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EXTENDED ECONOMIC AND INSTITUTIONAL ANALYSIS

IN THE AKHURYAN RIVER BASIN DISTRICT OF ARMENIA

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1. INTRODUCTION

This report is in accordance with the contract for Extended economic and institutional analysis in the Akhuryan River Basin District of Armenia, signed on June 6, 2016 between Hulla & Co. Human Dynamics KG andAlvak LLC. It combines 2 deliverables, envisaged by the contract:

- Deliverable 2: Draft economic analysis report, including to the extent possible: (a) monetary assessment, of cost of not implementing the program of measures, from a point of view of affected ecosystems, impacted human health and lost economic revenues; and (b) quantitative and qualitative assessment of benefits of implementing of program of measures; and (c) in case the costs of implementing the program of measures exceed the calculated benefits, assessment of costs for alternative measures; and
- Deliverable 3: Analysis of institutional and organizational arrangements for implementation of the RBMP for Akhuryan RBD, including identification of limitations imposed by governance arrangements.

2. EXTENDED ECONOMIC ANALYSIS IN THE AKHURYAN RBD OF ARMENIA

2.1 Background

This report has been prepared by "ALVAK" LLC as a deliverable of the "Extended economic and institutional analysis in the Akhuryan RBD of Armenia" implemented within the EU "Environmental Protection of International River Basins" (EPIRB) project.

The EU Water Framework Directive (WDF) is one of the first environmental policy directives of the European Community that explicitly integrates economic considerations for achieving its objectives. Economic principles are foremost addressed in Article 5 (and Annex III) and Article 9 of the Directive.

A program of measures is an essential part of the basin management plan. Annex III of the WFD requires the economic analysis conducted in reference to Article 5 to be in sufficient detail for preparing the selection of programs of measures on the basis of cost- effectiveness.

With increasing scarcity of both water resources and financial resources allocated to the water sector, economic analysis and expertise is important to support decision-making process and help to understand the economic issues and tradeoffs in river basin.

In general, cost information can be found in river basin management plans however, the available information differs significantly concerning the level of details provided and the transparency regarding the elements taken into account during cost calculation. In most cases, cost information is given in the RBMPs and accompanying documents very general and not enough for comprehensive analysis.

Proper and adequate water basin management can impact on economic sectors that have significant role and importance in the local, regional and national economy. Different economic sectors are often competing for the good quality water resources.

The work has been conducted in cooperation with the Water Resource Management Agency (WRMA), Ministry of Nature Protection and the EPIRB project team. Where possible, monetary assessment has been conducted, cost of not implementing the program of measures, from a point of view of affected ecosystems, impacted human health and lost economic revenues, as well as quantitative and qualitative assessment of benefits of implementing of program of measures.

Environmental impacts on the ecosystems, economy and public health, as well as the costs of non-implementation of the measures have been assessed. During assessment the types of measures (basic, supplementary/additional measures) were differentiated.

Economic value of water, as for most other natural resources is attributed to:

- Direct uses made of it (e.g. abstraction for public supply, agriculture, etc.);
- Indirect uses made of it (e.g. ecological services provided by water such as provision of habitatfor species, pollution abatement, and so on);
- Option value: not associated with current use of water but the benefit of making use of waterresources in the future.
- Non-use value is associated with benefits derived simply from the knowledge that the naturalresources and aspects of the natural environment are maintained (i.e. it is not associated withany use of a resource). Non-use value can be attributed to three motivations:
  - Altruistic value: Derived from knowing that contemporaries can enjoy the goods and servicesrelated to natural resources.
  - Bequest value: Associated with the knowledge that natural resources will be passed on to futuregenerations.
  - Existence value: Derived simply from the satisfaction of knowing that a natural resourcecontinues to exist, regardless of use made of it by oneself or others now or in the future.
- Preferences for ensuring future uses of water; and
- Reasons that are independent of use, including ensuring a sustainable water environment forothers to use, for the future generations and for the sake of a sustainable environment.

All these value components sum up to the “Total Economic Value”, which provides a comprehensive description of the sources of economic value for river basin management.

Economic valuation requires information from a range of disciplines todefine the good or service and the expected change in its provision resulting from some policymeasure. Consequently undertaking each stage of the process is dependent on the requisitescientific and technical information being available. The three stages are of valuation are:

- Qualitative assessment of the good or service.
- Quantitative assessment of the good or service.
- Monetary assessment of economic values: here economic valuation methods are used toestimate the monetary value of the change in the provision of the good or service.

The particular approach to economic valuation was chosen depending on the type of costs and benefits to beestimated, related context-specific details, and also data availability, particularly in terms of thequantitative assessment stage.

Parallel to economic assessment, an analysis of institutional and an organization arrangement for implementation of RBMP was conducted. The report includes information on existing legal and institutional frameworks, as well as a detailed analysis the weaknesses and existing obstacles that may hinder theimplementation of the Akhuryan RBMP after its official adoption by the Government of Armenia.

Lack of State-level budget is likely to undermine ongoing planning efforts and the full participation of BMOs in river basin planning. Inadequate information and analytical tools, as well as insufficient knowledge and capacity within the main institutions involved in the basin management planning, the WRMA and the BMOs, are some of the issues that need to be addressed for improved water management and compliance with the EU WFD approaches.

2.2. Proposed priority measures in Akhuryan RBD

The Programme of Measures (PoM) is the core of this draft basin management plan for the Akhuryan RBD, as it is developed to describe how the environmental objectives and, hence, "good water status' will be achieved in the Akhuryan RBD. It provides regulatory actions to be taken to reach maintain and/or improve water status in the Akhuryan RBD.

The PoM was set up based on analyses of the baseline conditions in the basin and anthropogenic impacts on surface and groundwater resources as required by WFD Article 5, and in accordance with requirements of Article 11 of the WFD.

Basic Measures are aimed at preventing the degradation of water status in all water bodies, ensuring stepwise improvement of water status in water bodies and enhancing national water management in relation to water uses.

Supplementary Measures are based on gaps that have been identified during preparation of this RBMP for the Akhuryan RBD, and are aimed at improving monitoring, national legislation and technical/personnel capacities to ensure WFD compliant implementation in future.

Thus, the following measures are proposed:

1. <u>Construction of Wastewater Treatment Plants for Gyumri and Armavir Agglomerations</u>

Both Gyumri city and Armavir town used to have wastewater treatment plants during Soviet Era. For the Gyumri city the capacity of the plant was 76,000 m3/day and for Armavir town - 24,000 m3/day. However, both WTTPs are currently non-operational, the facilities are damaged and ruined and more than 70% of technical equipment is out-dated and broken. Thus, it is proposed to construct new wastewater treatment plants (WWTPs) at the locations of the old ones since those

are the lowest points of the agglomerations and are topographically suitable for a treatment plant. It will also allow the gravity flow of wastewaters towards the treatment plant.

The total cost (WWTP for both plants) of this measure is estimated **55,313,470 Euro**.

