Water Sector Projects Implementation Unit

IRRIGATION SYSTEM ENHANCEMENT PROJECT

Meghri Gravity System

Environmental and Social Impact Assessment

July 2014

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Glossary

AMD	Armenian Dram
PAP	Project Affected Person
DM	Distance Marker (or "Picket Number")
ESIA	Environmental and Social Impact Assessment
EIMC	Environmental Impact Monitoring Centre
EMP	Environmental Management Plan
ESAOC	Environmental and Social Assessment and Oversight Consultant
FS/FD Consultant	Feasibility Study/Final Design Consultant hired under MCA-Armenia Program
GDP	Gross Domestic Product
GoA	Government of Armenia
HGSN	"Haygyughshinnakhagits" LLC Design Consultant
IBRD	International Bank for Reconstruction and Development
ICID	International Commission on Irrigation and Drainage
ISEP	Irrigation System Enhancement Project
LLC	Limited Liability Company
MAC	Maximum Allowed Concentration
MCC	Millennium Challenge Corporation
MCA-Armenia	Millennium Challenge Account - Armenia SNCO
MoNP	Ministry of Nature Protection of the Republic of Armenia
NGO	Non-Governmental Organization
NSS	National Statistical Service of the Republic of Armenia
O&M	Operation & Maintenance
RA	Republic of Armenia
SCWS	State Committee on Water Systems
SNCO	State Non Commercial Organization
USD	United States of America Dollars
WB	World Bank
WSA	Water Supply Agency
WS PIU	Water Sector Projects Implementation Unit State Institution
WTM	Water-to-Market Activity of the MCA-Armenia Program
WUA	Water User Association

Executive Summary

1 Introduction

After independence the economic structure of the Republic of Armenia (RA) has significantly changed. The previously industrial republic became an agrarian country. However, the agrarian economy faces significant challenges related to the lack of modern irrigation systems. The Government of RA is applying major efforts to solve this issue including both its own resources and those of the international organizations. With World Bank support the Government of RA implemented the Irrigation Development Project, and the Dam Safety Projects I and II. These projects undertook the most critical interventions helping to secure operation of 8 major irrigation systems. The interventions included rehabilitation of 260 km of the most deteriorated sections of main and secondary canals, 126 hydraulic structures (aqueducts and siphons), 310 km of drainage network, 11 pump stations, 238 deep wells, 74 reservoirs in dangerous condition, and tertiary canals servicing 26 000 ha. Another World Bank supported operation is the Irrigation Rehabilitation Emergency Project (IREP). It included rehabilitation of two primary canals of Talin and Armavir irrigation systems and improvement of water use efficiency in the two selected irrigation schemes. About 90 km of canals are already rehabilitated. IREP financed studies and design for the reconstruction of the Meghri Gravity Irrigation Scheme. However, preparation for the reconstruction of the Meghri scheme had been initiated earlier, under the Millennium Challenge Account - Armenia Program, (MCA-Armenia Program). The initial Environmental Impact Assessment (EIA) was carried out by Mott MacDonald Inc. The present Environmental and Social Impact Assessment (ESIA) report benefited from the initial EIA report, but required considerable additional work due to changes in the project design and the difference between the MCA and the World Bank requirements pertaining environmental documents.

The State Committee for Water Management (SCWM) under the Ministry of Territorial Administration (MoTA) is the implementing agency of the World Bank supported irrigation projects, while the Water Sector Projects Implementation Unit (PIU) is responsible for their day-to-day management, monitoring and evaluation.

A new Irrigation System Enhancement Project (ISEP) was prepared and is currently being implemented with the support of the World Bank. It is aimed at conversion and reconstruction of several pumping schemes into gravity systems, rehabilitation of canals as well as capacity building of the entities involved in water management. Reconstruction of Meghri irrigation scheme is part of the ISEP investments.

National Environmental Regulations and WB Policies Applicable

In the Republic of Armenia environmental issues are regulated according to several legislative acts, including the law on Environmental Impact Expertise. This law governs the process of environmental screening, impact assessment, and permitting for various types of economic activities. According to the requirements of this law, reconstruction of Meghri irrigation system is subject to environmental expertise and issuance of its positive conclusion (i.e. environmental permit) prior to commencement of civil works.

