associations fail to recover their expenditures, as a result there were accumulated debts of million MDLs. High costs of energy consumption in the field of water supply and sanitation along with low consumer financial discipline put considerable financial pressure on “Apă-Canal” companies. In consequence, they are required to use almost all financial accumulations to pay for the consumed electricity, and are not able to maintain and develop their systems properly. Only “Apă-Canal Chisinau” JSC has a positive financial result. In 2012 for example, the profit of this company was 2.9 million €.

In this context, it is recommended to consolidate and merge, gradually the operating companies of WSS into regional corporations that are economically viable and have access to skilled human resources. Multilateral donors such as EBRD (Europeen bank for Reconstruction and Development) promote the organisational modernisation of water utilities through their restructuring and concentration in sense of regional networks. This development should be based on actual experience of their project which comprises six regional centres (Orhei, Soroca, Leova, Hancești, Ceadîr-Lunga and Florești).

Thus, the proposed approach for encouraging their aggregation is to strengthen the infrastructure of the WSS companies of all district centres. This must be accompanied by a significant increase in tariffs compatible with sustainable operation and maintenance. In the second phase, smaller group of about three of "best" WSS operators will be promoted.

Correct tariff is a needed precondition for assuring quality service. However due to Moldova’s scarce recourses at central and regional and local level, the best option is to set up Private Public Partnerships for WSS sector. We can expect better maintenance and operation of the newly created environmental infrastructure (waste management systems, waste water treatment plants), when these should be private with mixed or foreign management (Moldovan and/or foreign, depending on the country of investment). As general policy, Private Public Partnerships should be encouraged and facilitated in creating new environmental infrastructure in Moldova.

It is important to engage financially the local public authorities from Moldova in investing in creation of environmental infrastructure, otherwise if the investment is only foreign, it is usually not sustainable.

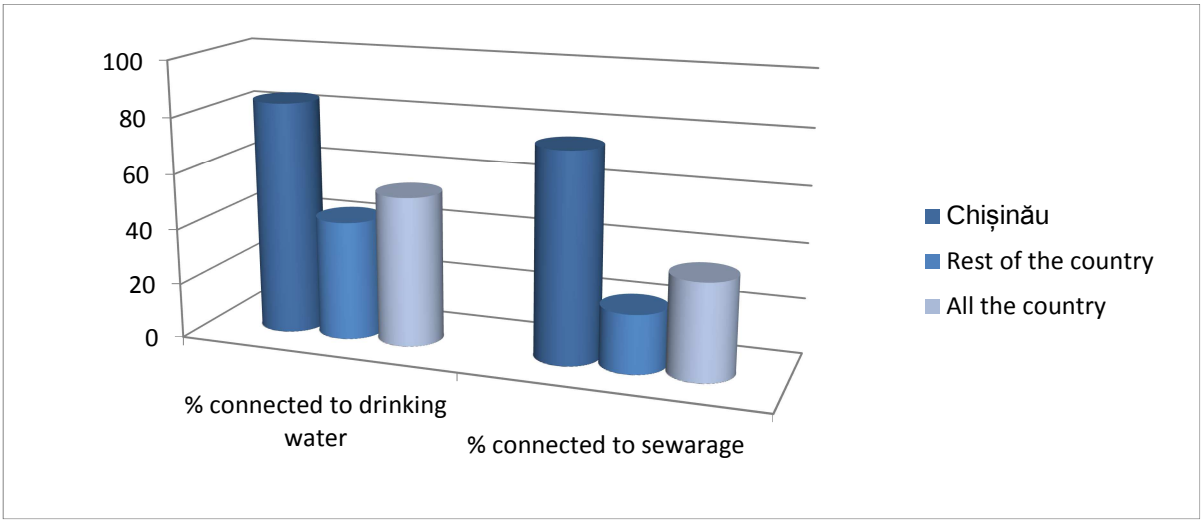
CHAPTER 3. EXISTING INFRASTRUCTURE IN WATER, SANITATION AND WASTE

3.1. Water and Sanitation

Half of Moldovan population, particularly in rural areas, does not have access to reliable sources of water supply and to an improved sanitation system. About 90 % of rural households do not have basic installations of water supply and sanitation in their homes.

Currently, the connection rate of the population to centralized water supply is about 43 %, excluding Chișinău. Of the total rural localities, centralized systems of drinking water supply and sanitation have 251 localities (17 %). The number of citizens with access to public sewerage services, in 2013, was 790,000 people, which represents 21 % of the total population, including 51.6 % in urban areas and only 1 % in rural areas. (Figure 2).

Figure 2. The Average Rate of Connection to the WSS in Moldova

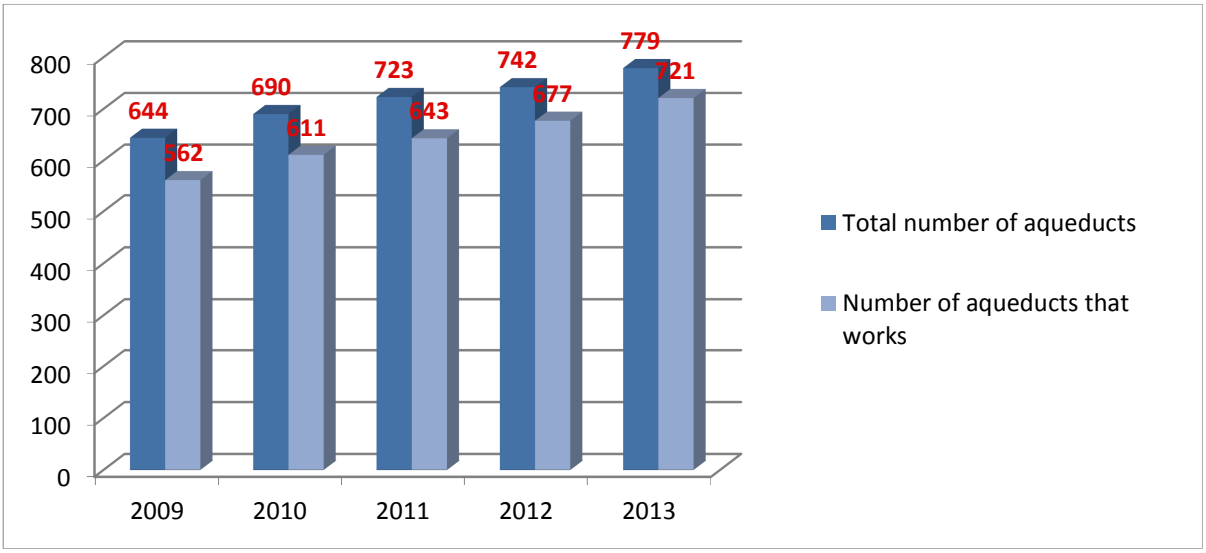


Source: elaborated by the author based on statistical data

As the figure shows, only about 80 % of the population is served with drinking water in Chișinău, while not even half of this percentage (or less than 40 %) in rural areas. It is even worse with sewerage with less than 20 % of the rural population being served in the countryside of Moldova.

In 2013, on the country's territory were placed 779 systems of water supply, of which 605 units are in public ownership, 171 in private, 3 in joint ownership. From the total amount of aqueducts, 721 were operational in 2013, which represent 92.5 %.

Figure 3. Water Supply Systems, 2009 to 2013



Source: elaborated by author based on "Drinking water and sanitation in 2013", www.statistica.md

On the other hand, in the same year (2013) from the total aqueducts, 156 were equipped with sanitation systems, of which only 108 had operated or with 2 units less than in 2012. During the year 2013 (January) was put into operation sanitation systems in Cimișlia, Orhei and Leova. Of the total sanitation systems, 120 are equipped with waste water treatment plants (Table 6).

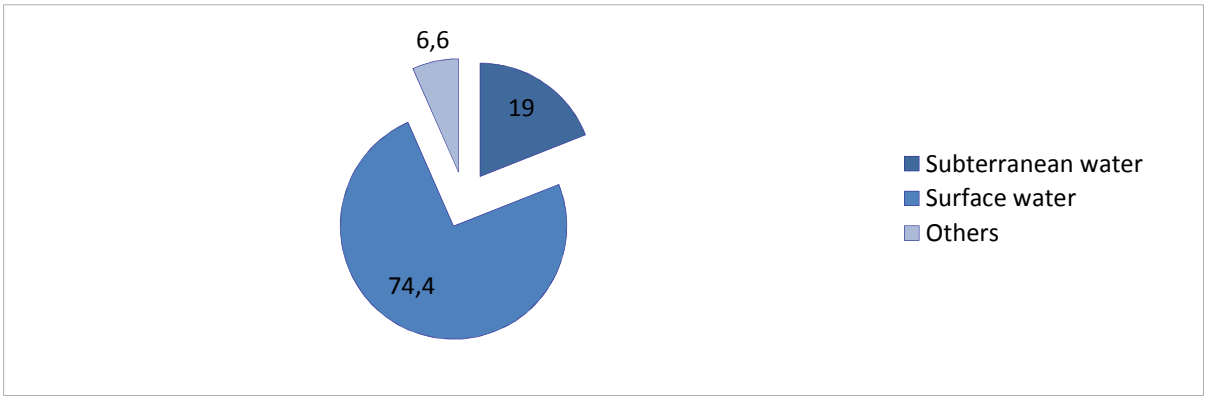
Table 6. Network Sanitation Systems, 2009 to 2013

	2009	2010	2011	2012	2013
Number of localities with sanitation system	135	134	135	130	125
Sanitation systems, units	172	169	167	158	156
with wastewater treatment plants	128	126	132	124	120
The total length of sanitation network, km	2548.5	2586.5	2592.1	2602.1	2633.4

Source: elaborated by the author based on statistical data

The volume of water captured was 116.7 mln m^3, including 74.4 % from surface sources, 19.0 % from groundwater sources and 6.6 % from other sources (Figure 4). Despite this situation the main source of drinking water supply in the Republic of Moldova is groundwater which is used by 70 % of the population, while 30 % are supplied with drinking water from surface water sources. Nistru River (at the border with Ukraine) covers 32 % of the needs and Prut River (at the border with Romania) covers 2.8 %. Nowadays, 1032 localities (66 % of the total number of villages and towns) have centralised water supply systems, including three municipalities, 52 towns (100 %) and 977 villages. The distribution network has a total length of 8,994 km, but 3,725 km are in an unsatisfactory situation, these causes 4.9 mishaps per km (2007). 226 pump stations out of 271 are in bad technical state.