2. Conduct Feasibility Studies for Wastewater Treatment Plants Outside of the Defined Agglomerations

According to EC 91/271 Urban Wastewater Directive, operation of a WWTP is not required for the communities with small population (less than 500 p.e.). In the Akhuryan RBD, there are over dozen of communities with p.e. exceeding this threshold value. For those communities it is recommended to conduct feasibility studies to determine the viable alternative options for municipal wastewater treatment (construction of septic wells, biological ponds, local wastewater treatment facilities, etc).

The preliminary estimated cost of such study is **840,000Euro.**

3. Application of Good Agricultural Practices

In order to reduce the agricultural impact on the environment and water resources, it is necessary to use natural resources (feed and irrigation water) more efficiently and sustainably, to ensure Good Agricultural Practices (GAP) and create more efficient farms.

The GAP program proposed in Akhuryan basin would cost **1,040,000Euro**.

4. Implementation of River Restoration

About 11 km long stretch of the Akhuryan River (from Berdashen community to Pokr Sepasar community) is diverted through the earthen canal. This was done in 1951, after construction of the Arpilich Reservoir with the purpose of regulating the river flow by straightening the river bed. This diversion has altered the natural regime of the Akhuryan River, and the above-mentioned modified section should be restored. Thus, this particular river restoration includes restoring more natural processes and channel forms to the watercourse. By restoring natural conditions, the resilience of the river system and sustainability will improve.

The estimated cost of this measure will cost **150,000Euro.**

5. Review of Water Use Permit Conditions and Improvement of Enforcement

The following activities are proposed to improve the water use permit conditions and strengthen the enforcement in terms of maintaining ecological flow, regulating water abstraction and return flows:

- Revising water use permit conditions in the Akhuryan RBD and Armenia in general;
- Introducing an online water use control system for selected pilot sites.

Estimated cost for implementation of this measure is **67,000Euro**.

6. Introduction of Best Available Technologies in industry

It is recommended to introduce Best Available Technologies (BAT) in the Akhuryan RBD to implement:

- Pre-treatment and recycling of water in construction materials processing industry in the Akhuryan River basin.
- Installation of closed and semi-closed water systems, as well as treatment systems of the return flows in the fish farms of the Metsamor River basin.

The cost is estimated **1,172,000Euro.**

7. Abolish Abandoned and Illegally Operated Groundwater Wells

To restore the groundwater levels in the Metsamor River basin, it is recommended to:

- Abolish existing 348 emergency, unsanitary and abandoned ownerless wells (according to inventory data of 2006-2007 and inventory in July-October, 2014);
- Close down temporarily or liquidate the required number of wells to reduce abstraction by artesian wells taking into account the wells' impact radius and technical state and converting other wells into valve operation regime.

Cost estimate is **1,278,000Euro**.

8. Investigative Monitoring of Elevated Arsenic Concentrations in Ashotzq and Armavir Regions

Such monitoring is required when the reason for any elevated concentration is unknown, or when there is a need to ascertain the magnitude and impacts of accidental pollution. The investigative monitoring shall inform the establishment of a program of measures for the achievement of the environmental objectives and specific measures, necessary to remedy the effects of accidental pollution.

The investigative monitoring shall inform the establishment of a program of measures for the achievement of the environmental objectives and specific measures, necessary to remedy the effects of accidental pollution.The implementation would require **10,000 Euro** investment.

9. Development of WFD Compliant Monitoring Programme and network for Surface Water and Groundwater bodies

The proposed WFD compliant monitoring programme for surface water bodies of the Akhuryan RBD includes 40 points. Of this, 24 monitoring points are on rivers, 11 on artificial water bodies such as canals and artificial ponds, and 5 monitoring points are on reservoirs. The monitoring programme shall be in compliance with the EU WFD approaches and include: operational, surveillance, reference and pollution transport monitoring.

Preliminary assessment of the costs is **778,600Euro**.

10. Improve water status assessment system

Armenia has not yet introduced both biological and hydromorphological status assessment system in the surface water monitoring and assessment programmes. Thus it is proposed to revise the existing system to fill in the gaps taking into consideration the EU WFD approaches.

For assessment of groundwater status it is proposed to use the approach outlined in the EU WFD, rather than invent a new assessment system, which will be difficult to implement, very costly and time consuming. According to the WFD recommendations, all groundwater bodies are classified as having good and/or poor quantitative and chemical status.

Estimated cost is **65,000Euro.**

2.3 The approach and methodology for the efficiency assessment of priority measures in the Akhuryna RBD

The efficiency analysis of the proposed priority measures in Akhuryan RBD should provide clear image of the cost-benefit ratio, as well as assist in planning the implementation of measures or define priority alternative measures.

At present many river basin management plans in may not be financially sustainable as the costs arising exceed budget opportunities of the countries, farmers, industries and households. Therefore there is a need for more justified analysis of water management costs, the financial resources available to cover these costs and the benefits that can be obtained from the proper management of water resources.

One of the key steps in river basin management planning for Akhuryan RBD is the evaluation of the costs of the core and supplementary measures aimed at achieving environmental objectives for surface and groundwater bodies and the definition of their priority level based on their efficiency.

The preliminary cost estimation for implementation of priority measures proposed for Akhuryan and Metsamor river basins was based on comparative analysis of state budget or other donor-supported activities within similar projects, estimates made by the various institutions.

Efficiency assessment was conducted for the priority measures in the Akhuryan basin district, which served as a basis for defining the priority level of each measure according to the availability of funding and the most reasonable measures in terms of ecological benefits according to the experts assessment.

Economic analysis of the PoM was based on the common “cost-benefit” analysis methodology. Analytical work was carried out separately for each measure based on their priorities. To the extent possible a systematic approach was applied to assess the strengths and weaknesses of

alternatives, introducing economic evaluation of implementation of each proposed measure and comparing the expected benefits and costs of each option.

During the assessment it became clear that not all measures are possible to assess in monetary terms, which would allow for a more detailed comparative analysis. A number of measures have been evaluated based on pure environmental benefits.

At the same time, depending on the data and information, as well as the time availability, minimum requirements imposed by the principles and approaches of the planning have been applied.

The assessment of costs and efficiency of the main and supplementary measures aimed at achieving environmental objectives for surface and groundwater in Akhuryan RBD is very preliminary and intended to give a general idea about the costs of the management plan.

2.4. Assessment of the main measures

2.4.1. Construction of wastewater treatment plants for Gyumri and Armavir agglomerations

***General description*:**
Gyumri and Akhuryan communities are considered to be the sources of significant pressure in Akhurya Basin. Communities with about 132 thousand population discharge untreated wastewater in Akhuryan and Jajur Rivers leading to significant increase of relevant water quality indicators, such as the BOD, suspended particles, Phosphorus, and Nitrogen. The 86% of industrial enterprises in the Akhuryan River basin is centralized in Gyumri town, and industrial flows discharge into the sewage network, thus adding the impact of these flows to the impact of sewage pipeline. The pressure of food enterprises on quality of water resources of the Akhuryan River is also significant.

