

Environmental Management Plan

Semestral Report
January 2012

ARM: Water Supply and Sanitation Project – Improvement of Water and Sanitation Systems of Town Agrak and Village Karchevan

Prepared by Armenian Water and Sewerage Company for the Republic of Armenia and the Asian Development Bank.

APPENDIX

Contract No. L2363-NCB-1-08/2

Part D – Special Conditions of the Contract

SUB-PROJECT XIII – SETTLEMENTS OF MEGHRI REGION

PACKAGE XIII.2 – IMPROVEMENT OF WATER AND SANITATION SYSTEMS OF TOWN AGRAK AND VILLAGE KARCHEVAN

ENVIRONMENTAL MANAGEMENT PLAN



TABLE OF CONTENT

1. INTRODUCTION.....	4
2. SCOPE OF WORK	5
2.1. Description of the existing water supply system.....	5
2.2. Description of the proposed rehabilitation works	7
3. DESCRIPTION OF PRESENT CONDITIONS	8
3.1 The geographical location and climate of the residential areas.....	8
3.2. Environmental Examination.....	9
4. ENVIRONMENTAL AND SOCIAL IMPACT	11
5. MEASURES TO MITIGATE FOR ENVIRONMENTAL AND SOCIAL IMPACTS	12
6. ENVIRONMENTAL PROTECTION MANAGEMENT.....	13

Appendix A - ENVIRONMENT MANAGEMENT AND MONITORING PLAN

Appendix B - EMP CHECKLIST

LIST OF ABBREVIATIONS

RA	MNP - Republic of Armenia Ministry of Nature Protection
RA	MH - Republic of Armenia Ministry of Health
RA	MTG - Republic of Armenia Ministry for Territorial Governance
RA	MC - Republic of Armenia Ministry of Culture
LSGA	– Local Self-governing authorities
EIA	- Environmental Impact Assessment
AWSC/ADB PMU	-“Armwatersewerage” /Asian Development Bank Project Management Unit
EMP	Environmental Management Plan
IEE	Initial Environmental Examination
DD	Detailed design

According to the ADB Environmental policy (November 2002), the sub-project is ranked to Category B, which does not require a full/large scale EIA. The sub-project does not require also Conclusion of Environmental Expert Examination, in accordance with the RA legislation - RA Law on Environmental Expert Examination (20 November 1995) and RA Government's Decision on limit sizes of planned activities subject to Environmental Expert Examination (N-139, 30 March 1999).

1. INTRODUCTION

This report has been developed for the XIII.1 package of the XIII sub-project for improvement of water supply and wastewater systems of settlements in Meghri region of Syunik marz and covers town Agarak and village Karchevan.

The sub-project design was implemented by JINJ Ltd. and HGSN joint venture. The preliminary design has developed designed proposals for improvement of the above mentioned sites water supply systems at Meghri region and has done investment assessments of implementation of measures.

It has been planned in the detailed design (DD) to do the following works at the above mentioned communities: reconstruction of WTP building industrial part, repair of production structures, replacement of technological section emergency pipes and nodes, reconstruction of pipe-line from WTP to Agarak, repair of Agarak 2x200m³ capacity DRRs that are currently out of operation, construction of valve nodes, design of distribution network at Karchevan village and construction of inlet lines for individual houses.

Adverse environmental impacts can be both in the course of construction implementation and during further operation of water supply systems. The impacts during construction can be cutting of vegetation, land erosion, air pollution, as well as land and water resources pollution with lubricants, chlorine, household and construction waste.

Adverse environmental impacts are reduced during the operation stage and are related to undue implementation of operational rules.

One of the essential positive environmental impacts is water resources protection, water loss reduction and sustainable use, as well as potable water quality improvement after reconstruction of water mains and cleaning of water supply chambers.

Social and economic impact of water systems improvement are mainly positive - excluding mixing of drinking, irrigation, and sewerage water, reduction of water pollution hazard, preventing, excluding penetration of infectious disease viruses into drinking water; increasing duration of water supply to population, providing sustainable water use, reasonable water consumption.

Below the description of possible adverse impacts during various stage of the project implementation is provided, as well as the proposed mitigating measures.