ISEP triggers WB OP/BP 4.01 Environmental Assessment. Based on the nature and scope of physical activities required for the implementation of ISEP and construction of a Meghri Gravity System, as well as the general types of impacts expected from such kind of construction, it is classified as environmental Category B and requires Environmental and Social Impact Assessment (ESIA). Taking into account that the preparation of the Meghri scheme reconstruction had been initiated under the Millennium Challenge Account - Armenia Program, (MCA-Armenia Program), the initial EIA report was produced by the Mott MacDonald Inc. The present ESIA report was derived through re-working of the initial document with consideration of changes in the project design and requirements specific to the World Bank financed activities.

ISEP also triggers WB OP/BP 7.50 Projects on International Waterways. Meghri scheme abstracts water from the Meghri and Araks rivers, the former being tributary of the latter. River Araks is an international waterway shared by Armenia, Turkey, Iran, and Azerbaijan. Taking into account that designed water intake capacity of the Meghri scheme after conversion will be less than of the original designed capacity of the pumping scheme, while actual water abstraction after the project implementation will remain the same

as it had been before the project intervention, communication between the riparian states was deemed unnecessary.

ISEP triggers OP/BP 4.09 Pest Management, because it is anticipated that the improved irrigation services will intensify agriculture in the service area, and higher value crops may be cultivated, which could entail more intensive use of pesticides. While there is no need for developing a Pest Management Plan, promotion of safe handling of pesticides and of the applicable techniques of the Integrated Pest Management is included into the project design.

ISEP will finance heightening of a dam required for upgrading a reservoir feeding the scheme and, therefore, triggers OP/BP 4.37 Safety of Dams. Meghri irrigation scheme does not include dams and OP/BP 4.37 is not applicable to this particular investment.

OP/BP 4.12 Involuntary Resettlement is triggered, because construction of new irrigation pipelines, as well as rehabilitation of the existing ones - to lesser extent - may cause a need for temporary restriction of land use.

Project Description

The Government of the Republic of Armenia (RA) is implementing Additional Financing of the Irrigation Rehabilitation Emergency Project (IREP AF) with the support of the World Bank (WB). The scope of the program covers development of design for replacement of the mechanical irrigation system with gravity irrigation system for 686 ha area of Meghri region in Syunik Marz.

The preliminary design of the Project was prepared by MCC.

The design for Meghri Gravity System has been developed according to the contract: IREP/AF/QCBS/SW-11/003, signed between the "Water Sector Projects Implementation Unit State Agency" (PIU) and the joint venture of HGSN LLC (Armenia) and ECOSTUDIO S.R.L. (Italy).

According to the contract the design work of the replacement of irrigation mechanical system with gravity irrigation system is planned in 3 phases (Lot.1, Lot 2, and Lot 3). After the completion of the construction an area of 686ha will be irrigated by gravity (including areas in Meghri town, Agarak town, Alvank, Shvanidzor, Nrnadzor and Karchevan communities). This will be done by constructing a new head intake structure at the Lehvaz community stretch of the Meghri River and about 37.5 km long pipeline. Amount of water required for operation of the system is estimated at 0.65 m^3/sec) to be fully taken from Meghri River. Ten pumping stations currently serving the area annually withdraw 7.183 mln m^3 of water from Araks River. All these pumping stations will be eliminated as a result of construction of the Meghri Gravity System. The estimated design/project cost is about $10.5 million, with the Economic Rate of Return (ERR) 19.6%.

The economic results of the gravity irrigation system construction and operation will include the increased crop yields and higher incomes of water users. These will be facilitated by the adoption of more efficient on-farm water management practices.

Environmental and Social Baseline

The area influenced by the project is the southern section of Meghri River. The area is characterized as a semi-desert zone. The climate of the command area of Meghri gravity system is moderate-warm, with mild winters and dry subtropical summers at the sites adjoining to the river Araks.

The vegetation is also presented by semi-desert and steppe species. In this region there are areas rich in fauna and flora, which are included in the specially protected areas of Arevik National Park. The National Park includes the upper and middle sections of Meghri River. The designed irrigation system is located in the lower section of the river and the planned work can't have any influence on the preserved flora and fauna. The project intervention site does not represent an important habitat for any animal or plant species.

The area covers 6 communities with the total number of population over 10 500, including Meghri and Agarak towns. The population is mainly occupied in agriculture and mining industry. The region has favorable conditions for the development of agriculture.

Expected Environmental Impacts and Their Mitigation

The expected environmental and social risks associated with the construction of the Meghri Gravity Irrigation System are moderate and can be effectively mitigated.