Armavir and Metsamor towns with about 38500 inhabitants are viewed as potential sources of significant pressures from municipal wastewater in the Metsamor River basin. There are wastewater collectors in these towns, which discharge the collected wastewater into open water bodies without any treatment. The sewage pipelines of Armavir and Metsamor towns are connected to the municipal wastewater system but are discharged into the Metsamor River through the sewage pipeline, practically without any treatment. The overall volume of industrial wastewaters in Metsamor River Basin is 0.015 m3/sec and is discharged into the municipal sewage system, then into the Metsamor River. Armavir agglomeration with six rural communities (about 20 000 inhabitants) are the source of significant pressure.

The quantity of food industry wastewaters is actually small in Armavir. The volume of all types of industrial wastewaters discharged into Armavir sewage pipeline is half of the volume of municipal wastewaters. The volume of all types of industrial wastewaters discharged into Armavir sewage pipeline is half of the volume of municipal wastewaters. The proportion of food industry discharge is not identified, therefore, it is impossible to differentiate the food enterprise pressure from municipal pressure. However, food enterprises also have significant pressure on quality of water resources of the Metsamor River. The data show that point source pollution from municipal

wastewater is a significant pressure on water resources of the Akhuryan River basin and is, hence, investigated if it puts water bodies at risk to fail the WFD environmental objectives.

Determination of settlements to be included in the agglomerations in the Akhuryan RBD was done in accordance with the "Guidance on How to Define Agglomerations under the Urban Wastewater Treatment Directive 91/271".

The first step for identification of agglomerations is determination of the main large settlements in the Akhuryan RBD,having significant pressures on surface water bodies. . In addition, the agglomeration also includes settlements, which can be connected to the sewage collector with pipelines of up to 15 km length (taking into consideration the peculiarities of the topography and the preference that sewage collector has gravity flow, given the high costs associated with pumped sewage) and the population density meets the requirements of the above-mentioned Guidance Document. Thus, the criteria for inclusion of a settlement into the given agglomeration are as follows:

Agglomerations in the Akhuryan RBD

Settlements in agglomerations	Distance from the proposed WWTP	Area, km^2	Area, ha	Number of inhabitants	Population density, inhab/km^2	Population density, inhab/ha
1. Gyumri Agglomeration						
Gyumri	6.2 km	32.31	3,231.27	**150,917**	4,670	46.7
Akhuryan	8.7 km	2.52	251.84	**9696**	3,850	38.5
			Total	**160,613**		
2. Armavir Agglomeration						
Armavir	11.5 km	5.06	506.18	**32,034**	6,330	63.3
Metsamor	5.6 km	0.9	90.25	**9,870**	10,966	109.7
Hoktember	14.6 km	2.87	287.02	**5,727**	1,995	19.95
Mrgashat	8.1 km	2.7	269.76	**5,297**	1,963	19.63
Mayisyan	8.9 km	0.23	23.32	**2,910**	12,477	124.77
Norapat	10.9 km	0.75	75.16	**2,780**	3,698	36.98
Zhdanov	7.3 km	0.52	51.85	**1,653**	3,187	31.87
Noravan	13.3 km	0.45	45.07	**962**	2,134	21.34
			Total	**61,233**		

In order to estimate the capacities of the proposed WWTPs in Gyumri and Armavir agglomerations, the quantities of BOD5 in wastewaters discharged from all the industrial enterprises operating within the agglomerations are considered. A baseline for calculations is the maximum wastewater discharge from each industrial facility and the quantity of BOD5, mentioned in the water use permit issued to the given enterprise. In order to convert the calculated BOD5 into population equivalent, the daily BOD5 quantity is re-computed into per capita, by dividing the total value of BOD5 on the its daily value (60 g/day). It provides the total value of "population equivalent" for each agglomeration, based on which the capacity of the proposed WWTP is determined.

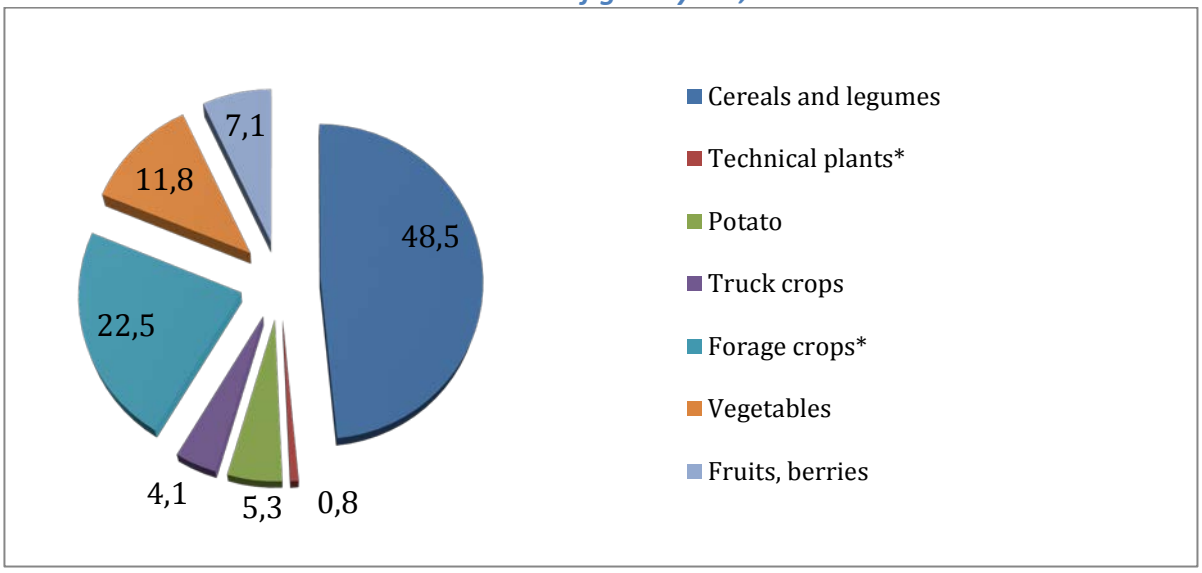
Based on the results of calculations of the total "population equivalent" and the provisions of the EC Urban Wastewater Directive, the type of wastewater treatment, as well as recommended capacity of the proposed WWTP is identified for each agglomeration in the Akhuryan RBD. For both Gyumri and Armavir agglomerations, the total p.e. is more than 10,000. Thus, both primary (mechanical) and secondary (biological) treatment are proposed to be used in the WWTPs.

Efficiency assessment: Arable lands in Akhuryan basin comprise about 35% of agricultural lands - 80,500ha. As of 2013, 61,309 ha of arable lands have been developed in the basin. 69% of agricultural crops are cereals. About 24% of agricultural lands in Metsamor River Basin (54456 ha) are arable. As of 2013 43150ha of land were developed, which is 79% of total arable lands in the basin.