Figure 4. The Volume of Water Abstracted by Source, 2013



Source: elaborated by the author based on "The activity of drinking water and sewerage in 2013", www.statistica.md

Therefore, Republic of Moldova faces critical issues related to water and sanitation which are emphasised by unsatisfactory technical condition of water supply systems and sewerage/wastewater treatment plant sand small percentage of the population with access to improved sanitation.

In Moldova there are accredited and non-accredited research laboratories. Accredited ones are at the Academy of Sciences of Moldova, the State Hydrometeorological Service, the State Ecological Inspectorate. These laboratories are testing samples as required by law.

Underling the existence of industrial treatment plants, definitely can be pinpoint that in Moldova there are industrial treatment plants, for example Boncom (Czech company described above) which installed stations at small businesses of sausage, milk, but most private companies do not comply with the legislation and are not equipped with pre-treatment stations that are otherwise required under legislation.

Currently, the treated sludge, which is initially dehydrated in geo-tubes is inhumed in ground at the treatment station in Chisinau. It is carried on based on the idea of dispersing the dewatered sludge on agricultural lands in Cahul, but this is just an experiment. However, for the spreading of sludge on agricultural lands is needed to remove all hazardous substances, this procedure is not followed at the moment, so this sludge can be toxic and devastating to agricultural soils.

Thus, at the moment in Moldova there don't exist sustainable practices of sludge management from the treatment of wastewater.

3.2. Water resources

Since the Republic of Moldova is located in South-East of Europe, there is temperate climate and relatively limited humidity.

The hydrographical network includes 3,621 rivers and streams (including seven water courses that exceed 100 km length and 247 exceeding 10 km length), 57 lakes with a total surface of 62.2 km^2 and about 3,000 ponds (Annex 1). The complete network of water courses exceeds 16,000 km. Republic of Moldova is mostly located between two large rivers: Nistru and Prut. River Nistru separates the Republic of Moldova from Ukraine. It has a basin which covers 57 % of the

Moldavian territory and an average annual discharge of 10 km^3. River Prut delimits Moldova from Romania having a catchment covering 24 % of country's territory and a yearly discharge of 2.4 km^3. The hydrographical characteristics of the main water courses are given in the Table 7.

Table 7. Hydrographical and Hydrologic Characteristics of the Main Water Courses

River	Length, km	Surface of hydrographical basin, km^2	Average annual discharge, million m^3	Average discharge, m^3/s
Nistru*	1,352 (657) **	721,000 (19,070)**	10,700	330
Prut *	976 (695) **	27,500 (7,990) **	2,906	92
Dunare *	2,857 (<1) **	817,000 (8,350)**	203,000	6,500
Raut	286	7,760	313	9.9
Bic	155	2,150	91.3	2.9
Botna	152	1,540	33.6	1.1
Ichel	101	814	20.5	0.7
Cubolta	100	947	61.0	1.6
Ialpug *	142 (135) **	3,180 (3,165)**	91.2	2.9
Cogilnic *	243 (125) **	3,910 (1,030)**	59.1	1.9
Cainari	113	835	46.8	1.4
Ciuhur	97	724	21.8	0.7
Cahul *	39	605	9.2	0.3

Source: Environment Information Centre from Moldova

* Transboundary waters
** The length and catchment area of the rivers within the political boundaries of the Republic of Moldova are given in brackets

The largest natural lakes are situated in the lower part of rivers Prut and Nistru. The largest water reservoirs are Costești-Stînca on river Prut (735 million m^3) and Dubăsari on river Nistru (490 million m^3). The hydrological characteristics of the main water courses and water bodies are given in the next table (Table 8).

Table 8. Hydrographic and Hydrologic Characteristics of the Main Water Bodies

Water body	River	Year of creation	Water volume, million m^3 (design)	Water surface, km^2
Badragii Vechi	Racovat, Prut	1989	4.9	1.0

Beleu (natural lake)	Prut		2.1	6.26
Ghidighici	Bic	1963	40.0	8.0
Dubasari	Nistru	1954	490.0	67.5
Cahul (natural lake) *	Danube		240.0	99.2
Caplani	Caplani	1983	8.3	1.5
Ceaga	Ceaga	1960	4.1	2.8
Cneazevca	Sarata	1967	2.8	1.0
Comrat	Ialpug	1957	4.0	1.7
Congaz	Ialpug	1961	9.9	4.9
Costesti	Botna	1962	3.3	1.8
Costesti-Stinca**	Prut	1976	735.0	59.0
Cuciurgan (natural lake) *	Cuciurgan-Nistru		88.0	27.3
Ialoveni	Isnovat	1978	21.7	4.4
Manta (natural lake)	Prut		1.5	2.3
Mingir	Lapusna	1982	12.2	2.6
Rezeni	Botna	1963	3.4	1.9
Sarata Noua	Sarata	1967	2.2	1.5
Taraclia	Ialpug	1988	62.0	15.1
Ulmu	Botna	1961	2.2	0.7
Zgurita	Cainari	1980	1.7	0.9
Volontiri 1	Bobei	1957	1.6	0.8
Volontiri 2	Bobei	1988	12.0	1.9

Source: Environment Information Centre from Moldova

* Cahul and Cuciurgan are international lakes (Ukraine).
** The Costesti - Stinca reservoir is operated jointly with Romania.

Based on *"Management of Intentional and Accidental Water Pollution"*, river water resources are classified by Gyula Dura in four categories: *natural resources*, generated by some specific climatic conditions of the territory; *real resources,* gathered from the entire river catchment, modified by the activity of humans; *ecological resources*, necessary to maintain the ecologic balance of rivers and *available resources*, which can be used for industrial, agricultural and household purposes.

The density of hydrographical network is on average 0.48 km per km^2. It varies from 0.84 km per km^2 in the North of the country to 0.12 km per km^2 in the South. The main feeding sources of rivers are rainfalls and snowmelt runoff. The hydrologic regime of the rivers considers the climatic conditions specific to Republic of Moldova. On average, the annual runoff from the territory of Republic of Moldova (internal resources) is 1.32 km^3 of water. In the North-Western areas, the average precipitation rate is 500 to 600 mm, decreasing progressively from 370 to 400 mm towards South-West.

Most of the precipitations during the year fall as rains and only 10 % as snow. The annual runoff in spring time of rivers is 40 to 50 %. In Nistru, 44 % of the annual runoff is passed during spring, 26 % in summer, 16 % in autumn and 14 % during winter. The seasonal distribution of runoff for Prut river is: 39 %: 34 %: 12 %: 15 %, respectively.

3.3. Sources and pollution level

The Moldovan National Environmental Action Plan (NEAP) calculated the social and economic impact of water pollution. The conclusion which was reached stated that the polluted drinking water (rural and urban) leads to between 950 and 1,850 premature deaths annually as well as between two to four million days of illness annually. The monetary cost to the economy was assessed to be in the range of 5 % to 10 % of GDP (Gross Domestic Product).

In Moldova, nearly two million of people (50 % of the population) use daily polluted water. This situation is because of the limited coverage of water supply systems in rural regions, since in 80 % of the wells used by the rural population water quality is below the standards.

On the other hand, both number and impact of pollution sources of the natural waters in the Republic of Moldova diminished, comparing to the 1980s and the early 1990s. However, the main sources of pollution remained the same: municipal waste water treatment plants; livestock rising; agriculture; population with no sewerage, runoff waters from residential areas and industrial sites, communal waste sites. Water sources have become more polluted, ill-maintained water treatment plants are no longer able to meet water quality standards and most wastewater treatment plants operate de facto with mechanical treatment only. A particular major transboundary pollution source is the hydropower station at Novodnestrovsk (Ukraine), which caused severe changes of the temperature regime of the Nistru river within Moldova and, in consequence, heavily impacted the natural river ecosystems.

Only some of the point sources of pollution, mentioned above, are monitored (mainly waste water treatment plants).

The status of infrastructure in water supply and sanitation is eminently obsolete. Installations of water supply and sewerage are used under capacity with about 25 to 30 %; at the same time, significant water losses are caused by wear and tear of equipment and bad maintenance. The total amount of water used by consumers is 800 million cubic meters per year, from which 120 million cubic meters are used by households.

Domestic consumption constitutes the main component of demand in all sizes of towns. Industrial consumption of water has decreased meaningfully over the last twenty years. This is partly due to the adaptation to the post-soviet economic situation, but also partially due to the very high tariffs applied to industrial consumers. The level of cross subsidization is not sustainable to industry, and will tend to demoralize some of the sector's best customers. Industrial tariffs are, nowadays, about five times higher than domestic tariffs in the weighted national average.

The decrease in total consumption of water is conditioned also by increasing cost of communal services. Some regions of Moldova do not have local water sources because of the uneven distribution of water resources on the territory of the state, groundwater is significantly polluted.

In the larger towns (Chișinău, Ungheni, Cahul, Bălți) water supply is regular and generally of good quality. On the other hand, they tend to be provided from surface water sources, which need full treatment including coagulation, settlement, filtration and disinfection. Currently, these towns are

all supplied with infrastructure for full treatment and disinfection with more than suitable capacity to meet the current demands. This infrastructure, especially the mechanical and electrical parts, is almost all in poor condition. Without rehabilitation these plants will quickly discontinue to be operational. Additionally, rehabilitation is complicated by the excess capacity of most of the plants, and by the need to only rehabilitate the capacity that will be utilized within the planning horizon.

Nearly, all the smaller towns are supplied by groundwater sources. Many of these sources do not need other treatment than disinfection as a precautionary measure against possible contamination. However, there are regions within Republic of Moldova that suffer from high levels of fluoride, nitrates, etc., and water treatment is required according to the level of concentration and nature of particular substance. It is estimated that about 10 % of groundwater water supply systems require such treatment, but currently no efficient treatment is provided for any of these settlements. Towns between 25,000 and 50,000 inhabitants are regularly disconnected for 4 to 8 hours partly due to energy supply problems. Disconnection and lack of pressure in the network adversely impacts water quality.

Wastewater collected is generally led to wastewater treatment plants designed for mechanical and biological treatment. Anyway, as a result of a combination of inadequate maintenance, power cuts, strong reductions in water inflow to treatment plants and limited financial resources for operation, most wastewater treatment plants designed for mechanical and biological treatment operate de facto with mechanical treatment only.