- *Design stage*

Design works have been implemented by JINJ Ltd. and HGSN Ltd. joint venture, which was selected as Consultant for ADB funded “Water supply and sanitation project”. The design documents include items on climatic conditions, relief, soil types, hydrology, vegetation types and the requirements for obtaining the required permits from the Ministry of Nature Protection, other ministries and from the community leader. The documents include also appropriate environmental and social parts. The design package includes also the Environmental Management Plan (EMP) of this package. The project Consultant shall follow the corresponding provisions of RA environmental and social legislation, as well as ADB’s guidelines and strategies, mentioned in the Contract.

- *Construction stage*

In general, during the construction stage the Contractor must follow the measures provided in the EMP.

- *Operation stage*

The operation must be implemented in accordance with the operation rules and standards.

To reduce adverse environmental impacts during the construction and operation stages, EMP has been developed, which represents the list of the required measures (Appendix A).

2. SCOPE OF WORK

2.1. Description of the existing water supply system

In this package XIII.1 Meghri region town Agarak and village Karchevan (served by AWSC Ltd.) are included.

Agarak Water Treatment Plant

Agarak WTP is allocated at 1280-1300m altitudes North-West from Agarak town. The WTP is fed from Vahravar and Ayri rivers through water intake structures. From the water intake structures water is fed to WTP by gravity. Total flow from the water intake structures that are on the above mentioned two rivers makes about 70l/sec.

Currently water clarification is not carried up completely. The reagent and junction chambers do not function. The water to be processed is directly given to suspended water clarifiers, then – to velocity filters. Afterwards, the already filtered water is collected into 250mm diameter collector through 150mm diameter pipes, from where is supplied to 2x200m³ capacity DRRs (in the plan – round DRRs) allocated in the WTP territory.

There is a chlorination station with “ALLDOS” chlorinating equipments. Water is supplied to the chlorination chamber from the filter cleaning pump station through a pump installed for the purpose. From the chlorination chamber water is supplied to DRRs.

Some WTP productive constructions parts are in emergency. Nearly all valve nodes are in emergency, too. WTP building roof and filter cleaning pump station roof, are completely deteriorated, the stones at some parts of the walls have fallen.

Water-line from WTP to Agarak and DRRs

Today water supply to town Agarak is carried out through two main systems:

1. From WTP to Agarak
2. From Agarak deep wells to Agarak.

The WTP – Agarak water main is a 150-200mm diameter steel pipe-line that starts at WTP DRRs. The water main passes through Agarak Copper-molybdenum plant territory. Within the plant territory there is a $W=200\text{m}^3$ capacity round DRR at 890.0m altitude, that also serves as a break pressure chamber, from where water is directly supplied to town Agarak distribution network. The water main is $L=7.5\text{km}$ long. Currently WTP – Agarak system supplies water to town Agarak individual households, and the water supply to multi-flat buildings is carried out from Agarak deep wells through 200mm diameter water main.

WTP – Agarak water main passes through the way to the mines, where the grunts contain chemically active substances and emergency cases are frequent at this part.

North-West from the town at about 710.0- 715.0m altitudes, $2\times 200\text{m}^3$ capacity DRRs are allocated that do not function. At DRR territory the technological pipes and valve nodes are in emergency. The about 150m long 150mm diameter pipe-line from DRRs to the network is also in emergency.

Village Karchevan Distribution Network

Village Karchevan is served by AWSC Ltd. The village is allocated at 890-970.0m altitudes. Village Karchevan water supply, too, is carried out from Agarak WTP through about $L=3.5\text{km}$ long 100mm diameter water line.

Currently water supply from WTP to the village is carried out with 24 hour schedule, but there is no distribution network in the village. Only one about 600m long 100mm diameter water line passes through the village main street, that is completely deteriorated and in emergency. There are community water springs on some parts of the water line, from where water is supplied to the inhabitants according to agreed schedule, through ppe-lines installed by the community means. Most pipe-lines are installed over ground. The village has no sewerage system, but certain households have their individual sewage lines.

The village has no irrigation system. Potable water is used for irrigation purposes.