Gross harvest and average yield in Shirak and Armavir regions (Source: National Statistical Service, 2015)

	Type of crops	Sowing area/ ha of plantations	Harvested crops, centner	Average yeld per one hectare, center/ha
1	Cereals and legumes	52867.0	425319.0	8.0
2	Technical plants	878.0	17968.0	20.5
3	Potato	5822.0	1652697.0	283.9
4	Truck crops	4432.0	1837005.0	414.5
5	Forage crops	24555.0	2035122.0	82.9
6	Vegetables	12829.0	4320767.0	336.8
7	Fruits, berries	7697.0	1078114.0	140.1
	Total	109080.0	11366992.0	104.2

The share of gross yield,%



Due to deteriorated status of irrigation infrastructure water losses in the system reach about 50%.

About 18000 ha of arable agricultural lands in the lower section of Ahuryan WBD (Metsamor River Basin) are not cultivated mainly due to the lack of irrigation water, absence of local pipelines, and secondary salinization of the soil. Due to availability of good quality irrigation water it will be possible to increase the density of cultivated lands and perennial crops in agricultural lands of Akhuryan WBA. Besides, it will be possible to use the most portion of 18000ha agricultural lands, contributing, in turn, to the increase of agricultural production and the employment rate in this region.

Preliminary assessment of this measure is based on the average yields of agricultural lands in Akhuryan RBD. Considering the above and based on the 2015 official data of the National Statistical Sevice of RA, the preliminary annual income has been estimated for the intended use of 18,000 hectares of irrigated agricultural lands.

Estimated annual revenue in case of cultivation of uncultivated agricultural lands in Akhuryan RBD /source: official data of RA NSS, 2015/

Crop type	Sowing area/ ha of plantations	Harvested crops, centner	Calculated average price for 1 centner of agricultural product, EUR**	Generated income, mln. EUR
Cereals and legumes	8723.9	70184.7	22.7	1.6
Technical plants*	144.9	2965.0	123.8	0.37
Potato	960.7	272722.3	26.7	7.3
Truck crops	731.4	303136.1	114.3	34.64
Forage crops*	4052.0	335828.7	95.2	31.98
Vegetables	2117.0	712997.9	1,193	850.5
Fruits, berries	1270.1	177906.6	33.1	5.88
Total	**18000.0**	**1875741.3**	**x**	**932.3**

*Since the average sales prices are missing in the official reports by the NSS, calculation is based on the average market prices.
**Exchange rate used: 1EUR=525AMD

Summarizing the preliminary assessment of the effectiveness with the above approach, the annual revenue will be about **932 million EUR**.

Due to construction of wastewater treatment plants in Gyumri and Armavir the quality of water discharged into the water bodies of Akhuryan Basin will be improved, this will have a significant positive impact on increasing agricultural productivity, as water in the mentioned river basins is mainly abstracted for irrigation purposes. As a result of the operation of these treatment plants about 15,5 mln. cub. m of water will be treated, thus resulting not only in healthier aquatic ecosystems in the basin but also cleaner land. Besides, in several dozens of rural communities in Shirak and Armavir marzes this measure will allow getting ecologically clean and healthy agricultural production due to use of clean irrigation water.

At the same time, it is worth mentioning that there is no market base for ecologically clean agricultural production in the Republic of Armenia, which does not allow making relevant calculations. The availability of "Green markets" would provide additional income from the sales of ecologically clean organic agricultural products.

2.4.2 Construction of Wastewater Treatment Plants Outside of the Defined Agglomerations

General description:
According to EC 91/271 Urban Wastewater Directive, operation of a WWTP is not required for the communities with small population (less than 500 p.e.). In the Akhuryan RBD, there are over dozen of communities with p.e. exceeding this threshold value. For those communities it is recommended to conduct feasibility studies to determine the viable alternative options for municipal wastewater treatment (construction of septic wells, biological ponds, local wastewater treatment facilities, etc). Artik and Maralik towns (with population of around 25000) in the Akhuryan River basin and the town of Talin (with 5300 inhabitants) in Metsamor River basin are viewed as potential sources of significant pressures. There are wastewater collectors in Artik and Maralik towns, which discharge the collected wastewater into Akhuryan River without any treatment. This results in increased BOD, suspended solids, phosphorus and nitrogen in Akhuryan River in some cases up to 25 times.

Wastewaters from the Talin sewage collector are discharged into the Selav-Mastara internal stream bed, thus discharging again into the upper section of the Metsamor River. Industrial wastewater of Talin is also collected and dumped into Metsamor River.

Efficiency assessment:
For more than 100 communities outside of Akhuryan RBD with population exceeding 500 inhabitants absence of feasibility study for construction of wastewater treatment facilities or incorrectly reasoned WTTPs may lead to further projects failure, inefficient use of financial resources and further environmental issues.

2.4.3 Application of Good agricultural practices

General description:
The use of fertilizers for crop production is not significant in Akhuryan RBD. The impact of agriculture on the environment and water resources is mainly through cattle farms. Large pastures in the basin support the development of cattle farming. Cattle breeding has always been a traditional branch of agriculture in the Akhuryan RBD as widespread pastures, geographical position and natural climatic conditions create favorable conditions. This is proven by an annual increase of both livestock capita and livestock yield.

One of the significant pressures from agriculture is the distribution of manure that can cause pollution of water resources. It is recommended to develop a system of manure collection from cattle farms, in order to minimize its impact. This system will include collection and accumulation of manure in septic pits and its further use in the fields. The system will also reduce significant

pressures on bodies of water in the river basin due chemical fertilizers and improve the fertility of agricultural lands.

Such a system of manure management shall include the following components: (1) manure accumulation sites/structures; (2) manure sputtering equipment; and (3) areas for the use of manure (croplands). In 2013 the agricultural lands in the Akhuryan RBD comprised an area of 456,900 hectares, out of which 51% are pastures, 30% - arable lands, 8% grasslands and 3% perennials, and 9% are used for miscellaneous purposes. In the Shirak Valley the main crops are grains, which are cultivated on about 70% of the cultivated land, fodder crops and potatoes. In Armavir region production of vegetables in the green houses has been gradually increasing. Various types of vegetables and strawberry are grown under glass and polyethylene covers on about 1,000 hectares of the land, which enables to provide the national population with fresh vegetables almost all over the year. Thus, there is sufficient area for the 3rd element (areas for the use of manure/croplands) of the suggested manure management system.

2.4.4 Implementation of River Restoration for 11 km of Akhuryan River

About 11 km long stretch of the Akhuryan River (from Berdashen community to Pokr Sepasar community) is diverted through the earthen canal. This was done in 1951, after construction of the Arpilich Reservoir with the purpose of regulating the river flow by straightening the river bed. This diversion has altered the natural regime of the Akhuryan River, and the above-mentioned modified section should be restored. Thus, this particular river restoration includes restoring more natural processes and channel forms to the watercourse (see the Figure 1).