The target assumes that the plants will come to operate according to the designed technologies, i.e. plants that were designed for mechanical and biological treatment also will come to perform both treatments. In consequence, the drinking water quality will improve to design levels as a result of the implicit assumption that the plants purchase and use the chemicals needed. However, as a case for networks, the average age of plants is assumed to be unchanged. Thus service levels may be less than for new plants of the same type.

The table 9 represents the existing infrastructure of water supply and sanitation service.

Table 9. Infrastructure of Water Supply and Sanitation Service

Indicator	unit	2006	2007	2008	2009	2010	2011	2012
% Coverage of water services	%	*82*	*80*	*80*	*80*	*80*	*83*	*84*
% Coverage of sanitation services	%	*65*	*63*	*64*	*65*	*67*	*69*	*70*
Rate - water supply	MDL	*4.62*	*5.06*	*5.98*	*6.66*	*8.6*	*8.8*	*9.2*
Cost of 1 m^3 of water sold	MDL	*5.13*	*6.55*	*7.09*	*7.15*	*7.89*	*8.40*	*8.70*
Rate - sewer	MDL	*2.07*	*2.81*	*2.87*	*2.82*	*4.23*	*4.3*	*4.5*
Cost of services 1 m^3 designated and treated wastewater	MDL	*2.7*	*3.26*	*3.22*	*3.32*	*5.14*	*5.60*	*5.80*

The average annual net sales by 1 worker	Mil. MDL	*77.6*	*100.8*	*132.4*	*139.6*	*168.1*	*173.8*	*178.3*
% Fixed assets depreciation	%	*47.8*	*44.9*	*47.0*	*48.3*	*48.5*	*49.6*	*49.1*
The number of employees, total	people	*5,547*	*5,475*	*5,430*	*5,326*	*5,318*	*5,248*	*5,318*
The share of wage bill costs	%	*26.1*	*23.7*	*24.6*	*26.1*	*26.2*	*25.5*	*25.6*

Source: Association Moldova Apă-Canal (AMAC)

At the same time, should be added that this infrastructure does not operate properly. From the data in table 9, follows that the percentage of consumers covering water and sanitation services is rising. Among the positive trends should be also noted the annual increase in average net sales per employee. Among the negative trends, can be observed the rising cost of water supply and sanitation, accompanied by an increase in average tariff services. As evidence of the deterioration of the fixed assets, there is a tendency to an increase in depreciation.

Insufficient introduction of efficient technologies and equipment in water and sanitation sector show no tendency to reduce the specific cost share of electricity (KWh/m^3) per unit (eg. pumping) in the water sector of Moldova, as well as pumping and wastewater treatment and unbilled cost of water (non revenue water-NRW).

Urban regions have a high level of water and sanitation coverage while rural areas have a low level of water and sanitation.

As a result of lack of maintenance and reinvestment, the systems have continued to deteriorate to the extent that the level of pipe breaks and losses are excessive, and the reliability of the supplies is unacceptable. Pipe break frequency, analysed for nine years (2000 to 2008), by size of settlement provides some interesting comments:

- The break frequency in Western Europe is below 0.2 breaks per km per year. The average rate of pipe breaks in Republic of Moldova is 40 times more than in Western Europe.
- There is a worrying trend of increasing breaks of approximately 5 % increase per year.
- Chișinău and Bălți having older networks are significantly worse than the medium and smaller sized networks, which are generally newer.
- Bălți (in 2005) had the highest frequency of breaks, indicating mainly poor conditions.

This very high level of pipe breaks provides an important indication of the poor condition of the networks, and the urgency to start reinvestments into the systems to stop further deterioration and through rehabilitation to improve service levels.

In Republic of Moldova, about 85 % of the waste waters are not being purified. This is particularly due to the inefficient functioning of waste water treatment plants. The quantity of pollutants in waste water had increased and the maximum concentration permitted is over the allowed limit by the environmental authorities. Insufficiently purified waste water volume evacuated into the water bodies increased during this period from 8.2 million m^3 to 13.3 million m^3, including waters without any purification from 0.5 million m^3 up to 0.76 million m^3.

Waste water treatment plants play one of the most important roles in water resources protection. Efficiency of the plants in operation is supervised by environmental laboratories. Meanwhile, 129 sanitation systems were equipped with waste water treatment plants.

Currently, waste water treatment plants built in the 90-ties of the 20th century (usually of large capacity) are destroyed or have a high degree of wear. Most of the biological waste water treatment plants work at a very low capacity, it requires reconstruction. Several factors have led to this situation:

a. Essential reduction of volumes of waste water treatment plants;
b. Transmission of the systems into the management of the local public administration authorities, which do not have experience and professional development needed.

3.4. Waste

Annually, through urban sanitation services around 1,144 to 2,303 thousand m^3 of municipal solid waste are transported to waste sites/landfills. There is no statistical evidence for the volume of accumulated waste, only some estimation on the total volume of municipal solid waste accumulated in landfills which are approximately 30 to 35 million tons. Although only 10 % of municipal solid waste landfills are authorized, they do not meet the environmental requirements.

The national institutional framework of the Republic of Moldova which creates a regulation system in the waste field consists of: the Parliament of the Republic of Moldova, the Government, the Ministry of Environment, the State Ecological Inspectorate, the Ministry of Regional Development and Constructions, the Ministry of Health and other entities.

The most recent policy that had been developed is the *"National Waste Management Strategy of the Republic of Moldova (2013 to 2027)"* which aims to improve the infrastructure and develop the legal framework in order to support the national waste management.

The Central Body of the Ministry of Environment has 51 units, five departments and five services. There are 7 departments subordinated to the Ministry with regulatory, policy implementation and control functions: State Ecological Inspectorate, Agency for Geology and Mineral Resources, State Agency „Waters of Moldova", National Agency for Regulation of Nuclear and Radiological Activities, State Hydrometeorological Service, Fisheries Service, State Enterprise „Hydrogeological Expedition of Moldova".

Besides, the Ministry of Environment, also coordinates the activity of seven offices and three units for implementation: „Carbon Finance" Office, „Climate Change" Office, „Sustainable Persistent Organic Pollutants Management" Office, „Ozone" Office, „Biodiversity" Office, „Biosafety" Office, „Environmental Pollution Prevention" Office, Water Supply and Sanitation Project Implementation Unit and the Enhanced Environmental Project Implementation Unit.

In terms of legislation, there are 35 legal acts and a lot of Government Decisions that regulate waste management. Moreover, some of them were adjusted, partially, to the provisions of the European Union environmental legislation. The development of legislative/normative framework started with the adoption of the Law on Environmental Protection, no. 1515-XII of 16 June 1993. Currently, environmental protection is covered by about 30 laws and a set of regulations, developed under the framework of the above mentioned organic law.

But, despite this situation the legal framework is far from being satisfactory, since it requires the creation of an integrated system of regulation. The system should cover the field of selective collection for recycling, recovery, waste disposal and storage. The existence of the legislative and regulatory documents that cover, virtually, all environmental sectors, do not fully comply with the international environmental treaties adopted by Moldova and do not ensure proper management.

Currently, the environmental policy framework is in a development process and includes several policy papers that reflect objectives and actions in various domains such as waste and chemicals management, pollution prevention, water supply and sanitation, forestry, biodiversity conservation, desertification etc. However, most of these documents contain old concepts that have to be updated, whereas for the certain environmental components and aspects (air, soil and useful mineral resources protection) it is necessary to elaborate other proper policy documents.

However, despite the national institutional and legal framework, Republic of Moldova encounters a lot of challenges. Waste management is far from being satisfactory and remains a difficult issue in terms of organization.

Now, the operational revenue for waste management system is a combination of budget allocations and tariffs, but they cannot cover all the expenses. Budget allocations come from local budgets and ranges from 5 % to 20 % of its value.

The fees for waste collection and disposal/dumping are determined by municipal councils. The standard is for households living in apartment blocks to pay a fixed fee per person per month. Households living in individual houses in some towns (e.g. Chișinău) have to pay a fee per m^3 of waste. The use of a volumetric fee (per m^3) is more frequent in the case of municipal waste from commerce, industry and other sources. Available data suggest that the current waste fees are quite low across the country, ranging from some 7 MDL (0.20 €) to 12 MDL (0.75 €) per person per month for private households. Discounts may be offered for pensioners and for children up to a certain age. In Chișinău, the standard fee is nine MDL (0.48 €) per month for persons living in apartment blocks. Persons living in individual houses pay 46 MDL (2.95 €) per m^3. Fees for enterprises are within a range of 40 MDL (2.60 €) to 114 MDL (7.30 €) per month across the towns. Volumetric fees range from 69 MDL (4.40 €) to 150 MDL (9.65 €).

In particular, for Moldova a big problem is the chaotic location of the waste. The current situation in waste management is characterized by lack of equipment for the waste collection, waste disposal without any pre-treatment, waste dumps etc.

Also, a key area to concern is most waste dumps which exist without any Public Authority permit, being considered illegal. Therefore, the collection of solid waste in the Republic of Moldova is done without selection and requirements of waste storage are not respected which negatively influence the environment of the country.

The responsibility for the waste management activities in the Republic of Moldova is on local governments which are responsible for the organization of waste collection and disposal. The special waste collection and disposal services are set up in municipalities, in all the district centres, therefore the municipal waste management is organized with the support of these services that work under a contract concluded with individual generators. However, this system covers only 60 to 90 % of the generators of municipal waste from the urban areas.

The current waste management practice relies on disposal in dumpsites. These are, in the majority of cases, small, uncontrolled and operating without an environmental permit. Only 12

national level permits have been issued for disposal sites in the Republic of Moldova. The remaining 1,864 disposal sites are operating on a land allocation decision issued by the local council.

The landfill at Țînțăreni was developed according to the Master Plan for Construction of Solid Waste Landfills prepared by the State Institute of Design (IPROCOM). The landfill was put into operation in 1991 and ceased operation in 2010 by the decision of Chișinău Municipal Council. The reason for cancelling the operation was the end of its lifespan, defined by IPROCOM as being 20 years. However, the full capacity of the site was not reached, of the designed 44.2 million m^3 only 19 million m^3 were used. The designed waste generation rate was overestimated and the Țînțăreni landfill has the potential to receive waste from Chișinău for another 20 years. Due to the closure of Țînțăreni landfill, "I.M. Regia Autosalubritate" does not have any other option than dumping waste in a temporary location in the vicinity of the waste transfer station, without any measures to control potential pollution.