2.2. **Description of the proposed rehabilitation works**

For town Agarak and village Karchevan water supply systems improvement the following activities are planned to be implemented at the above mentioned sites:

For Agarak water treatment plant it is planned:

- To completely repair 2 Agarak WTP building,
- To repair technological pipe-lines, and to reconstruct perforated pipes that feed the clarification chambers and eliminate the waste,
- To change all valve nodes,
- To construct reagent chamber,
- To repair turbulent junctions,
- To install total L=90.0 m long PE pipe-lines,
- To install total L=199.0 m long steel pipe-lines,
- To construct wastewater and chlorination water reserve chambers,
- To repair filter cleaning pump station building cover and roof,
- To reconstruct covers of the 2x200m³ round DRRs.
- To install general power electricity supply network to WTP building, as well as heating constructions.

The DD also plans the deconstruction of the 1/3 part of WTP building that will not be repaired.

For WTP – Agarak water main and the DRRs it is planned in the DD:

- To connect the newly constructed about 2.5km long section to the water main that will bypass Agarak Steel-molybdenum plant: The new water main passes through village Karchevan, routing Agarak-Karchevan highway,
- To construct pressure reducing valve node and outflow chamber on the water main,
- To repair the existing 2x200m³ capacity DRRs,
- To change all inlet and outlet technological pipes at DRRs territory,
- To construct valve nodes and water elimination chamber,
- To construct valve nodes on the way to DRR and within the network,
- To fence DRRs territory,
- To construct L=160 m long pipe-line from DRRs to the network.

For village Karchevan distribution network it is planned:

- To completely construct village Karchevan distribution network, providing individual inlet lines for all individual households,
- To implement zoning within the distribution network (two main zones) to avoid unallowable high pressures.

Table 1. Construction works proposed under the sub-project

Name of community	WTP repair mxm	Water-lines de40-de110 km	DRRs repair W=330m ³	Break pressure chambers	Regulating and water metering chambers	Buried valve nodes (pcs)	Connections to individual households (pcs)
Town Agarak	24 x 17.6	0.2	2	2	5	1	-
Village Karchevan		0.85	-	-	-	4	96
Total	24 x 17.6	0.16	2	2	5	5	96

According to the data, received from the town municipality and village administration, the number of population for two sites is 6303, as of 01.01.08 (Agarak – 5900, Karchevan – 403). Taking into consideration future development growth (up to 2023) by 0.8% of annual growth, the number of design population will be 7103.

The water demand rate is assumed as 200L/ day per capita.

As a result of the works to be implemented for water supply distribution network construction and renovation, the distribution network average hourly water demand ($Q_{av,h}$) varies from 1.05 l/sec (village Karchevan) to 19.08 l/sec (town Agarak).

At town Agarak there are both 1-2 storey individual houses and up to 5 storey multi-flat buildings. Village Karchevas has mainly 1-2 storey individual houses.

Total consumer number of the residential areas involved in this package is about 1356.

According to the agreements reached with Agarak municipality and Karchevan village council, regardless of installed/renovated pipe-line diameter or purpose, the following should be done after construction works are over:

1. Asphalt-concrete cover should be rehabilitated after the works are over,
2. Grunt covers should be rehabilitated after the works are over.

3. DESCRIPTION OF PRESENT CONDITIONS

3.1 The geographical location and climate of the residential areas

Town Agarak and village Karchevan are located in Southern part of Syunik Marz, at 380.0km distance from Yerevan city.

The region has dry, subtropical climate.

Absolute maximum air temperature is +41⁰C.

Absolute minimum air temperature is - 18⁰C.

Annual precipitation is 283mm. Western and Eastern winds with 1,6m/sec velocity predominate here. During 20 years, winds of 28m/sec velocity are possible. Snow cover thickness reaches 27cm. Snow cover pressure – 50kg/m² Maximum land freezing depth is 20cm.

Residential areas are located at 555-970m altitudes.

From seismo-tectonic view the area is located within the fold zone range of Armenia. According to the tectonic map of the territory of Armenia, an abyssal tectonic break is passing through Karchevan river bed from North to South. The area is considered to be one of the seismically most active zones of the Armenian Plateau.

According to the RA CC II-6.02.2006 the region is included in the third seismic zone: village Karchevan – I (first seismic zone) and town Agarak III (third seismic zone) with 0.20g and 0.40g phone accelerations respectively.

From hydro-geological point of view the region is poor in water. The underground waters contain unpartitioned consolidations of radical beds as well as adduced beds and belong to porous void type of fracture void, partially terrace water subtypes.

3.2. Environmental Examination

Town Agarak and village Karchevan are located on the left bank of Araks River, at about 600m altitude.