Figure 1. The straightened section of Akhuryan River between Pokr Sepasar and Berdashen communities

The overall objective of the river restoration is to increase natural storage capacity of the river and reduce flood risk through bringing back to former meander. Excess water will be stored in a timely and natural manner in areas where biodiversity is improved. In this way, river restoration will also directly contribute to climate change strategies aimed at mitigating the effects of increased and erratic peak flows and droughts.

Efficiency assessment:
Restoration of natural conditions will improve the flexibility and sustainability of the river ecosystem. Re-meandering straightened channel of the Akhuryan River will help to deliver objectives of the WFD by increasing morphological and flow diversity in a straightened river channel. These more natural conditions can provide better quality habitats for benthic invertebrates, and as a result also improve habitats for fish.
Re-meandering increases the length of a straightened river channel. This decreases flow conveyance, which can effectively store water in the river channel. Re-meandering can therefore decrease flood risks downstream of Berdashen and Pokr Sepasar communities, by reducing hydrological response times during periods of high flows. The latter has significant importance for the Republic of Armenia, considering the frequent floods occurring in recent years. Financial efficiency of such disaster prevention is very high, however it is difficult to calculate since the damage caused by the disasters is unpredictable and may also be non-material (human losses).

2.4.5. Review of Water Use Permit Conditions and Improvement of Enforcement

General description:
The following activities are proposed to improve the water use permit (WUP) conditions and strengthen the enforcement in terms of maintaining ecological flow, regulating water abstraction and return flows:

- Revising water use permit conditions in the Akhuryan RBD and Armenia in general;
- Introducing an online water use control system for selected pilot sites.

It is recommended to review the current conditions of water use permits for construction and operation of the small HHPs in the Akhuryan and Metsamor River basins for the facilities located at the water bodies at risk. The revision should be aimed at enforcing the water use volumes that will provide for maintenance of ecological flow requirements in the rivers, in accordance with methodology defined by the Government Armenia Decision adopted in 2011.

The conditions of the water use permits issued for groundwater abstraction in the Metsamor River basin should be revised based on the findings of the recent and other ongoing assessment studies on groundwater resources in the Ararat Valley. Flow of the Metsamor River, which is fed mainly from groundwater, has reduced by 83% within the period of 1983-2013, while the drop in groundwater levels (as well as artesian water) could endanger the cooling process of the Metsamor nuclear plant. In order to restore the pressure zone of the Ararat Artesian Basin, it is recommended to strictly prohibit drilling of new wells in the Metsamor River basin, including drilling of wells for which water use permits were issued, but were not drilled yet.

Another activity is devoted to improvement of water resources management and ensuring efficient water use through development of a system for an automated, centralized, on-line control of actual water use in Metsamor River basin. It is recommended to take the following steps towards the introduction of the system:

1. Development of detailed Terms of Reference and scope for the system, including identification of technical specifications for water flow meters and data loggers/transmitters to be installed in selected sites (fish farms) in Metsamor River basin;

2. Development of computer program (software) for the water use on-line control system and its integration into the GIS environment. The software should ensure importing the real-time data transmitted from the water flow meters;
3. Procurement and installation of water flow meters and data loggers/transmitters at the groundwater abstraction sites selected as pilot sites in cooperation with WRMA of MNP;
4. Procurement and installation of computer servers at "control points" responsible for manage the on-line system, including WRMA of MNP, Akhuryan Water Basin Management Authority of the WRMA and Armavir Marz Service of the State Environmental Inspectorate of MNP;
5. Implementation of full economic assessment for introduction of the centralized, on-line control system for the whole Akhuryan RBD.

It is recommended to link the proposed system of centralized, on-line control of actual water use into the State Water Cadastre Information System of WRMA.

The developed software should be integrated in a GIS-based environment and have the functionality to cover all water abstraction points, specified in issued water use permits for the basin, as well as to generate reports on water use dynamics within the given period and/or permitted abstraction volume. It should also have alarm system and notify the decision-makers in case of violations of water use permit conditions.

Efficiency assessment:
It is expected that implementation of this measure will result in improved coordination of WUPs issuance procedures, as well as improve the overall operations of the management system. It is worth mentioning that earlier due to lack of adequate assessment of water resources and weak management there was a need to undertake measures for liquidation and//or conservation of illegally operating wells, as well as valve regulation and revision of water volumes provided by the WUPS. About 20190,5 l/sec water savings were made in 2015 or 636,7mln m^3 per year. According to the calculations provided by the «HayJrNakhagits Institute» CJSC (Armenian Water Design Institute) on methodology and costs of liquidation and conservation of deep wells in Ararat Valley, the works for one well will cost 147.16 - 2462.99 thousand AMD (280 – 4,690EUR), depending on the amount of work. Considering the above, it is assumed that adequate implementation of this measure will allow having efficient Water resources management system in place and avoid additional costs that would be needed for elimination of consequences.

2.4.7. Abolish Abandoned and Illegally Operated Groundwater Wells

General description:

To restore the groundwater levels in the Metsamor River basin, it is recommended to:

- Abolish existing 348 emergency, unsanitary and abandoned ownerless wells (according to inventory data of 2006-2007 and inventory in July-October, 2014);
- Close down temporarily or liquidate the required number of wells to reduce abstraction by artesian wells taking into account the wells' impact radius and technical state and converting other wells into valve operation regime.

Efficiency assessment:

The efficiency of implementation of this measure is possible to estimate only from the environmental perspective, as it aims at solving complex environmental issues occurred due to water use and establishes favorable conditions for efficient management of water in the basin.

2.4.8. Investigative Monitoring of Elevated Arsenic Concentrations in Ashotzq and Armavir Regions

General description:

The PoM proposes conducting investigative monitoring in five locations of the Akhuryan RBD, to detect the source and area of Arsenic spreading. These five locations include the following: Aknashen well No 108, Aknashen well No 18, Armavir well, Ashotzq spring and Ashotzq River mouth. The purpose of the investigative monitoring is to identify the source of high concentrations of Arsenic, including the area of spreading the Arsenic, to establish a buffer zone and implement corresponding protection measures.

During the 1st groundwater field survey in 2013, organized within the EPIRB Project, high arsenic concentrations, reaching 80-250 µg/l and from 8 to 25 times exceeding EU norms for drinking water (10 µg/l) were detected in Ashotzq and Armavir groundwater bodies (G101 and G103) of Akhuryan RBD of Armenia. It was assumed that such high concentrations of carcinogenic arsenic are caused by the laboratory error. In order to prove it, conduct further investigations were conducted. Thus, the second field survey was organized in June 2014 to find out if arsenic concentrations in the groundwater bodies of the Akhuryan RBD are really exceeding the allowable norms. Fifteen groundwater samples were collected for the analysis of trace elements, including arsenic. The measurements taken during field operations included water level in monitoring wells, geographic coordinates and temperature in all sampling points (observation and production wells, natural springs and surface streams).

It is proposed to conduct an investigative monitoring in the five locations, mentioned above at least 4 times per year, every season. Detailed report will be prepared based on the results of the analyses, where the causes of the pollution will be presented and mitigation measures for improved situation will be suggested.