Typically, each district has one larger disposal site, which serves the district administrative centre, and a number of smaller/rural dumpsites serving one or more villages. Based on the dumpsite inventory done by the Regional Development Agency South, there are approximately 20 to 25 rural dumpsites per district that operate because of the decision of local authorities and, additionally, more than 100 illegal dumpsites per district. In most cases, the licensing procedure is formal and the majority of approved dumpsites do not follow the requirements for construction, environmental protection and human health.

On the other hand, the problem of waste disposal is very important for rural localities, too. Waste collection covers the urban population at 75 % and 1.8 % of the rural population, which is a serious problem regarding the living conditions of the population. Most Moldovan villages are poor, with difficult access to public services, including waste collection and storage. Householders in most of cases throw the waste on the unauthorized waste sites, into rivers, lakes or streams. This fact conducts to pollution of waters and creates ecological problems.

Though, some positive results are gathered. For 2013 to 2015, the Ministry of Finance has identified a total budget of about 225,755 million MDL (about 13 million €) for waste management activities, of which about four million (ca. 0.25 million € or 1.7 % of the total) will be raised from external sources and the rest (98.3 %) from the National Environmental Fund.

In Chișinău, the local waste company ("I. M. Regia Autosalubritate") charges enterprises 75 MDL (4.50 €) per m^3. Revenues appear, in many cases, sufficient to cover operating costs, but this reflects the overall low waste management standards, notably the absence of proper landfills. In Chișinău, waste collection fees have not been modified since 2008, and the waste operator is now only barely able to cover basic operating costs.

The company "I.M. Regia Autosalubritate" provides waste collection and disposal services to Chișinău. The municipally owned company employs 350 people and operates a fleet of collection vehicles, and a transfer station and landfill at Țînțăreni. The company is modernizing the collection fleet. In addition, containers of a Russian type (0.75 m^3) are being replaced by standard Eurocontainers (1.1 m^3).

There are still some attempts to improve this situation resulting in a contractual relationship between the private sector "AVE Ungheni" and the public one, in Strășeni city. But unfortunately, after many petitions from residents and violation of contract obligations, services were stopped.

CHAPTER 4. DEVELOPMENT OF INFRASTRUCTURE STRATEGY FOR MOLDOVA

Moldova is a transition and a developing country. Its transition means that the country adapts to the new conditions of free market, parliamentary democracy and open society, after decades of planning economy and belonging to the Eastern Block of Soviet Union. Moldova is a relatively modest country regarding public infrastructure and economic development. Respectively, following we observe the policy and the dynamics in the development strategy of the country.

The National Water Supply and Sanitation Strategy is a new sector policy document, adopted by the Government on 20th March, 2014. The strategy aims to address key challenges faced by the sector, including its governance framework and information support. Its main goal is to ensure the access to safe drinking water and suitable sanitation in all the settlements and for all Moldova's citizens.

The Strategy sets specific targets for the first five years and until 2028. More exactly, by 2018:

- Water supply: extend the network (+1,400 km), connect 62,000 new users, rehabilitate and put into operation 42 WTPs, etc.
- Sanitation: extend the network (+511 km), connect 101,000 new users, rehabilitate and put into operation 49 WWTPs, etc.

The estimation of the capital investment for implementing the National Water Supply and Sanitation Strategy, based on a real scenario, shows that during 2014 to 2028 are needed a total amount of 705 million € of which 194 million € should be invested in the first five years (2014 to 2018).

The aims of the strategy will be achieved through decentralisation and regionalisation. Also by improving access to water supply and sanitation services and promotion of market economy principles and private sector implication (including public-private partnerships). Other interventions which will be prioritised are: meliorating the legal and regulatory framework and governance system (including human capacity building), improving planning and selection of the most reliable and cost-efficient technical solutions and tariff policy, increasing the sector financing (from 1 % to 1.2 % of the consolidated budget expenditure plus the donors' contributions, taking into account service affordability for the population.

Additionally, the Strategy promotes environmental protection of water resources and its sustainable development by harmonising the national legal framework with the EU Acquis, specifically noting the Drinking Water Directive (DWD) 98/83/EC and the Urban Wastewater Treatment Directive (UWWTD) 91/271/EEC.

The National Water Supply and Sanitation Strategy suggests a new authority which will be responsible for regulating the water supply and sanitation sector- the National Agency for Energy Regulation (ANRE). The Agency will work out a new methodology of determining tariffs and will be responsible for authorizing operators based on performance indicators. Even if the law on the public service of WSS was approved recently (in force on 14th September 2014), a period of transition is planned for the years 2014 to 2016 with a view to promote secondary legislation on a license issuing system, the tariff policy national performance indicators, etc. This time of transition represents a certain level of incertitude in the regulatory framework if the working out and approving of the secondary legislation is belated. An essential aspect in the regional development of the WSS services provided by the new Strategy is the Inter Municipal Co-operation (IMC). It is

reflected in a mandatory provision of a joint service providing agreement concluded between the beneficiary communities and the WSS operator to be met before the investment projects in the infrastructure.

According to Moldova's commitment to implement modern sanitation solutions (such as: constructed wetlands, EcoSan toilets etc.) stated in the Protocol Water and Health, the National Water Supply and Sanitation Strategy encourages implementation of such technologies.

The Protocol on Water and Health is a document which has as a main goal to protect the human health by improving water management. Republic of Moldova became part of this Protocol on 16th of December, 2005. The main tasks of the Protocol are to assure supply with safe drinking water and adequate sanitation for all Moldovan citizens. As a matter of fact, these tasks are partially covered by institutional and legal framework.

The National Regional Development Strategy (2013 to 2015) identifies the WSS sector as a priority area for further development and establishes responsibilities for regional WSS sector planning to the Ministry of Regional Development and Construction and other local public authorities included in coordination group, while the main institution responsible for the WSS planning at the national level is the Ministry of Environment.

Despite of those comprehensive regulatory and political agreements, most of the papers seem to be declaratory, since very few WWTPs are really planned and built.

Nevertheless, as an outcome of the workshop held in Chisinau on 22nd of January 2015, has been concluded that that the most frequently seen model is at the end the direct public management by public utilities (e. g. municipalities or associations of municipalities or public enterprises) and partly by publicly owned companies. That is why sooner or later, the above named institution will have to cope with the National Strategies in the way that at the moment, they will become plans coming into reality and not remaining on the paper.

CHAPTER 5. STATUS OF THE PLANNING OF NEW WWTPS OR THEIR RENOVATION / REPARATION

In 2014, most of the 304 treatment plants in Moldova are outdated. All of them are oversized, since many industries went bankrupt after Soviet Union collapsed, and the water consumption were reduced. Also, during Soviet times many of the waste water treatment plants were built in order to be extended at one point, but were never happened. Other ones are outdated thanks to a lacking reinvestment and their obsolete technology.

In this situation, all towns and most of the larger villages are interested in a new investment. Since there is a lack of fiscal power of the villages and towns, the majority of the decision-makers accept donor organisations and promotion agencies to finance feasibility studies for the planning of new treatment of wastewater. Unfortunately, most of such studies are done with a particular interest. Unlikely to the philosophy of a decision-making of towns and counties that is independent from political or commercial influence, feasibility studies are done for different reasons.

Anyways, the most needed investment refers to the 32 rayon centres of Moldova, from which only three have set-up a new treatment plant and only four have rehabilitated the outdated plant. Currently, Orhei, Cimișlia, Nisporeni, Ocnița, Șoldănești have installed new wastewater treatment technologies while Leova, Bălți, Ialoveni had rehabilitated the outdated ones.

The environmental financing strategy focuses on municipal water services. Water services include both water supply and sanitation. "Municipal" has been defined to cover all agglomerations with more than 1,500 inhabitants. Thus 80% of the population is covered by the strategy. The consultants have assessed the replacement value of water supply and sanitation systems, as they must be built in Moldova, to be approximately 705 million €. The average age of the water systems is 25 to 30 years. The water sector suffers from years of under-investment and lack of funds for systematic maintenance. This has resulted in significant, but unplanned disinvestments.

For towns larger than 25,000 inhabitants, almost all wastewater is collected. For smaller towns, wastewater is typically only collected from the core of the town. The wastewater collected is generally led to wastewater treatment plants designed for mechanical and biological treatment. However, as a result of a combination of inadequate maintenance, power cuts, strong reductions in water inflow to treatment plants and limited financial resources for operation, most wastewater treatment plants designed for mechanical and biological treatment operate de facto with mechanical treatment only.

In this context, key factor in the wastewater treatment plant management is the maintenance program. If this responsibility focuses on the most urgent maintenance needs this will yield relatively large service improvements in the first years. This reflects the observation made above, that disinvestment has taken place in an ad hoc fashion exacerbating the service implications. However, feasibility level studies would be required to assess precisely the service improvements obtainable from adequate maintenance and from making adequate resources available for operations (chemicals, power etc.).