From geomorphologic point of view the region is located on Karchevan River V-shaped gorge slopes and hills.

From orographical point of view the area is located in mid-mountain and downhill parts of Zangezur mountain range South-Eastern spurs. The relief is of volcanic type, with continental carbonic strata, is a cut relief high mountainous zone.

The geological structure of the area consists of middle Eocene Oligocene period rock complexes covered with quaternary alluvial, elluvial, delluvial-prolluvial, delluvial strata formations. The strata thickness varies between 0,5 ÷ 3.0m.

From hydro-geological point of view different volcanic type fractured ground waters are common in the region.

From hydro-geological point of view, the region is poor in water. The underground waters contain unpartitioned consolidations of radical beds as well as adduced beds.

According to published literature data the underground waters with radical beds are located at 15.0m depth, and the ground waters with adduced beds - at 2.0-10.0m depths that can bring forth great amount of outflow.

Among dangerous physical-geological processes and phenomena there are universal surface washing (by surface waters), erosion and intrusive weathering and decay, for the intrusive rocks are eroded easily, thus resulting to elluvial origin beds with sand and large grained

soil. The area is allocated at Karchevan River, Araks River left rivulet, outlet cone zone, partially covers the above mentioned rivers' large-ground and slope erosion-weathering hills.

In Syunik Marz Agarak region mountain-brown, mountain-black, mountain-forest-brown land types are dominant.

The region is in Meghri floristic region of Armenia. It is one of the twelve floristic regions in Armenia with certain specific peculiarities. The region is rich in flora species co-existence from low mountain zone (400m below sea level) to alpic zone of Zangezur and Meghri mountain range (3000m above sea level). Here all floristic types of Caucasus are available, except subtropical plants. Especially Meghri is rich in plant varieties: on a territory of 800 km² more than 1700 vascular plants exist, i.e. about half flora species types of Armenia. About 25 of the endemic species are specific to Meghri region, and more than 100 are South Caucasus endemic species, about 100 are considered as unique and endangered and are recorded in the Red Book of plants of Armenia.

Town Agarak and village Karchevan are in the *Artemisia* semi-desert zone. The specific plant type is *Artemisia fragrans*. In spring the territory is usually covered with ephemeres (*Ceratocephala falcata*, *Anisantha tectorum* and others). Also *Capparis spinosa*, *Zygophyllum fabago*, etc., are common here. Upwards on the mountainhill mountain-chserophit groups are spread, that have specific pillow-shaped forms, low trees, mixed juniperus thin woods and bushes (*Acantholimon Astragalus*, *Rhamnus*, *Amugdalu communis*, and other sorts). The so called “speckled- flowery” plants are very interesting. There are 131 tree-bushes sorts. *Quercus araxina* woods are common here with other types (*Cephalanthera rubra*, *Coeloglossum viride*, *Epipactis helleborine*, *Ophrys caucasica*, *Steveniella satyrioides*). On upper mountain zone are woods where *Quercus iberica*, *Quercus macranthera* occur. *Quercus macranthera* grows at 2400-2600m altitudes, too

On middle mountain zone dry rocky hills *Rosa atropatana* grows. Economically useful eatable plant sorts of the regions are *Onobrychis*, *Trifolium*, *Medicago*, *Alopecurus* about two thousand sorts, medicinal plants: *Crataegus*, *Rhamnus*, *Juniperus*, *Berberis*, *Rosa*, *Hypericum*, ether-oil plants, etc.

No species registered in the RA Red Book were identified in the region.

The invertebrata fauna mainly consists of ancient mediterranean, Iranish-Turkish, Krimean-Caucasian and Caucasian origin species. The invertebrata fauna is rich with endemic sorts. In particular *Phytodrymadusa armeniaca*, *Nocarodes armenus*, *Dictyla subdola*, *Geotomus punctulatus*, *Amphicoma eichleri*, *Cantharis araxicola*, *Tomomyza araxana*, *Bombilius schelkovnikovi*, *Shadinia akramowskii*, *Gabbiella araxena*, *Pupilla bipapulata*, *Zodarion petrobium* and other sorts.

Of mammals *Microtus arvalis*, *Martes martes*, *Vulpes vulpes*, *Erinaceus auritus*, *Nyctalus noctula*, *Vespertilio ottevi*, *Plecotus auritus*, etc., are common.