Preliminary calculations of the cost of proposed measures were made based on the costs of joint field works conducted within the framework of the EU EPIRB project in 2013 and 2014.

Preliminary assessment of investigative monitoring costs in Armavir and Ashotzq regions

	Unit cost, EUR	Number of points	Number of monitoring cycles	Total cost, EUR
Sampling	50	5	4	1,000
Chemical analysis	200	5	4	4,000
Development of detailed report and recommendations				2,000
			Total	**7,000**

Efficiency assessment:
The efficiency of this measure is not possible to present in monetary values, considering that the results have mere environmental and health importance. Monetary assessment would only be possible based on the monitoring results. Investigative monitoring should provide information on the development of action plan for reaching the environmental protection goals, as well as for mitigation measures for consequences of occasional pollution.

Once the results of the investigative monitoring are obtained, including the area of spreading the Arsenic, it is proposed to establish a buffer zone in iron and molybdenum ore deposits in Ashotzq River basin and implementation corresponding protection measures.

Meanwhile, the responsible institutions in Armavir town have to be informed to check arsenic concentrations in other water supply wells near the city. As for Ashotzq region, the local population in Ashotzq village shall be warned to stop using water from the Ashotzq spring for drinking purposes, given that Arsenic was one of the first chemicals recognized as a cause of cancer (particularly lung, urinary tract, bladder and kidney cancers).

Thus, in this phase it is not possible to precisely evaluate the costs needed for treatment and preventing of those diseases that occur in case of water pollution by the above mentioned hazardous chemicals.

2.4.9. Development of WFD Compliant Monitoring Programme and network for Surface Water and Groundwater bodies

General description:
The proposed WFD compliant monitoring program for surface water bodies includes 40 points. Of this, 24 monitoring points are on rivers, 11 on artificial water bodies such as canals and artificial ponds, and 5 monitoring points are on reservoirs. Preliminary cost-estimate is provided in Table 101 below. The proposed monitoring program should be an integrated programme including chemical, hydromorphological (flow) and biological monitoring as required by the EU WFD.

In the initial 6-year planning period the biological monitoring will only include macroinvertebrates, macrohpytes and fish as the methodologies of the other indicator groups for biological monitoring in rivers are currently far less developed, and the experience needed to address the results of the biological monitoring to status (high, good, moderate, poor bad) of these biological indicator groups is not yet available.

Figures from the joint field surveys within the EPIRB project, as well as from the following reports were used, to obtain cost estimates for these missing parameters, including biological quality elements: “Water Framework Directive compliant monitoring programme for Aghstev pilot basin, Armenia” and “Water Framework Directive compliant monitoring programme for Debed pilot basin, Armenia”, prepared within the EU “Trans-Boundary River Management – Phase II for the Kura River – Armenia, Georgia and Azerbaijan” project in 2011.

Thus, the total cost of WFD compliant surface water monitoring in the Akhuryan RBD of Armenia for the 1st planning cycle (2015-2021) composes about EUR 610,200, of which EUR 28,800 for

biological monitoring, EUR 231,000 for hydromorphological monitoring and EUR 350,040 for physical-chemical monitoring.

2.4.10. Improvement of Water Status Assessment

The Program of measures proposes to introduce a new system for assessment of status of surface and groundwater resources based on the EU WFD approach, which will become a sound basis for integrated assessment of water quality status and setting realistic water quality objectives.

It is proposed to establish a working group on surface and groundwater quality assessment and other relevant areas, with involvement of national and international experts. The group will work over an 18-month period on designing the systems for assessment of ecological and chemical status of surface water resources, and quantitative and chemical status of groundwater resources in accordance with requirements of the WFD. Along with the new assessment systems, the Working group will make recommendations on additional staffing and capacity building for the state agencies involved in management and protection of surface and groundwater resources.

The preliminary cost for developing new systems for status assessment of surface water and groundwater bodies by the working group is estimated at EUR 65,000. Costs for staffing and capacity building of the state agencies must be implemented after completion of the design works.
The last two measures have merely environmental status assessment and improvement focus, thus efficiency indicators are not possible to express in monetary values.

In general, the efficiency of most of the discussed priority measures was possible to express in terms of environmental benefits due to their merely ecological nature.

3. ANALYSIS OF INSTITUTIONAL AND ORGANIZATIONAL ARRANGEMENTS FOR MPLEMENTATION OF RIVER BASIN MANAGEMENT PLAN IN AKHURYAN RBD

The institutional dimension has a key role in policy-making. Implementation of the plan, apart from economic aspects, depends on organizations and their interactions, and very often limitations in governance arrangement may become obstacle in implementation of the plan.

Relevant legal and institutional frameworks in Armenia are presented below, as well as an analysis of the strengths and weaknesses for implementation of the Akhuryan RBMP.

3.1. Legal framework

The requirement to introduce river basin management principle is included in the Water Code of Armenia, adopted on June 4, 2002. Among other issues, the Code includes the idea of integrated river basin planning, development of RBMPs and requires the establishment of basin management authorities. Since adoption of the Code, a number of regulations and by-laws have been developed to guide implementation of the basin principle.

In December 2004 the Government of Armenia adopted Resolution No 1749-N, which defined the boundaries of the water basin management areas (river basin districts, RBD). Currently there are 6 RBDs in Armenia, which combine 14 hydrological river basins: Akhuryan, Ararat, Hrazdan, Northern Basin, Sevan, and Southern Basins.

The Water Code of Armenia, Law "On Fundamental Provisions of the National Water Policy" (from 2005), and Law "On National Water Program" (from 2006) require development of river basin management plans (RBMPs) and subsequent adoption by the Government.

Article 10 §8 of the Water Code requires a provision "for development of water basin management plans and implementation thereof". According to Article 11, the Water Basin Management Authorities shall develop water management plans based on the National Water Program and by coordinating sector and public interest into the development of those plans.

Article 17 stipulates that Water Basin Management Plans shall be based on the National Water Program. They shall balance the interconnected relationship of all water users, including communities, power generation, industry, agriculture and environment.

The Water use permits shall be issued in compliance with the Water Basin Management Plan (Art. 28, 29, 31, 33, 40).

3.2. Institutional framework

The *National Water Council*, chaired by the Prime Minister of Armenia, is the highest advisory body for water resources management. It provides guidance on issues concerning the National Water Policy, National Water Program, and other legal aspects. Draft laws and amendments are submitted to this body. The potential power of this council is unique and singular. However, the National Water Council does not have direct staff (or a secretariat) to coordinate information, policy, and program recommendations. The *Dispute Resolution Committee*, responsible for resolving disputes related to the issuance of water use permits, is under the National Water Council.

The *Ministry of Nature Protectionof the Republic of Armenia* has overall responsibility for natural resources management and protection, including atmosphere, water, soil, flora and fauna, and forests.