Impacts of the construction phase:

- Air pollution from the operation of the construction vehicles and machinery;
- Land degradation and erosion as a result of damaging vegetative cover and disruption of topsoil;
- River pollution with runoff from the construction site;
- Damage to the landscapes and ecosystems from borrowing of construction materials;
- Improper disposal of access material and construction waste;
- Damage to vegetative cover of soil in the area of earth works;
- Nuisance for local community residents due to temporary storage of construction materials and construction waste.

Mitigation measures of the construction phase:

Risks of the construction phase could be effectively mitigated by adherence to common good construction practice, implying:

- Keeping construction vehicles and machinery in good technical condition;
- Fueling, washing, and otherwise servicing vehicles and machinery at the service centers or in the designated locations of the construction site which can contain operational and accidental spillage of oils and lubricants and does not allow direct water discharge to the natural water bodies;
- Moving vehicles and machinery along the existing or designated access roads to avoid excessive damage of natural vegetation;
- Operating vehicles and machinery within working hours and shutting engines when idle;
- Keeping subsoil and topsoil separately and using them for backfilling and reinstatement of the construction site;
- Keeping construction materials and waste within the construction site and periodically disposing them into the formally designated locations;
- To the extent possible, purchasing inert construction materials (sand, gravel, rock) from the already registered operating vendors. If mining for them is required, obtaining and observing license terms, and ensuring reinstatement of the used borrow sites;
- Compensatory tree planting at the ratio of 1: 3;
- Ensuring clear and timely communications on potential negative impacts of construction to local residents, and the establishment of accessible complaint procedures and grievance redress mechanisms.

Impacts of the operation phase:

- Flooding and waterlogging due to malfunction of the hydraulic structures of the scheme;
- Salination, alkalization, and erosion;
- Contamination of agricultural lands as a result of poor quality of irrigation water;
- Damage to aquatic life of the river due to excessive water intake;
- Damage to human and environmental health from increase use of agrochemicals.

Mitigation measures of the operational phase:

- Properly maintaining hydraulic structures, pipes and canals throughout operation of the scheme;
- Periodic monitoring of soil quality in the Meghri scheme service area for early detection of undesired trends of its deterioration and for prompt corrective action;
- Obtaining river water quality data from hydrologic monitoring posts and screening them for the detection of excessive increase in the contents of pollutants and making emergency communication to relevant State entities in case of such occurrence;
- No considerable damage to aquatic life is expected in Meghri River, because meeting of the actual water demand is possible without significant decrease of the natural water flow and without disruption of its seasonal dynamics. Water flow in Araks River will not alter as compared to the present status, because the pumps currently extracting water from Araks will be substituted with a new water intake on Meghri River, which is a tributary of Araks, and the overall volume of water intake will remain the same;
- Raise public awareness, educate, and promote safe use of pesticides and application of relevant methods of the Integrated Pest Management among water users of the Meghri irrigation scheme.

Operation of the Meghri Scheme

After completion of the ISEP-supported works, the reconstructed Meghri gravity system will pass to the balance of the RA State Water Committee. Operation of irrigation system will be carried out by the Meghri Water User Association (WUA), which operates under the State Committee on Water Systems. WUAs are economic organizations and operate according to the principle of self cost-reimbursement. The gravity irrigation system will provide water to the communities, as well as to the individual land owners for the established fee. Collections will allow covering proper operation and maintenance of the scheme.

Environmental Management Plan

The present ESIA report carries an Environmental Management Plan (EMP), which is designed to ensure that all necessary measures are identified and implemented in order to mitigate possible negative environmental impacts of the construction and operation phases and to comply with the national environmental legislation. The EMP is included in tender documents and will become an integral part of the works contract. The construction contractor will be responsible to carry out all the measures anticipated by the EMP during the construction. Supervision of the EMP implementation will be carried out by PIU at the construction phase and will pass on to the WUA at the operation phase.

Public Participation

The process of Meghri gravity irrigation system design included a series of focus group discussions[1] on social-economic issues connected with irrigation and public discussions with representatives of WUA, Marzpetaran (provincial government), the village administrative heads, and other project affected people. The minutes of public consultations are presented in Annex G. The early draft EIA report produced under the MCA-Armenia Program underwent the process of environmental expert examination, which included conduct of a public consultation meeting in accordance with the requirements of RA law on Expert Examination of Environmental Impact. Positive conclusion (No. 98) of expert examination was issued by the State Non Commercial Organization (SNCO) *Environmental Expert Examination,* under the Ministry of Nature Protection of RA on October 14, 2013.