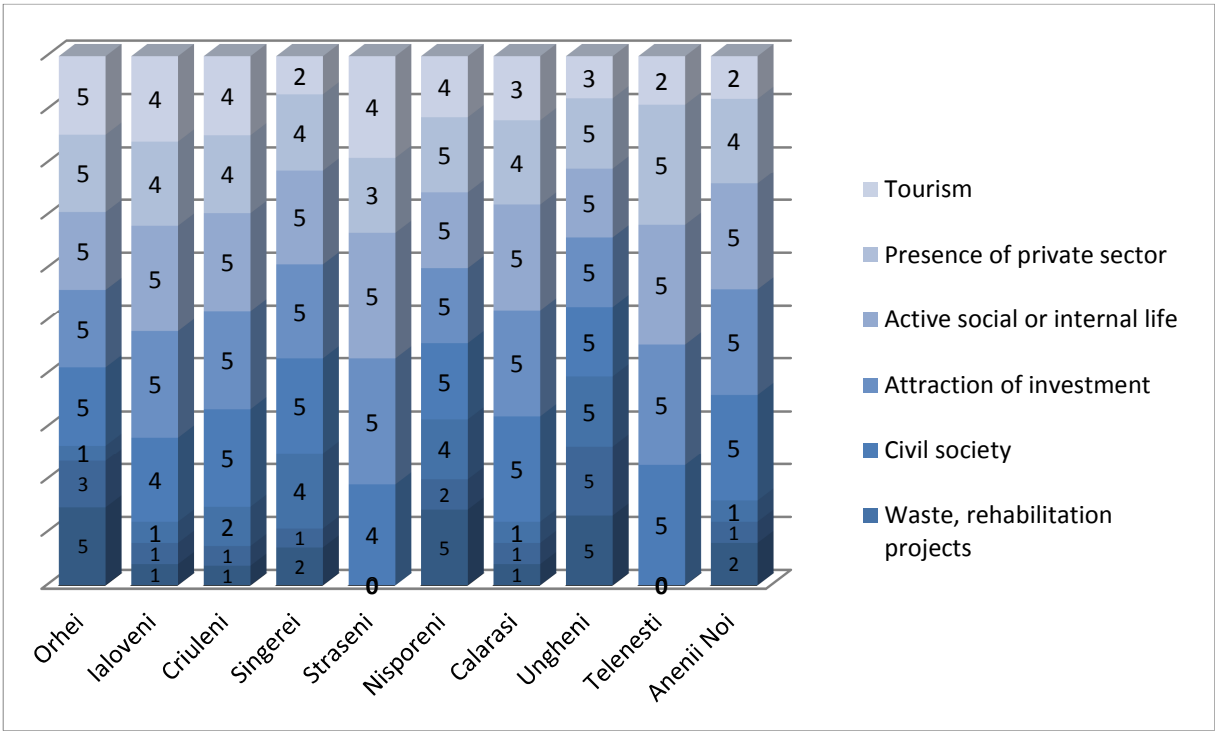
Furthermore it is assumed that in the long run other sectors, in particular the power sector, will deliver the services for which it was designed. For example, it is assumed that in the long run, there will be regular power supply to those villages (and water treatment plants) that are covered by the current distribution network. In many villages and small towns this will imply a substantial increase in the service level.

Table 10. Degree of financially sustainable infrastructure projects

Nr.	Town	PUG	Water supply projects	Sewerage projects	Waste, rehabilitation projects	Civil society/ Participation of population	Attraction of investment	Active social or internal life	Presence of private sector	Tourism
1.	Orhei		5	3	1	5	5	5	5	5
2.	Ialoveni		1	1	1	4	5	5	4	4
3.	Criuleni		1	1	2	5	5	5	4	4
4.	Singerei		2	1	4	5	5	5	4	2
5.	Straseni		-	-	-	4	5	5	3	4
6.	Nisporeni		5	2	4	5	5	5	5	4
7.	Calarasi		1	1	1	5	5	5	4	3
8.	Ungheni		5	5	5	5	5	5	5	3
9.	Telenesti		-	-	-	5	5	5	5	2
10.	Anenii Noi		2	1	1	5	5	5	4	2

The table 10 includes numbers from 1 to 5 (1 for very bad and 5 for excellent) to indicate increasing levels of household utility assessment and society study of the district centers in Moldova.

Figure 5. Degree of financially sustainable infrastructure projects



Source: elaborated by the author

The target of "maintaining the existing situation" has been interpreted to imply that a share of infrastructure equivalent of 1/n, where n is average lifetime, is replaced every year. In other words asset value is held constantly (assuming linear depreciation). Furthermore, it is assumed that this also involves a return to a practice of operation, which is consistent with the design criteria. In other words a return to "normal" or design use of power, chemicals, spare parts etc. has been assumed.

The total expenditure hereof was calculated at 31 million € per year (fixed 1999 prices). Of this, 17 million € cover maintenance expenditure. 14 million € cover the necessary operating expenditure.

The current total revenues to water utilities in Moldova were approximately 14 million € in 1999. In other words, current revenues were "just" enough to cover operating costs (on average). In reality, current revenues exceeded operating costs in Chișinău (which therefore had revenues for some maintenance) while it was insufficient to cover operating costs in some water utilities outside Chișinău.

This means that until revenues can be increased from the current 14 million € (1999 prices) to the level of expenditure for operations and maintenance there will be continued deterioration of infrastructure and service levels as a result of an increasing maintenance backlog.

The service level provided by water and sanitation system is determined by its design, the asset value of the system and how it is operated. As a given system grows older, repairs and replacements must take place in order to maintain designed service levels. If repairs and replacements do not take place, the service level will fall. Initially the fall in the service level will not be strongly felt by the consumer and may be partly offset through "creative" operation of the system. However, eventually service levels will fall until one day the system is no longer operational. The change in the asset value of the system is used as an indication of whether the system is being "sufficiently" repaired / maintained.

Certain initiatives are carried out at the local level in Moldova to improve water and sanitation infrastructure.

During the workshop held in Chisinau on 22nd of January was also discussed on crucial variable of the entire cycle of calculus of WWTP planning and implementation, and this was the affordability of the citizen.

Affordability constraints have a high impact on water consumption and this further determines the applicability of the proposed business models.

The disposable income per person and per family 17 shows that in urban areas in Moldova, some 33.9% of population has to limit water consumption due to affordability constraints, while in rural areas, consumption below even 45 litres per person per day would be a problem for 73.5% of population.

This leads to the following conclusions:

- In rural areas, even if a system (piped water supply, wastewater services) is built, a cost recovery tariff will be a problem for the majority of the population; the population will cope, among others, by lowering water consumption;

- Low water consumption affects the unit costs of service provision;

- Low water consumption leads to technological problems, especially for centralized wastewater systems: blockages will occur in the sewage network, while the WWTP will not be fully operational if the unused capacity is high.

Thus, centralized wastewater collection and treatment could be used in urban areas only with extension to sub-urban areas where the marginal costs of services for rural areas are not very high.

Table 11. Infrastructure Planning for Main Counties

City	Treatment plant	Collected information	Planning and feasibility	Contact Person
Anenii Noi	not operational waste water treatment plant	the actual waste water treatment plant is practical not operational, the level of depreciation is at 90 %.	technology-conventional. Waste disposal-Tintareni, sorting factory.	Mr. Mihai Cheibas
Nisporeni	new waste water treatment plant	the project had a financial contribution: Czech Embassy of RM-1 million €, the District Council and City Hall- 69 thousands € and the Government through the Ministry of Environment – 85 thousands €.	technology-open. The landfill is new up to 500 m from the treatment plant. 0.91 million € for building the waste polygon outside the city. Water protection-Prut Nisporeni project. Financial contribution to this project: Embassy of Austria with 3.5 million €, EU 5 million € and Swiss 800,000. €	Mr. Gangan
Ialoveni	rehabilitation of the treatment plant	the project is stopped. At the moment Ialoveni sewerage system is connected to APĂ-CANAL Chișinău.	technology-conventional. Waste disposal- sorting factory. No scheduled and financed water protection project.	Mr. Popescu
Cimislia	new waste water treatment plant	sewerage system-technical project is already developed. Industrial Park-necessary to perform works for water supply and sewerage system. At the pumping station were bought collectors and installed by Boncom. Is planned that GIZ allocate 1 million € for polygon construction.	technology-conventional. The chicken factory near the city is interested in construction of biogas stations. The farm has 250 birds and collect droppings 40 – 50 t per day. There is scheduled a water protection project. Strategic priorities- change of landfill location	Mr. Răileanu

City	Treatment plant	Collected information	Planning and feasibility	Contact Person
Calarasi		there are approximately 67 km of aqueduct of which 85 % in poor, old condition, that need to be rebuilt. Emergency is rehabilitating water supply network, namely 18 km, the tubes having a diameter of 350 110 and 57 mm.	the water supply- requires modernisation and efficient management. Water is extracted from 12 artesian wells accumulated in reservoirs, treated with chlorine. The water is not in line with requirements for drinking water. There are 6,000 consumers who have individual meters water, but they are very old. There is a memorandum signed between Calarasi, Straseni District Councils and Agency "Apele Moldovei" in order to extend the water supply system from Chisinau municipality. But there is no financing for this large scale project. The sewerage system- poorly developed, currently used 47 km of sewerage network. Existing sewerage network is connected to the treatment plant in the city, which is newly built with a capacity of 1,400m^3/day. Price for 1 m^3 of water is 1.31 € (including sewerage). These services are managed by the Calarasi Municipal Household Utility.	
Ungheni	Rehabilitation of waste water treatment plant	the project is in phase of contracting of the feasibility study.	will be analysed the feasibility of "Duplex" concept which involve treatment of municipal waste waters and organic fraction from municipal solid waste.	Mr. Ambros
Soroca	Construction of waste water treatment plant	Lack of treatment plant. The project is in phase of contracting of the feasibility study.	technology-conventional. Waste disposal- rehabilitated landfill with a sorting factory. There is scheduled a water protection project.	Mr. Sau
Balti	Rehabilitation of waste water treatment plant	there is public-private partnership agreement between local public authority and a private company "Gloring Engineering" SRL. At this moment were rehabilitated just few components parts of waste water treatment plant.	technology is mechanical-biological. There is available public land for implementation of constructed wetlands technology. This technology could replace existing biological treatment phase which is highly damaged and has a high energy consumption of 250 kW/h.	Mr. Dinga

City	Treatment plant	Collected information	Planning and feasibility	Contact Person
Chișinău	Rehabilitation of waste water treatment plant	Actually is the phase of contracting of the feasibility study. Project financed by EBRD. The overall investment of rehabilitation of waste water treatment plant is estimated at 60 to 70 Mln € .	The project will analyse the production of bio-gas from fermentation reactors. Actually, Chișinău WWTP treat about 130,000 m^3 per day.	Mr. Grozavu
Strășeni	planned waste water treatment plant	Lack of treatment plant. Before the waste water was pumped to waste water treatment plant "Apă-Canal" Chișinău. The system was broken in 2006. Currently, all the wastewater flows in the basin of Bîc river.	Elaboration of feasibility study. Technology-DUPLEX	Mrs. Casian
Rîșcani	Planned treatment plant	Only 1,000 households are connected to sewerage system. Amount of Wastewater: 1,500 – 2,000 m^3/d. The fees paid by natural persons-0.64 € / m^3 of wastewater; 0.64 € / m^3 of fresh water. Institutions pay higher fees-around 3.20 € / m^3.	Will be analysed the DUPLEX technology. No sorting of the waste at the moment. Landfill is located 1km outside the town.	Mr. Parea

Source: elaborated by the author

In conclusion, the Moldovan towns need to solve the waste water treatment issues based on the available implication of industrial actors or donor organisations due to the lack of local public finance.