The *Water Resources Management Agency* (WRMA) under the Ministry of Nature Protection has the responsibility for implementing the government's water resources management and protection plans (for both surface water and groundwater) under the Water Code (2002). This includes providing water availability and use estimates, water use regulation and allocation, issuing water use permits, monitoring, developing river basin management plans (RBMPs), ensuring that environmental needs for water are being met, and classifying water bodies. The WRMA is also responsible for the maintenance of the State Water Cadastre.

The WRMA has three divisions: (a) the Water Basin Planning Department, which participates in water resources protection planning and water distribution planning, develops medium-term water allocation plans, and links to communities via its water basin management bodies (BMOs); (b) the Water Cadastre Maintenance and Monitoring Division, which mainly maintains information regarding water use permits; and (c) the Water Use Permitting Department, which manages the water use permitting process.

There are six *Basin Management Organizations* (BMOs) under the WRMA, responsible for interfacing between the WRMA and the local communities in the basins. The six BMOs are subordinate to the WRMA and support the WRMA in administering its water protection and conservation responsibilities. Thus, BMOs are responsible for participating in development of water basin management plans, recording water use permits, ensuring water resources protection, assuring compliance with conditions set in water use permits, developing extraction regimes, and participating in the development of water allocation plans for their respective basin management areas.

The *Armenian State Hydro-meteorological and Monitoring Service* (ASHMS) of the Ministry of Emergency Situations (MES) is the authorized agency for monitoring surface water quantity, as part of the regular monitoring of meteorological and hydrological conditions. Collected information is used to prepare projections on unfavorable hydro-meteorological phenomena such as floods, storms, extreme increase/decrease of atmospheric temperature, thunderstorms, dust storms, heavy precipitation, hail, avalanches, droughts, and others. The ASHMS maintains an electronic database and prepares annual reference books based on obtained monitoring data, as well as provides summary data to the WRMA for inclusion in the State Water Cadastre Information System (SWCIS).

The *Environmental Impact Monitoring Center* SNCO (EIMC) of the MNP is responsible for monitoring of atmospheric air quality, surface water quality and soil pollution. The water quality monitoring system in the country has been established in 1964. After 1992 the extent of water quality monitoring activities was significantly decreased. Since 2007 the MNP-EIMC has expanded its activities again to currently collecting samples from 131 observation points - 39 large and medium size rivers, 6 water reservoirs and Lake Sevan - annually throughout the country.

The *Hydrogeological Monitoring Center SNCO* (HMC) of the MNP is responsible for the monitoring of groundwater resources. Although periodic observations of groundwater wells and springs have been conducted since 1950s, between 1990s and 2005 all monitoring was suspended, although nearly 96% of Armenia's drinking water is provided from groundwater sources. Between 2006 and 2008, the MNP-HMC re-introduced groundwater monitoring on a limited number of locations. Since 2009 the MNP-HMC's hydrogeological monitoring network included 70 sampling points, however later monitoring budget has been increased about 2.5 times and starting 2015 hydrogeological monitoring is conducted in 128 observation posts instead of the previously used 70 posts.

State Committee on Water Systems under the Ministry of Agriculture is responsible for management of water systems under state ownership, support to establishment of Water Users' Associations and Unions of Water Users, arrangement of tenders on management of water systems.

The Public Service Regulatory Commission (PSRC) of Armenia is responsible for regulating the Public Utility Sector, comprised of the: energy sector, water sector and the telecommunication (electronic communication) sector. The PSRC sets the regulated tariffs for water supply and waste water services proposed by the water utility companies according to the tariff methodology established. It also issues licenses/system use permits for respective services based on the procedure established by legislation, including licenses for construction and/or operation of hydropower facilities. It also approves model contracts between the public utility companies and users.

3.2.1. Weaknesses in RBMP

River basin management planning needs to be improved, and a strategic vision is required for IWRM in each basin in the country. Despite the various initiatives and multiyear efforts supported by the donor community, the water sector in Armenia still faces many challenges with respect to river basin management planning due to weak capacity and inadequate information and analytical tools.

The skills and data needed to carry out modeling and planning work are not yet available within the BMOs. The current river basin planning model relies heavily on the European Union Water Framework Directive and focuses primarily on achieving good ecological status of water bodies. Broad intersectoral planning that takes into account water, agriculture, energy, and environment linkages is not sufficiently developed.

Government endorsement of such plans is needed to ensure that all levels of government have a consistent approach to water management and clear prioritization of future investments. Analysis and knowledge of what would be the best allocation (both in terms of economics and efficiency) for the different water users in each basin is needed. This is despite the fact that water permit and allocation decisions are routinely being made. Currently, the planning of irrigation, water supply, and hydropower investment programs, which are managed at the central level, has limited relationship with the RBMPs. Thus, a clear disconnect exists between the basin plans and sector programs and budgets.

Moving forward, the government will need to invest budgetary resources in these multi-departmental basin planning efforts. Lack of State-level budget is likely to undermine ongoing planning efforts and the full participation of BMOs in river basin planning.

Some of the issues that may hinder the process of RBMP implementation in Armenia are presented in more details below:

3.2.2. Insufficient monitoring of water quality and quantity

Data collection and information management are weak. Despite improvements in recent years, limited financial and human resources hamper the collection of sufficient data covering the spatial-temporal and parameter extent necessary for informed decision making, for groundwater, surface water as well as related thematic fields. Monitoring networks were minimized following Armenia's independence. Today, salaries are too low to attract and keep capable staff, and

financing is insufficient to maintain or update technical resources – hardware and software – to meet modern requirements. Over the last decade, investments in monitoring have been done on occasional basis through provision of some pieces of equipment by donors. New practices cannot be introduced, lacking possibilities for hardware purchase, staff training, methodology development, even when international donor support is provided, e.g. on bio-monitoring in compliance with the EU WFD.

While the State Water Cadastre Information System presents a new approach to data management and information sharing in Armenia, many of the participating institutions have not fully adopted the concept of "open access" – the sharing of data among institutions and the public has yet to be improved.

Though a network of surface water and groundwater monitoring exists, additional investment is needed to ensure adequate future IWRM planning. Some clear gaps are observed (on a case-by-case basis) with each agency with monitoring functions. For instance, strengthened groundwater monitoring that involves improving the understanding of the various aquifer layers and changes over time is needed.

3.2.3. Insufficient skills and capacity within water management institutions

Despite the various initiatives and multiyear efforts supported by the donor community, the water sector in Armenia still faces many challenges with respect to river basin management planning due to weak capacity and inadequate information and analytical tools.

The skills and data needed to carry out modeling and planning work are not yet available within the basin management organizations. Ensuring compliance with water permits is also currently hampered by insufficient resources and weak agency capacity. Thus, building the capacity of the WRMA and BMOs will be critical in these regards.

3.2.4. Lack of legislation regulating and supporting wastewater treatment, drinking water, irrigation water standards etc.

Although there is significant legislative base regulating water resources management, however, the issues related to irrigation water standards, as well as drinking water regulation still remain unaddressed. As a result, industrial and other entities (hotels, restaurants and other facilities) discharge untreated water directly to open water bodies, rivers and lakes.