Herpetophauna has 26 species (11 reptile types, 13 snake types, 2 tortoise etc.).

More than 50 bird types, such as Phasianus colchicus, Francolinus francolinus, Oenanthe xanthopyrma, etc., occur in restricted sites.

In Araks River there 13 fish species, of which Siluridae, Salimo beghlou are predominant. Mountain rivers are specified with Salimo Trutta Fario.

In the sub component implementation area there are no specially protected zones. The selected residential sites do not have cultural, archeological or historical-cultural heritage. The information was obtained as a result of survey with town municipality and village head based on ADB survey form.

4. ENVIRONMENTAL AND SOCIAL IMPACT

During implementation of this sub-project there will be possible adverse and positive impacts on environment and human health.

Among the possible positive impacts as a result of rehabilitation of water supply and wastewater system of the sites are:

- water loss reduction,
- increasing duration of water supply to population, providing sustainable water use,
- reduction of water pollution hazard, providing high drinking water quality;
- preventing, excluding penetration of infectious disease viruses into drinking water;
- improvement of health condition of population;
- reasonable water consumption through introduction of water metering system.

As a significant positive impact also water resources protection against depletion is to be mentioned as a result of their save use.

Initial environmental examination (IEE) has identified that in the area of water supply system improvement in the villages no adverse impact is anticipated in the landscapes, flora and fauna.

Possible adverse impacts are mainly related to the construction and are limited and short-term. To prevent them mitigation measures have been planned and environmental management and monitoring plan has been developed; the constructor, supervising authorities shall follow the plan.

EMP and monitoring plan are environmental assessment document and are included in working drawings.

Based on the initial assessment, the following adverse impacts can be expected:

- Air pollution,
- Noise,
- Traffic congestion,
- Soil erosion and sediment transport,
- Environment pollution with household and construction waste,
- Land and water resources pollution with fuels and lubricants,
- Land and water resources pollution with chlorine.

The sub-project will have significant positive environmental results. It will reduce land and water resources pollution risk, as WTP – Agarak water main routes the way to the mines, where in the grunts chemically active substances are available, and emergencies are frequent in that part. The about 150m pipe-line from DRRs to the network is also in emergency.

The sub-project implementation will also have positive social results. It will immediately improve the life quality of the project-involved sites and the surrounding environment by providing sustainable and reliable water supply and safe use of water resources for about 6.5 thousand people.

5. MEASURES TO MITIGATE FOR ENVIRONMENTAL AND SOCIAL IMPACTS

To prevent soil erosion and sediment transport, the following is to be implemented: in inclined sites of the water line route implement measures for retaining the inclinations to prevent soil erosion and sediment transport; minimize the time during which trench and pit excavations for regulation and metering nodes are open

Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design:

- recover the asphalt-concrete cover in the streets in a good condition;
- recover earth covers in streets with deteriorated asphalt-concrete streets and earth streets.

To exclude **land and water resources pollution with fuels and lubricants**, the latter must be stored on a sealed surface, away from water resources, plan use of special tanks for their collection, which will then be removed to special sites envisaged for re-treatment.

To prevent **environment pollution with construction and household waste**, remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.

To exclude **land and water resources pollution with chlorine**, organize works for washing the water supply distribution network with chlorine, according to technical calculations. Provide appropriate technical means; implement chlorine discharge to surface water body or land area after washing the pipes, according to the regime planned under the design.

Water quality change – Environmental monitoring plan must include also control over water quality and residual chlorine level.

To reduce **dust during the construction works**, the construction site and roads are to be regularly watered, and to prevent **noise**, night work in residential areas is to be limited, and usage of machines/equipment with extra noise is to be avoided; installation of silencers if needed.

To reduce **disturbance to population because of overloaded roads** safe area for trucks is to be provided; waste on the construction site must not be accumulated and burnt, construction should be implemented in stages, adequate notice of construction activities must be given to the population, effective road signs, diversions or barricades are to be provided.

To prevent hazards for workers and the population during the construction, the following must be implemented: install fencing around construction site; control access of unauthorized persons to site; place warning signs in dangerous places; carry out regular examination of equipment by highly qualified staff, as well as make regular safety audits; provide first aid and safety training to construction staff.