CHAPTER 6. COMPETITION OF TECHNOLOGIES AND PROVIDERS. DONOR ORGANISATIONS AND COMMUNAL SELF-FINANCE

According to official statistics, financing of environmental expenditure today constitutes 0.8 % of GDP, most of which is for wastewater treatment. In addition hereto, 2.0 % of GDP is spent on water supply. The sources of these expenditures are:

- **User charges for operations** (approximately MDL 265 million per year).
- **Public budget funds** for capital repairs hitherto approx. MDL 15 million per year. Due to the Chișinău water and wastewater improvement project, where the state has to provide a grant of about 50 % of the total investment, the public budget contribution will be as high as MDL 50 million annually in 2012 to 2014
- **Foreign grant financing** (MDL 33 million per year).

The level of user charges (average) is equivalent to 3.5 % of average household incomes. However, reflecting a 65 % collection rate, households' payments are on average equivalent to 2.3 % of average household incomes. There is considerable room for increasing user payments primarily through increased collection rates.

However, two issues need to be noted. First, the affordability is much better in Chișinău than in other parts of the country. This needs to be reflected in differences in user charges and service levels. Secondly, all water utilities have a tariff structure which implies heavy cross subsidisation of households by industry and budget organisations of the state. For example, in Bălți, the tariff for industry and budget organisations is ten times of the household tariff. The heavy cross subsidisation gives increase of problems in collecting cash revenues from industries and budget organisations and this issue needs to be addressed politically.

Two major loans have recently been channelled to the sector. These loans have increased the supply of finance with a total of approx. 32 million € over a five-year period. An EBRD (European Bank for Reconstruction and Development) loan (18.37 million €) has mainly been channelled to the rehabilitation of water supply and wastewater in Chișinău. In addition, there is a limited component of "green-field" investments in the wastewater treatment. Rehabilitation, and partly "green-field" investments in extension of water supply in small towns and villages are still very rate in the southern part of the country. The so-called baseline supply of finance includes only committed finance. With regard to the future supply of international grants and loans, this is dealt with below under "policy options to increase the supply of finance". There are few decisions taken without involving the donor policies since the grants are so important for the investments in public infrastructure, nowadays, in Moldova.

Under these conditions in Moldova, there are practically three key technologies competing with each other. In most of the feasibility studies made by Municipalities (the content of the entire studies are not available only resumes) the biological-mechanical technology of WWTP is promoted by the Czech corporation Boncom. Such plants are proposed for several towns in Moldova. Now, Boncom has already reconstructed five waste water treatment plants for municipal use in towns: Ștefan Vodă, Lipcani, Nisporeni, Vulcănești, Cimișlia.

The technology of Boncom uses methods of chemical purification that are mainly associated with mechanical method, actually forming mechanical-chemical method, ensuring highly advanced

elimination of un-dissolved impurities, partially of dissolved matters, as well as colloids, using the process of coagulation with the addition of chemical reagents (coagulants).

It is a higher step than mechanical one and consists, besides specific objects of mechanical method, in particular, of decanters and its annexes, from the following supplementary installations:

- installations for blending of chemical reagents with waste waters;
- basin for reactions between reagents and waste waters where specific flakes are formed, which precipitate, entailing impurities. From the basin of reactions water passes to decanter.

Other two forms of chemical purification, besides coagulation, are:

- neutralization, respectively pH correction, used particularly in industrial water
- purification
- disinfection

Due to lack of financial resources, many authorities consider the constructed wetland as a solution for the treatment of waste water. The constructed wetland (Pflanzenkläranlage) requires much less and less expensive machinery, since it consists of a central tank and some large pools that combine aerobe and anaerobe fermentation.

Constructed wetlands are a technology that has the maintenance and operating costs reduced compared to traditional technologies. Such plants were applied in villages like Rusca, Sărata Galbenă, Brătuleni, Drăguşenii Noi, Cristești, Irceni, Neagra and in Orhei town.

Finally, some few providers promote the more recent technologies of co-fermentation. The higher investment cost and the more sophisticated engineering are a shortage for the availability of this technology, in the country.

One crucial reason is the law on public acquisition that considers the financial economy (investment costs) to be the crucial factor of evaluation with 80 %. With only 20 % the running costs are considered, therefore a high quality in regard to energy efficiency achieved by technological sophistication cannot be scored.

For this reason, most planning engineers in Moldova do not consider international practices of innovation and energy efficiency. The competition regarding the planning of solutions of wastewater treatment does not consider the sophistication in recent research and development, until now.

The competition of waste water treatment technologies in Moldova is additionally reduced because of lack of local specialists in this domain. This is a general problem for municipal and, in a shorter extends for the few private operators, is the shortage or unavailability of engineers in waste water treatment in Moldova. In the last twenty years the need for such specialisation was very low, this leading to the situation when few young people would consider studying water supply and sewerage topics. Now with the perspective of modernisation of municipal infrastructure and environment protection issues becoming national priorities, the situation shall improve. However time and policy adjustment is needed to solve the problem in short term.

There are some local engineering institutions, which in soviet time were very active and had a big staff of engineers, but due to the social-economic difficulties which Moldova faces – most specialists have migrated. So at this moment on the Moldovan market there are successful driven

equipment companies which are mainly focused on selling the equipment rather than the use of best planning.

In conclusion, the self-finance of Moldovan state units like towns are depending on donor grants. Such donor dominated project development processes of decision-making impose a rather conventional technology, while the self-financed investment in WWTP allow more sophisticated technologies but require PPP-procedures for its set-up and legalisation.

There is an important comment regarding Central European economies and their industrial providers of WWTP technologies. Countries like Czech Republic and Slovenia feed their installation industries with state subsidies belonging to their development orientated quorum of national budget. They fulfil the 0.7 % obligation of aid share signed under UN-conventions and they promote their national industries, at the same time.

This is in a sharp distance and contrasts to the German policy of equidistance of technical and financial co-finance or promotion where the policy of Federal Ministries wants to be neutral or avoids to promote German providers.

CHAPTER 7. CASE STUDY: WASTE WATER TREATMENT PLANT OF CHISINAU MUNICIPALITY

The Chișinău wastewater treatment plant is owned and operated by the Chișinău sewerage company "Apă-Canal", which is also responsible for the water supply in Chișinău. Apă-Canal is 100 % owned by Chișinau City.

The wastewater treatment plant in Chișinău - the capital of Moldova with a population of approximately 850,000 inhabitants - is the largest wastewater treatment plant in Moldova. The wastewater treatment plant receives about 150,000 m^3 of wastewater per day from the inhabitants and the industries in Chișinău. The wastewater is treated so that the amount of suspended matter and organic content is reduced considerably before the wastewater is led to Bic River which flows into Nistru River.

The waste water treatment consists of three main steps:

1. Removal of solids by gravitation in primary tanks: On this stage, the primary sludge which contains untreated organic material is produced. The sludge from the primary settlers is led to "compactors", where the primary sludge is concentrated by gravitation to about 6 % of dry matter.
2. Aerobic treatment of remaining wastewater: On this stage, the wastewater is oxidised, and the remaining organic content is hereby stabilised.
3. Removal of solids by gravitation in secondary tanks: On this stage, the stabilised secondary sludge is produced, and the cleaned wastewater is led to Bic river.

The primary settlers are constantly being maintained. The sludge is pumped from the bottom to another settler, the "compactor". Hereby, the dry part in the sludge becomes about 6 %.

The main environmental problem in the wastewater treatment plant is that the main organic part of the produced primary and secondary sludge decomposes by anaerobic processes into methane (CH_4) and carbon dioxide (CO_2) in the sludge pits. Hereby, a large part of the organic material from the wastewater is converted into methane and released to the atmosphere, this is bad for the world climate.

In discussion between EBRD and other donors, for many years (since at least 2007 or even earlier), a rehabilitation of the WWTP of Chișinău has been discussed. Due to the high capacity and respective volume of investment costs, the new construction of this plant for about 200 million € was refused.

Recently, the city council with support of EBRD has decided to apply for the long-term finance of a rehabilitation of the described WWTP for 64 million €. In a quick analysis of aqua consult it was found that with only 10 million € more there could be a combined processing of the sludge of wastewater treatment of the capital together with the caloric fraction of the solid waste of Chișinău. Such co-fermentation and respective production of electricity on the given territory at the northern side of the capital would reduce the national gas imports significantly (about 2 %).

Anyway, the only alternative to donor-based and –financed planning and implementation is the attraction of investors. The law on PPP allows such procedure, though few cases of concessions and other PPP(Private Public Partnership) contracts have been practised in Moldova, yet.

CHAPTER 8. TECHNOLOGY OF CONSTRUCTED WETLANDS

A new energy efficient Wastewater Treatment Plant was inaugurated in September, 2013, in **Orhei**. Previously, the city of Orhei was equipped with an old wastewater treatment plant, a high rate percolating filter, very expensive especially for its localisation on top of the hill where the city wastewater had to be pumped up and no longer sufficiently effective for the treatment itself of the whole city and the future scenarios.

Photo 1: Orhei Constructed Wetland Treatment Plant

Source: Global Wetland Technology (www.globalwettech.com)

For this reason the Moldovan government, under a World Bank programme and feasibility study (Design Team: SWS Srl, IRIDRA Srl, HYDEA Srl, POSH&Partners GmbH), decided to replace it with a constructed wetland system (as it shows in Photo 1 above) at the service of about 26,000

inhabitants. A **constructed wetland** (CW) is an artificial wetland created as a new or restored habitat for native and migratory wildlife, for anthropogenic discharge such as wastewater, storm water runoff, or sewage treatment, for land reclamation after mining, refineries, or other ecological disturbances such as required mitigation for natural *areas* lost to a development.

Constructed wetlands serve mainly a purpose of treating contaminated water.They are engineered systems that use natural functions of vegetation, soil, and organisms to treat different water streams. Depending on the type of (waste-)water stream that has to be treated the system has to be adjusted accordingly which means that pre- or post-treatments might be necessary.

Also, the flexibility of constructed wetlands (CWs), and especially of the CW in Orhei, permits to control the impacts not only of its inhabitants, but also of the agro-food industries of the area, currently without any pre-treatment and characterized by a seasonal production of wastewater with high organic content. During the peak period of food processing industries, the constructed wetlands system will be capable to treat a maximum organic load of 2,000 kg BOD_5/day (more than 33,000 P.E., 2022 prevision). At its start the average load is 700 kg BOD_5/day (1,666 PE) with a peak of 1,200 kg BOD_5/day (20,000 PE).

Photo 2: Orhei Constructed Wetland - Vegetal Area

Source: www.worldbank.org.