Present final draft ESIA report will be disclosed electronically in Armenian and English languages nationwide and hard copies in Armenian will be made available at the Syuniq marzpetaran (the regional authority) for easy access by the project affected people.

[1] Focus Group Research and Public discussions were conducted in all communities involved with participation of representatives of all layers, municipalities, stakeholders, WUA.

2 General Information

The Republic of Armenia is a landlocked country (29,800 km²) between the Black and Caspian seas, bordered in the north by Georgia, to the east by Azerbaijan, on the south by Iran and to the west by Turkey (Figure 1). The country's terrain is a high plateau with mountains with little forest land. Climate is highland continental with hot summers and cold winters. Armenia's natural resources are molybdenum, zinc, gold, silver, lead, marble, granite and mineral spring water.

Armenia's population is officially estimated at 3,213,011 de jure (3,002,011 de facto) according to the final results of the October 2001 census, announced in 2003[2]. 98% of the population is ethnic Armenian, 1.2 % Yezidi, 0.5% Russian, 0.3% other.

Armenia's work force is estimated at 1.24 million and the unemployment rate stands at 10.5%. Employment of the work force in Armenia's economy is described as follows: industry and construction – 24.5%; agriculture and forestry – 24.6%; trade – 17.3%; education – 13.4% other - 22.2%.

As a result sectors such as construction and services currently replace agriculture and industry as the main contributors to economic growth. Other industrial sectors driving the country's industrial growth include energy, metallurgy and food processing. According to preliminary data in 2011 the Gross Domestic Product (GDP) comprised AMD 3776.4 billion (USD 1= 405.32 AMD as of December 1, 2012), with 4.7% growth rate. Volume of gross agricultural output was estimated at around 20.2%, an increase compared to an average 17.6% in the last 4-year period.

Figure 1: Map of the Republic of Armenia

The structure of Armenia's economy has changed substantially since its independence in 1991. Irrigated agriculture has declined significantly due to non-operational mechanical irrigation (high electricity prices) and deteriorated infrastructure due to a lack of recurrent expenditure and maintenance. This, amongst other contributing factors, has caused severe unemployment, especially in rural areas. Reforms supported by international donors have been and continue to be undertaken to rehabilitate the economic situation in the country.

According to the "Social Snapshot and Poverty in Armenia, 2012"[3] (a study prepared by the NSS), poverty still remains a problem in Armenia. In 2011 the poverty level accounted for 35.0%, which is lower as compared to the previous year (35.8%). In 2011, more than third of population (35%) was poor, 19.9% was very poor and 3.7% was extremely poor.

[2] National Statistical Service of the Republic of Armenia. Official web-site of the NSS of the RA: http://www.armstat.am/en/.
[3] Social Snapshot and Poverty in Armenia, 2012. National Statistical Service of Armenia.

The Government of RA, with significant support from international institutions, continues strengthening its macro-economic management. The ISEP will be implemented over the four years, based on the loan agreement between the World Bank and the Republic of Armenia, aiming at improvement of irrigation infrastructure and capacity building of WUAs.

3 Policy, Legal and Administrative Framework

3.1 National Legal and Regulatory Framework

Article 10 of the Constitution of the Republic of Armenia (adopted in 1995) guarantees protection of the environment by the State, as well as the rational use and renewal of natural resources. To fulfill this obligation, the Republic of Armenia has adopted a number of environmental laws and regulations since its independence in 1991 and also signed and ratified a list of international conventions and protocols. Table 1 below lists a number of the RA environmental laws that pertain to implementation of various components of the Irrigation System Enhancement Project.

Table 1. Selected Environmental Laws of the Republic of Armenia

Name of Law	**Year of Adoption**
RA Law on Atmospheric Air Protection	1994
RA Law on Expert Examination of Environmental Impact	1995
RA Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment	1998
RA Law on Environmental Fees and Nature Use Charges	1998
RA Law on Flora	1999
RA Law on Fauna	2000
RA Land Code	2001
RA Law on Lake Sevan	2001
RA Law on Complex Program for the Lake Sevan Ecosystem Restoration, Conservation, Reproduction and Use	2001
RA Code on Underground Resources	2002
RA Water Code	2002
RA Law on Water Users' Associations and Federations of the Water Users Associations	2002
RA Law on Wastes	2004
RA Law on Environmental Oversight	2005
RA Forest Code	2005
RA Law on Fundamental Provisions of the National Water Policy	2005
RA Law on the National Water Program	2006
RA Law on Specially Protected Areas	2006
RA Law on Inspection of Use and Protection of Land	2008

Below is a brief description of the main provisions of the laws which are most relevant to environmental and social review of the proposed Meghri gravity system project.