Provide community participation in subproject design, which will minimize disruption to community social activities

To provide drinking water quality in the communities of Meghri region, AWSC will implement planned sampling of water pumped from Agarak WTP, checking all the parameters required by the Ministry of Health. Water quality monitoring is carried out also by State Hygienic and Epidemiological Surveillance Inspectorate, according to “Drinking Water: Requirements to the Centralized Water Supply System’s Water Quality”; Quality Control № 2-III-2-1 sanitary rules and norms” (registered on 28.12.2002), document, which establishes the requirements to the drinking water quality, as well as the rules for quality control of water produced and supplied to residential areas through water supply systems.

In general, Agarak WTP water is of very high quality and meets the requirements to the drinking water quality established by the RA Ministry of Health. However, water disinfecting is required and since it is made by chlorinating, the monitoring of residual chlorine in drinking water is also very important.

6. ENVIRONMENTAL PROTECTION MANAGEMENT

The organizational obligations for the proposed mitigating measures are distributed among the following agencies:

- ***Executive agencies, which are responsible for implementation of the measure.***

1. For this special task the executive agency (JINJ Ltd. and HGSN Ltd. joint venture) must provide in the design stage obtaining of all the required agreements and permits from corresponding state and local authorities, before tendering the construction works;

- Conclusion of environmental expert examination (if needed);
- Decision of town and village administrations related to land allotment during the construction works (if needed);
- Agreement of the State Agency for Protection of Historical and Cultural Monuments, if impact is envisaged by the design.

2. The executive agencies in the construction stage (construction contractors) will be responsible for physical implementation of mitigating measures planned under the EMP, as well as for obtaining of all permits and agreements required during the construction implementation. Those are:

- Agreements from the local self-governing authorities for the sites allotted for transportation of wastes and construction garbage,
- Agreement of the State Agency for Protection of Historical and Cultural Monuments, if unexpectedly historical and cultural or archaeological monuments are discovered during the construction implementation.

3. Before commencement of the construction, the following permits and certificates must be obtained from ADB/PMU, if needed:

- Cadastre certificate on the land allotment;
- Water use permit, if needed.

• Controlling agencies, which are responsible for controlling the executive units to provide implementation of the EMP measures by the latter

1. AWS CJSC/ADP PIU environmental specialists will be responsible for in time, due and reliable implementation of the works and measures in the order under the EMP. The mentioned specialists will regularly visit the construction sites to provide due implementation of the measures aimed at mitigation of work impact. During the visits the possible gaps will be identified through the check list and the infringements in implementation of mitigating measures will be discovered.

The AWS CJSC/ADP PIU has the right also to require and check whether all permits are available and valid, all the measures and monitoring part under the EMP are implemented during the construction, in accordance with ADB guidelines and the RA environmental and social legislation.

2. JINJ Ltd. and HGSN Ltd. joint venture will also implement control of implementation of mitigating measures during the construction. The environmental specialist shall make visits to control the EMP implementation.

State monitoring agencies, which are responsible for observing the extent and efficiency of EMP implementation and making corrections in the project, if needed.

The state monitoring agencies are as follows:

- State Environmental Agency of the Ministry of Nature Protection,
- State Epidemiological Agency of the Ministry of Health,
- The State Agency for Protection of Historical and Cultural Monuments, if needed,
- The RA local self-governance bodies,
- The RA Ministry of Transport and Communication.

The amounts envisaged for implementation of environmental measures included in the EMP are included in the detailed design.

Implementation of mitigating measures for environmental impacts will be controlled regularly through visits to the construction sites. With the help of the specially developed check list the gaps and drawbacks will be discovered.

In case of not implementing or infringing the implementation of the mitigating measures, after warning, the next payment will be terminated until the infringement is completely eliminated.