Insufficient financing of water sector

Insufficient financial resources are a major problem for improved water management in Armenia. Implementation and enforcement of existing legislation is also hampered due to insufficient funding, inadequate laboratory infrastructure and equipment. Despite improvements in recent years, limited financial and human resources hamper the collection of sufficient data covering the spatial-temporal and parameter extent necessary for informed decision making, for groundwater, surface water as well as related thematic fields. Monitoring networks were minimized following Armenia's independence. Today, salaries are too low to attract and keep capable staff, and financing is insufficient to maintain or update technical resources – hardware and software – to meet modern requirements. New practices cannot be introduced, lacking possibilities for

hardware purchase, staff training, methodology development, lack of sufficient technical tools and equipment and relevant skilled specialists.

Water tariffs recover operation and minimum maintenance expenditures of water and sewerage facilities but do not recover the operation and maintenance expenditures of wastewater treatment. They do not contribute to investment except in Yerevan. Capital investments are funded by external grant and loans guaranteed by the government. Except in Yerevan, loans are reimbursed by the State budget without consumers' contribution.

The share of water abstraction and pollution fees in the water tariff is at a very low level (less than 1 % of amount of the water bill) compared with EU countries where it represents till 10 %. This level neither finances sufficiently the specialized institutions in charge of water resource management, nor provides incentive to reduce water losses, nor enables to implement the River Basin Management Plans under preparation.

3.2.5. Large losses in water distribution and water-use systems

The public-private partnership approach has shown success, particularly with improving water supply duration, water meter installment, and collection efficiency. Compliance with water quality requirements has also improved and energy consumption has, in most cases, been reduced. However, levels of nonrevenue water have remained high (70–85%), of which approximately 45% is estimated to be technical losses, such as leakages due to the age and very poor state of the physical pipelines and assets, and 40 percent comprises commercial losses, including non-payment, underpayment, and theft (World Bank, 2011).

3.2.6. Insufficient compliance of water use permits

The permitting process is the main regulatory tool for IWRM. The Water Resources Management Agency (WRMA) has the primary responsibility of issuing WUPs. More specific guidelines on the permitting process were prepared in 2003 to support the WRMA. The water use application contains a basic description of the proposal for water use and an analysis of its possible effects on water resources, ecosystems, protected areas, and people. The WUP applies to withdrawals from surface water and groundwater and controls the amount of extraction and the discharge quality. The WRMA determines the necessity of performing an environmental impact assessment. Public input is solicited at various points in the permitting process.

Despite significant progress made in WUP procedures during the last several years, there are still gaps and insufficiencies in the existing procedures. Ensuring compliance of water permits is currently insufficient due primarily to lack of resources and capacity. Greater cooperation (perhaps legislated) on inspection and enforcement is needed between the WRMA and the SEI to reduce duplication and overlap in functions and increase monitoring efficiency.

Though the legislation provides the broad contours of how WUPs are to be applied, including the application process, contents, and criteria for review, it does not provide adequate guidance on compliance assurance and enforcement. Moreover, the full effectiveness of the water permit function is not possible due to lack of human, technical, and financial resources for compliance and weak public participation input (USAID, 2007).

Defining the optimal methodology for calculation of ecological flow remains an issue that needs urgent solution, considering that rapid development of the small HPPs, leaving insufficient ecological flow in the rivers, had significant negative impact on some river ecosystems in various basins of Armenia.

3.2.7. Insufficient water storage capacity

Per capita storage capacity in Armenia is much lower than the capacity of its neighbors, with the exception of the Islamic Republic of Iran.

Storage plays an important strategic role in the regulation of variable surface runoff in Armenia. This is critical for the irrigation, water supply, and energy subsectors, particularly in the semiarid regions where rapidly growing populations are facing depletion of groundwater resources. A comparison with its neighbors shows that Armenia's per capita storage capacity is much lower (with the exception of the Islamic Republic of Iran). Though many of the earlier plans for reservoir development date back to Soviet days, an updated strategic master plan that addresses economic, financial, environmental, and social dimensions, including transboundary and climate change impacts, is missing (Winston et al., 2015).

Moreover, many of the current incomplete dams and existing feasibility studies would need to be updated to reassess the technical and economic viability of the investments. These large investments should be considered and analyzed within the context of overall river basin planning.

3.2.8. Public participation

To provide greater transparency and public participation in the decision-making process, public notice and environmental impact assessment requirements are part of the WUP application process. These are highlighted in the Water Code. Article 5 (on basic principles of management, use, and protection of water resources and water systems) recognizes the importance of public participation and awareness in the process of management and protection of water resources. Article 20 (on public participation) lists the items that are subject to public notice (for example, draft RBMPs, pending WUPs, draft water tariff strategy, and draft water standards). Article 106 (on participation of nongovernmental organizations and citizens in the protection of water resources and water systems) defines the role of nongovernmental organizations and citizens in this process. The Water Code also provides a mechanism by which the public may file a complaint on a WUP decision. Finally, the specifics on public consultation are fixed in government Resolution 217-N (07.03.2003) on Approving the Procedures for Ensuring Public Notification and Transparency of Documents Developed by the Water Resources Management and Protection Body, and its subsequent amendment of March 3, 2005.

The current permit guidelines require public notification and comment at the initial review process and then after a final decision. They do not require public notification on the proposed decision. Hence, potentially affected stakeholders do not have an opportunity to study any reports on the impact of the proposed application and the proposed permit conditions before the final decision. Thus, the procedures for public notification and appeal need improvement. The WRMA should provide ample time to the public to study the results of any impact studies, the justification of the

proposed decision, and the proposed conditions for the permit. A few weeks after the provision of this kind of information, a public hearing could be organized by the BMO.

3.2.9. Conclusions

The above analysis shows that despite the various initiatives and significant reforms in the water management sector of Armenia, there are still many challenges with respect to river basin management planning.

While the main institutional framework is established, some of the functions of the WRMA and the six BMOs still remain unfulfilled. Development and implementation of RBMPs is hampered by insufficient staff, weak capacity and inadequate information and analytical tools at the WRMA and BMOs.

The EU WFD largely relies on biological monitoring data, whereas biological monitoring is yet to be established in Armenia. Inadequate monitoring and insufficient data exchange on water quality and quantity among relevant agencies is one of the main issues that need to be regulated. Refurbishment and further enhancement of the State Water Cadastre Information System could serve as a useful tool for basin planning.

Water Use Permits issuance process and their compliance assurance are important for adequate control of water use in the basin. The roles and functions of the BMOs and SEI should be clearly defined to ensure the above.

Clear public participation mechanisms could also contribute to basin planning and implementation activities. Continuous and improved education and training programs on ecosystem approach, environmental impact assessment and other relevant aspects would be beneficial for the staff of relevant water management agencies and other stakeholders in the basin.

Thus, continuous donor support, capacity building and technical assistance along with the increased state budget allocations would be essential for the implementation of basin plans in Armenia.

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