The Law on Expert Examination of Environmental Impact (1995)

The Law on Environmental Impact Assessment contains the standard steps of the EIA process for various projects and activities in Armenia. In Articles 2-5 it establishes the general legal, economic, and organizational principles for conducting the mandatory state EIA of various types of projects and "concepts" of sectoral

development (e.g. energy, mining, chemical industry, construction, metallurgy, pulp and paper, agriculture, food and fishery, water, electronics, infrastructure, services, tourism and recreation). The Law forbids any economic unit to operate or any concept, program, plan or master plan to be implemented without a positive conclusion of an EIA. In addition, an EIA may also be initiated for projects that exceed "threshold" value requirements set by Governmental Decree No 193 issued on March 30, 1999. The "special status" of a particular territory may also trigger a review of environmental impact. The Ministry of Nature Protection can initiate a review of environmental impact when it considers it necessary to do so. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements (Articles 6-11).

Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998)

The Law provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for - amongst other things - the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments.

Law on Flora (1999) and Law on Fauna (2000)

The Laws on Flora and Fauna outline the Republic's policies for the conservation, protection, use, regeneration, and management of natural populations of plants and animals, and for regulating the impact of human activities on biodiversity. These laws aim for the sustainable protection and use of flora/fauna and the conservation of biodiversity. There are provisions for assessing and monitoring species, especially rare and threatened species.

Law on Atmospheric Air Protection (1994 and last amended in 2007)

This Law regulates the emission licenses and provides maximum allowed loads/concentrations for atmospheric air pollution, etc. There is secondary legislation that establishes sanitary norms for noise in workplaces, residential and public buildings, residential development areas as well as construction sites.

Land Code (2001)

The Land Code defines the main directives for use of the lands allocated for energy production, water economy (water supply, water discharge, pumping stations, reservoirs, etc.), and other purposes. The Code defines the lands under the specially protected areas as well as forested, watered and reserved lands. It also establishes the measures aimed at protection of the lands as well as the rights of state bodies, local authorities and citizens towards the land.

Code on Underground Resources (2002)

This Code contains the main directives for use and protection of mineral resources and underground water, including the sanitary protection zones for the underground water resources.

Water Code (2002)

The main purpose of the Water Code is to provide the legal basis for the protection of the country's water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations. The Water Code addresses the following key issues: responsibilities of state/local authorities and public, development of the national water policy and national water program, water cadastre and monitoring system, public access to the relevant information, water use and water system use permitting systems, trans-boundary water resources use, water quality standards, hydraulic structures operation safety issues, protection of water resources and state supervision.

Adoption of the Water Code in 2002 generated the need for development of a number of Governmental regulations and procedures, including permitting procedures, environmental flows, drainage water use, water alternative accounting, access to information on trans-boundary water, water use for fishery purposes,

reservation of underground water sources, registration of documents in state water cadastre, public awareness and publicity of the documents developed by WRMA and other normative documents which provide guidelines directly linked with water and environmental issues.

Law on Water Users' Associations (WUA) and Federations of the WUAs (2002)

The WUAs and federations of WUAs are established to effectively operate and maintain the irrigation infrastructure and provide for reliable irrigation water supply to members of the WUA, collect water payments and present and protect the rights of member water users. Within the objectives of the Association and Federation (Article 4) the following important issues from an environmental perspective could be mentioned: operation and maintenance of irrigation system; implementation of construction works and restoration of watercourses and irrigation systems; water supply management and pollution prevention; implementation of activities necessary to improve the quality of land, supporting the drainage system; providing ecological safety through preventing land erosion, prevention from salinization, over-watering and promoting the protection of irrigation system.

Law on Wastes (2004)

The law provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes as well as prevention of negative impacts of waste on natural resources, human life and health. The law defines the roles and responsibilities of the state authorized bodies in the waste sector.

Law on Environmental Oversight (2005)

The Law regulates the issues of organization and enforcement of oversight over the implementation of environmental legislation of the Republic of Armenia and defines the legal and economic bases underlying the specifics of oversight over the implementation of environmental legislation, the relevant procedures, conditions and relations as well as environmental oversight in the Republic of Armenia. The existing legal framework governing the use of natural resources and environmental protection includes a large variety of legal documents. Government resolutions are the main legal implementing instruments for environmental laws. The environmental field is also regulated by presidential orders, Prime-Minister's resolutions and ministerial decrees.