Constructed Wetlands technology (CWTP) is successfully applied in many countries around the world but has not been implemented until now in the region. The Orhei Constructed Wetland treatment plant is the biggest secondary treatment in the world entirely based on CW's. The Orhei CWTP' consists of usual pre-treatment and equalization with pre-aeration; the primary sedimentation phase has been skipped, because it's carried out directly to the secondary treatment stage by the so-called French system. The system consists of 4 lines operating in parallel independently, each composed of two vertical flow stages in series. Each line is composed of two stages in series: 1st Stage - French system (vertical flow reed beds fed with raw wastewater where there's a formation of a sludge aerobic layer on the surface, removed every 10 – 12 years. 2nd Stage - vertical submerged flow reed beds. Total surface is about 35,000 m^2 (3.5 ha) and the gross area is about 5 ha. Vegetal area (Photo 2 from above) is the largest part of the CWTP. Although the majority of constructed wetland designers have long relied principally on Typhas and Phragmites, both species are extremely invasive, although effective. The field is currently evolving however towards greater biodiversity.

The plants used (placed on an area 1/4 of the water mass) are divided in four separate water depth-zones:

1. 0–20 cm: Yellow Iris (*Iris pseudacorus*), Simplestem Bur-reed (*Sparganium erectum*); may be placed here (temperate climates)
2. 40–60 cm: Water Soldier (*Stratiotes aloides*), European Frogbit may be placed here (temperate climates)
3. 60–120 cm: European White Waterlily (*Nymphaea alba*); may be placed here (temperate climates)
4. Below 120 cm: Eurasian Water-milfoil (*Myriophyllum spicatum*); may be placed here (temperate climates)

The plants are usually grown on coco peat. At the time of implantation to water-purifying ponds, de-nutrified soil is used to prevent unwanted algae and other organisms from taking over.

The new wastewater treatment plant is designed with a capacity sufficient to treat all wastewater generated by the city of Orhei and at efficiency levels consistent with EU requirements. It is expected to generate an estimated 40 % in energy savings per cubic meter treated and will reduce the amount of pollution discharged to the environment due to high treatment performance.

The plant's construction was funded from the Regional Development and Social Protection Grant (2.3 million €), financed by the European Union, the National Ecological Fund (1.8 million €) and the National Water Supply and Sanitation Project (0.32 million €), financed by the World Bank.

Additional Info

- In operation since: 2013
- Type of wastewater treated: Domestic
- Type of wastewater (other): + food processing
- Hydraulic load: 4,600 m³/day
- Organic load (PE): 21,666 PE
- Organic design load (kg BOD_5/day): 1,300
- Location: Orhei
- Client: PIU Moldova – World Bank
- Stage 1 type: French system
- Stage 1 surface area (m²): 18,000
- Stage 2 type: Vertical flow, unsaturated
- Stage 2 surface area (m²): 17,000
- Cost: 3,387,000 € according to 156 €/PE

Therefore, the designed system is characterized by low energy consumption and very low production of surplus material, considering that the sludge extraction will happen after many years and that the sludge should be reused in agriculture as soil conditioner.

Another project of using of technology of Constructed Wetlands was analysed for **Soroca**. But unfortunately, this project has not been implemented till now due to the lack of decision of local authorities of Soroca. The reason is a dispute between the political parties. Since 2009, based on a feasibility study recommending the CWTP-technology, the discussion and planning has been developed, but suddenly stopped due to the resistance of the communist party opposing itself against the proposal of construction promoted by the governing county president of the opposed

political movement from the liberal-democratic party. Unfortunately, prejudices like smell and winter freezing risks have been promoted, during that time.

The city of Soroca is located in the north-eastern part of Moldova on the right bank of the river Nistru and close to the border with Ukraine. Soroca has about 28 000 inhabitants. The main industrial sector of Soroca is represented by food industry (fruits and vegetables processing, milk industry, meat products and tobacco). At the moment the sewerage system of the city has two outlets in correspondence of the South and Main Pumping Stations. Both outlets discharge directly to the Nistru River with no treatment or mechanical screening of the wastewater, with final negative effects on the Black Sea water quality. The project could be financed by the World Bank, under the Global Environment Facility (GEF) program. GEF is a mechanism which provides grant and concessional funding in order to achieve environment benefits. The aim is to improve the quality of sanitation services in Soroca and to discharge pollutants from Soroca into the Nistru through the construction of a waste water treatment plant and engineering technical assistance.

The municipal wastewater in Soroca can be classified as domestic wastewater: the monitoring data showed common concentrations for a municipal wastewater, with the exclusion of the organic matter (expressed as COD and BOD_5) and Total Suspended Solids at the sampling point closer to two specific industrial activities (dairy and meat processing factories). In any case, due to the presence of untreated industrial discharges, the CWTP design will consider as BOD_5 inlet 500 mg per l and as COD inlet 800 mg per l, adopting this way a very conservative approach in selecting the influent concentrations.

The benefits of the Soroca CWTP project would be the following:

- Recovered ecosystem in the upper Nistru area, helping the restoration of aquatic life and increase of biodiversity.
- Reduced pollution to crops irrigated by polluted water and increased agricultural and aqua-cultural yields and productivity.
- Improved environmental infrastructure for sustained economic development and attracting outside investments.
- Improved recreation and environmental aesthetics of the project area.
- Increased revenues from tourism.
- Improved biodiversity and ecosystem.

Since Soroca has allocated a 2.5 ha sized property North of the town for a CWTP, the refusal of such technology is not determined, yet. A final decision could be expected for spring 2015.

Though the constructed wetland is a technology that requires less capital and allows easier self-management of the facility, few such plants have been constructed in Moldova.

CHAPTER 9. TECHNOLOGY CHOICE IN MOLDOVA

Since Moldova was recently associated with EU, the country is in a wishful and strong transition towards transparency and constitution of legally based market economy. This means that all public planning and construction is regulated by law, and the law on public acquisition requires that the economy reflects 80 % of the decision. With other words: if the works of one offer are more expensive than of a second one, it is almost sure that the offer will be denied; even if its amortisation would be shorter in time.

The water and wastewater sector is traditionally financed through a combination of **tariffs, taxes** from central budgets, and **transfers** from donors. The affordability level in rural areas in Moldova is very limited and there is almost no experience with tariffs for either water supply or wastewater, especially for the treatment of wastewater. From rough estimates, the tariff that would cover operating costs for water and wastewater would exceed the affordability level of the majority of the population. Accompanying measures may not be appropriate when a large share of the population is unable to foot water bills. As a transition period, direct subsidies may be justified, when the water bill, and wastewater treatment costs in particular, represent a disproportionate effort for a large part of the community. Such public support is partly justified by the public good dimension of some elements of the wastewater treatment services. However, it should be transitional only, recurrently reviewed, with a view to phase out (and be focused only on the public good dimension of the service).

At the same time, the dominant donor organisations that substitute most of the conventional public decision-making by “imposed international practices” force such economy-driven project development tendencies. This often means that donor finance provokes lower technology and a very modest application rate of advanced or even innovative technologies.

Simplified, this leads to a difficult competitiveness of technologies of cofermentation or other innovations in wastewater treatment.

At the same time, the donors also include some countries that promote their own technologies like Czech Republic or Slovenia. These countries and their providers of WWTP are represented by funding agencies that first sponsor pre-feasibility or feasibility studies and then finance the construction of the recommended technology.

In comparison, German philosophy of communal planning and decision-making considers the best planning as an instrument for local souveranity: an independent planning engineer elaborates a study analysing the basic data and comparing heterogeneous solutions. As a result, he presents the best technology for the situation of the town or village, and even prepares the papers for public bidding.

Such work would be wishful for Moldovan towns, under the situation figured out in this study. The Moldovan mayor needs a trustful expert who is independent from delivery interest. Anyway, the mayor or county president has to assure that there are certain requirements or boundary conditions fulfilled (especially if advanced solutions of cofermentation are analysed):

- Detailed information of pollution load from the catchment area is clarified.
- Technology of the wastewater treatment plant and sludge formation is evaluated.

- Formation, transport, depositing technology and alternatives for sorting of the organic fraction of municipal solid waste are clarified.
- Possible other co-substrates and energy crops production is investigated.
- Possible production streams, investment requirements and cost estimation are clarified.
- Geodetic plans and site layouts are clarified.
- Boundary conditions and legal circumstances for erection of the biogas plans are clarified.
- Environmental limits and demands for management and utilisation of sewerage sludge are clarified.

Such conditions are very difficult to fulfil, since town administration has suffered an outdating of knowledge and access to international knowledge, for many years. Under these conditions, the best planners from Moldova or abroad have to research and to collect their data with additional efforts and from multiple sources.

While agglomerations require wastewater collection and treatment (mechanical and biological, but also could be wastewater ponds), remote areas require small WWTPs or septic tanks (with wastewater delivered to the WWTP) or alternative sanitation technologies. It is important that the Government of Moldova establishes clear rules where small WWTP could be installed. Otherwise small
WWTPs, which are expensive (both capital and operating costs), will be installed randomly by local governments that do not want to wait for proper wastewater collection and treatment systems or that are lobbied by manufacturers of small WWTPs.

Anyway, the best planning could be a leverage for objective decision-making and investment attraction.

9.1. The Workshop on Advanced Wastewater Treatment Technologies and its Results

In the context of technology choice and development, on 22th of January, in Chisinau was held a workshop which had as a main purpose the finding of tariffs and discussion of professionals from public and private sector about water and sanitation sector diagnosis and measures. The long term goal was to create a communication forum for wastewater treatment and its development in Republic of Moldova in the form of a professional dialogue and association (treatment club). This workshop/conference was supposed to be the first in such a broad way.

The conference brought together over 70 participants from the Republic of Moldova. The participants were represented by government ministries, policy-makers, mayors and vice-mayors, donors and other representatives of associations of water and sanitation utilities and local companies. For a transition country was needed to attract the private sector, too, which is quite separate from the public one, traditionally. The participants had reviewed the results of a preparatory study on the framework for wastewater treatment, in Moldova, and started the dialog about technologies and project opportunities for WWTP in the country.

The workshop focused the attention of participants on the importance and urgency of taking action in improving the wastewater and sanitation sector, including to:

- Identify the basic principles, methods and strategies for developing national action plans in the field of water and sanitation services;
- Strengthen political commitment by encouraging macro-counterparts to develop and implement reforms;
- Share experiences, challenges and technical knowledge regarding the wastewater treatment considering the need to strengthen this sector.