Appendix A

Environmental Management and Monitoring Plan

Construction and possible impacts	Proposed mitigating measures	Monitoring	Responsible agencies
1. Air pollution , noise and traffic congestion			
<ul style="list-style-type: none"> Noise and dust in the process of construction work Disturbance to population because of overloaded roads 	<ul style="list-style-type: none"> To fence the construction site,, To periodically clean the construction site and roads, To limit night work in residential areas, To avoid use of machines/equipment with extra noise, To install silencers if needed. To provide safe area for trucks, Not to accumulate and burn waste on the construction site, To implement construction in stages, give adequate notice of construction activities to the population, To provide road signs, diversions or barricades, To provide community participation in sub-project activities, that will reduce the construction works disturbance to community life 	Daily observation of the site	Contractor, Consultant, PIU
2. Environment pollution			
<ul style="list-style-type: none"> Soil erosion and sediment transport Environment pollution with construction waste 	<ul style="list-style-type: none"> To implement measures for retaining the inclinations to prevent soil erosion and sediment transport in inclined sites of the water line route; minimize the time during which trench and pit excavations for regulation and metering nodes are open To minimize the time during which trench and pit excavations for regulation and metering nodes are open To repair the destructed surfaces after construction works end within the possible shortest time range, 	Daily observation of construction and agreement technical service stages	contractor, Consultant, PIU

<ul style="list-style-type: none"> ▪ Land and water resources pollution with fuel and lubricants ▪ Land and water resources pollution with chlorine implement chlorine discharge to surface water body or land area after washing the pipes, according to the regime planned under the design. 	<ul style="list-style-type: none"> - To store the fuel and lubricants on a sealed surface, away from water resources, - to remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators. - To organize works for washing the water supply distribution network with chlorine, according to technical calculations. To provide appropriate technical means. - To implement chlorine discharge to surface water body or land area after washing the pipes, according to the regime planned under the design. 	Monitoring of necessary measures implementation after construction works are over	
3. Health and Safety			
<ul style="list-style-type: none"> ▪ Hazards for workers and the population 	<ul style="list-style-type: none"> - To install fencing around construction site, - To control access of unauthorized persons to site, - To place warning signs in dangerous places, - To carry out regular examination of equipment by highly qualified staff, as well as make regular safety audits; - To provide first aid and safety training to construction staff. 	<p>Daily observation of construction stages.</p> <p>Monthly observation of case reports and appeals.</p>	<p>Contractor,</p> <p>Consultant,</p> <p>PIU,</p> <p>Inhabitants</p>

Appendix B**EMP CHECKLIST**

<u>General information</u>	D/M/Y			
	Subproject			
	Location			
	Constriction contractor			
	Marz			
<u>Design</u>				
Required permissions	EEC	Yes	No	N/A
	written consent on land acquisition	Yes	No	N/A
	assessment of impact on cultural heritage	Yes	No	N/A
<u>Constriction</u>				
Required permissions	written consent on disposal of construction waste	Yes	No	N/A
	written consent in case of sudden discovery of cultural heritage	Yes	No	N/A
<u>Public awareness</u>				
	awareness of population regarding construction works according to the project design	Yes	No	N/A
	community's participation in construction works according to the project design	Yes	No	N/A
<u>Safety</u>				
Safety of workers	availability of safety uniforms (earflaps, mask)	Yes	No	N/A
	regular study of equipment used for construction for safety matter	Yes	No	N/A
Safety of population	Installation of road signs or fences, organization of a bypass during interrupted or limited traffic	Yes	No	N/A
<u>Management measures during construction</u>				
Operation on area/construction site	regular sprinkling to area/construction site	Yes	No	N/A
	availability of safe place at the construction site for vehicles	Yes	No	N/A
	availability of storage for oils and lubricants at the appropriate part of the construction site	Yes	No	N/A

<u>Temporary air pollution/dust</u>				
	use of cover for the vehicle transporting construction waste	Yes	No	N/A
	moistening of the construction site by water	Yes	No	N/A
<u>Soil erosion</u>				
	soil erosion prevention measures at the slope places according to the project design	Yes	No	N/A
	timely coverage of holes by soil	Yes	No	N/A
	repair of damaged surface after completion of construction works	Yes	No	N/A
<u>Water pollution</u>				
	water pollution caused by fuel and lubricants	Yes	No	N/A
	Leakage of chlorine after wash up of the pipes according to the scheduled regime.	Yes	No	N/A
<u>Noise close to settlements</u>				
	implementation of the works during working hours, otherwise in projected manner	Yes	No	N/A
<u>Construction waste disposal</u>				
	transportation and disposal of construction and consumer waste in appropriate community landfill	Yes	No	N/A
<u>Operation</u>				
Drinking water pollution	Correspondence of balance quantity of residual chlorine to the quality of potable water	Yes	No	N/A