The feedback-workshop presented the results of the study to a broad but qualified circle of experts of the water sector. The ministries of environment, economy and agriculture as well as the significant partner association APSP, the association of the municipal utilities AMAC are involved. To them communal architects, manager of municipal utilities and coworker of the departments communal development, constructing and investment planning from the most of the 32 county towns came along. To the feedback-workshop about 50 participants were expected. Results should have been to correct and confirm the results of the study in order to hand in realistic and workable initial conditions for forming and navigating the planned lecture series as a train-the-trainers program.

In practice the workshop was a big success relating to the participants' number (74) and composition (many heads of institutes, two vice-ministers and several mayors) and to the dynamic of the discussion.

From the invited cities about twenty appeared, representing more than the half of the communal structures of the country. All of the central institutes were present, particularly active in terms of the main water authority Apele Moldovei, the association AMAC and of the hosting association APSP. The open-mindedness the mayors and the heads of water plants and various small towns showed in the discussion was very surprising.

Some central arguments made in the morning marked by four presentations after the greetings from APSP UBA and Mr Severovan and Mr Spelleken should be underlined. In these presentations Dr. Dorin Dusciac (Vice Minister of Environment) drawn the ambitious agenda of the country on its way to fulfill the joining criterias for the EU in just two years, Vladimir Vladidescu (Apele Moldovei) talked about the difficult process of handing out licenses for constructions and companies in the frame of the old Gost-norms, the new EU-norms and the actual operation praxis below every environmental and hygienic standards, a representative of a NGO presented the available technologies the rural regions and Prof. Peter Hartwig the recently most discussed wastewater technology, the Duplex-Co-Fermentation.

The afternoon was characterized by very practicable – almost too ambitious – discussions about the transfer of technology and the financing of new plants.

During the event, two working groups were formed to discuss on the one hand the ways to refinance Wastewater Treatment Plants (Group 1, moderated by Hans-Gerd Spelleken) and on the other hand the problems of introducing new technologies for Wastewater Treatment in

Moldova und ideas how to incorporate technical competence in the system (Group 2, moderated by Prof. Peter Hartwig).

In a nutshell Group 1 proposed establishing a small group called “Task Force for Tax Design” working on an analysis of the legislation of tariff collection, creating a methodology of designing tariffs, lobbying them and developing a guide for authorities. Group 2 was raising questions about the difficulties of introducing a new technology. One of the most important points is that it is both a challenge to set new norms and standards and finding and instructing qualified staff. It was also pointed out to consider the long-time effects on health and environment.

Both groups suggested to execute ongoing seminars both on attracting investment and on instructing specialists.

Therefore, the workshop confirmed the strategic goals that Moldova has to follow in environment protection. In 2014, Moldovan Government has approved the National Environment Strategy for 2014-2020. This document supposes the implication of the entire society in achieving global objectives. Within the objectives highlighted in the Strategy a list of actions has been designed.

Participants have expressed their opinion regarding the priority area and actions. All of them agreed that the following actions, already included in the strategy document have to be stressed and prioritized in the Government of Moldova agenda:

1. Harmonisation of environment legislation to EU directives, referring mostly to drinkable water and on solid waste.
2. Development of environment related information system with public access and training of trainers for consolidation of regional education centers.
3. Reviewing the environment related fiscal and economic instruments in the sense of decreasing the pollution effects by economic entities.
4. Reviewing the environment quality standards, monitoring indicators and integrated control system.
5. Extend the water supply network and waste water sewerage, in such a way contributing to the increase of population’s access to these important public services.
6. Develop feasibility studies for solid waste sorting and biological treatment plants for North and Centre regions.
7. Extend the solid waste collection service and rural and urban areas, contributing to the improved management of solid waste in Moldova.

CHAPTER 10. CONCLUSIONS

From the above mentioned analysis and observations, the following lessons could be learned or conclusions be offered for foreign and Moldovan companies and professionals contributing to the development of technology and to the investment in public WWTP.

It is important to mention lacks in administration of water supply and sanitation systems including waste water treatment plants, by municipal companies, subordinated to local public authorities.

Usually local public authorities did not focus on the necessity of protecting the environment and operating properly the local environmental infrastructure. Money which is collected to operate the systems is used in other purposes and hereby the authorities return to the initial situation of environmental pollution even if new sewerage and treatment systems were built in the settlements.

There are certain challenges connected to the assessment of the used water volume**,** which could be met by the investor or operator of the installation. First of all the data is insufficiently monitored or known in order to calculate correctly the volume of the waste waters which should be treated. At the same time, the concentration of chemical substances is relatively high.

When a new waste water treatment plant is scheduled to be built, the information on lack of pre-treatment waste water plants at industrial enterprises should be taken into consideration. Those industrial enterprises either are discharging the untreated waste waters into the sewerage system harming the operation of the biological waste water treatment plants or are discharging the untreated waste waters directly into the water bodies. The new regulations which were approved for the new Law on Water require pre-treatment waste water plants at each industrial enterprise. This future policy should be one column of income-collection both for the investor and operator of new plants.

Consumers are not always paying for waste supply and sanitation services. This creates a deficit of money to properly operate the installations of waste water treatment. Here it is important to inform the public about the importance of treating waste waters and protecting the environment.

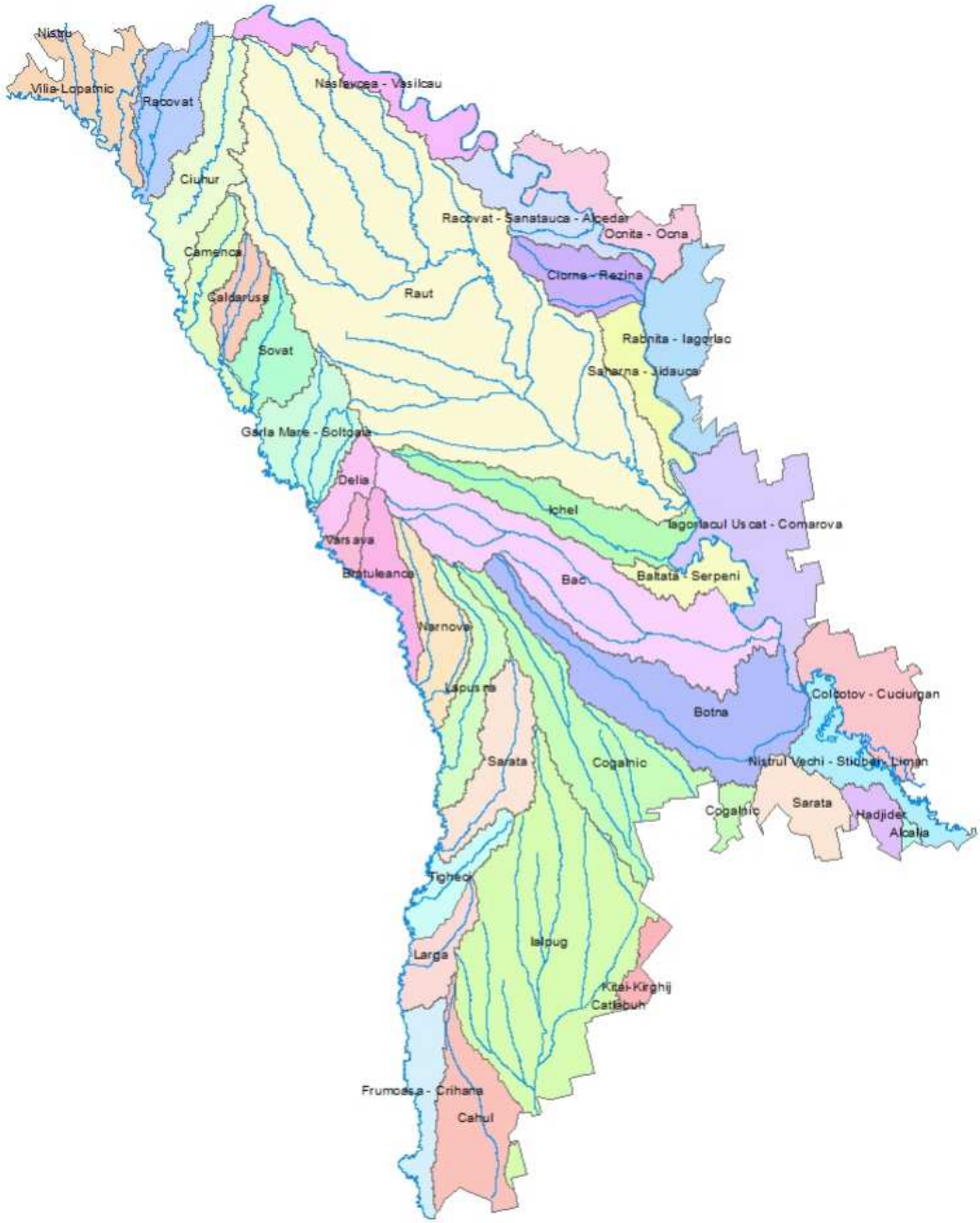
There are no professional engineers at the local level who would be able to efficiently operate waste water treatment systems. It is important to raise capacities of the engineers in this field and collaborate for this with the Technical Univerisity of Moldova which prepares engineers in water supply and sanitation.

At the moment environmental infrastructure is managed by municipalities, and this management is not efficient, because of many factors and the most important being lack of professional capacities. Money which is collected for waste water supply and treatment services, is used for other purposes than those related to operation and maintenance of waste water treatment plants. For better maintenance and operation of the newly created environmental infrastructure (waste management systems, waste water treatment plants), these should be private with mixed or foreign management (Moldovan and/or foreign, depending on the country of investment). Private public partnerships should be encouraged and facilitated in creating new environmental infrastructure in Moldova.

It is important to engage financially the local public authorities from Moldova in investing in creation of environmental infrastructure, otherwise if the investment is only foreign, it is usually not sustainable.

Finally the population should be involved in the process of planning and creation of the new environmental infrastructure (water supply and sanitation systems and waste management systems) according to the Moldovan legislation related to public participation in environmental decision-making process. This is stated in the Aarhus Convention on access to information, public participation in decision-making process and access to justice on environmental matters which the Republic of Moldova ratified in April 1999. The respective provision was adopted into the environmental legislation of Moldova.

ANNEX 1. THE WATER CATCHMENT AREA OF MOLDOVA



Source: www. apelemoldovei.gov.md