Law on Fundamental Provisions of the National Water Policy (2005)

The Law defines a long-term development concept for protection, strategic management and use of water resources and water systems of Armenia. It spells out the key principles for integrated management and planning of Armenia's water sector by defining priorities and approaches to be addressed.

Law on National Water Program (2006)

The overall goal of the Law is to provide short-term (until 2010), medium-term (2010-2015) and long-term (2015-2021) measures for achieving the goals and objectives defined by the Water Code, National Water Policy and Program. The National Water Program Law is a "living" document to be updated regularly. The law defines the following key measures: development of measures aimed at definition of the national water reserve; strategic water reserve; useable water resources and conservation and enhancement of the national water reserve; classification of water systems; development of criteria for defining the water systems of state significance; assessment of water demand and supply; development of a strategy for storage, distribution and use of water resources; definition of measures aimed at development of water standards; volumes of ecological/minimum flow volumes and maximum permissible quantities of water withdrawn for consumption; determination of specially protected basin areas and zones of ecological emergencies and ecological disasters; prevention of negative impact on water eco-systems; improvement of water resources monitoring and pollution prevention; determination of financial requirements and proposed funding sources suggested for implementation of the National Water Program; ensuring public awareness; etc.

Law on Specially Protected Areas (2006)

The Law on Specially Protected Areas outlines the procedures for establishing protected areas and their management. The Law defines four categories of protected areas in RA: (i) State Reserves; (ii) State Reservations;

(iii) National Parks; and (iv) Nature Monuments.

Law on Inspection of Use and Protection of Land (2008)

This newly adopted law provides objectives and types of effective use and protection of lands of the Republic of Armenia, inspection related to enforcement of land legislation and institutions, procedures of control, rights and responsibilities of entities controlling land use and protection. The law applies to all lands of the Republic of Armenia Land Fund, irrespective of purpose, ownership and/or right to use.

A number of other laws and regulations were consulted during the conduct of the ESIA, primarily those regulating the construction sector and defining construction norms and standards (SNiPs), and the RA Law on property alienation for social/public and state needs (2006).

In addition to the aforementioned legal acts, the Republic of Armenia has signed and ratified a number of environmental conventions and protocols, which are presented below in Table 2. Highlighted items are most relevant to this ESIA study.

Table 2: Overview of Environmental Conventions and Protocols signed and/or ratified by the Republic of Armenia[4]

	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Relevant	Comment
1	**Convention on Wetlands of International Significance especially as Waterfowl Habitat (Ramsar, 1971)**	**1975**	**1993**	**Ratified by USSR**	**X**	
2	**Convention on Biological Diversity (Rio-De-Janeiro, 1992)**	**1993**	**1992**	**1993**	**x**	**Re-registered in UN 1993**
3	Cartagena Protocol on Biological Safety (Cartagena, 2000)		2000	2004		
4	UN Framework Convention on Climate Change (New York, 1992)	1994	1992	1993		Re-registered in UN 1993
5	Kyoto Protocol (Kyoto, 1997)			2002		Re-registered in UN 2003
6	Convention on Long-range Transboundary Air Pollution (Geneva, 1979)	1983		1996		Re-registered in UN 1997
7	**Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)**	**1997**		**1996**	**x**	**Re-registered in UN 1997**
	Protocol on Strategic Environmental Assessment (Kiev, 2003)		**2003**		**x**	
8	Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1992)	2000		1996		Re-registered in UN 1997
	Protocol on Civil Liability and Compensation for Damage caused by the		2003			

[4] Official web-site of the Ministry of Nature Protection: http://www.nature-ic.am/ccarmenia/en/?nid=365. Accessed in March 2009.

	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Relevant	Comment
	Transboundary Effects of Industrial Accidents on Transboundary Waters (Kiev, 2003)					
9	**UN Convention to Combat Desertification (Paris, 1994)**	**1996**	**1994**	**1997**	**x**	**Re-registered in UN 1997**
10	Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989)	1992		1999		Re-registered in UN 1999
11	Convention for the protection of Ozone Layer (Vienna, 1985)	1988		1999		Re-registered in UN 1999
	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1987)	1989		1999		Re-registered in UN 1999
12	**Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998)**	**2001**	**1998**	**2001**	**x**	
13	Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)		1998	2003		
14	**Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)**	**1996** (Protocol only)			**x**	
	Protocol on Water and Health (London, 1999)		**1999**		**x**	
15	Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001)		2001	2003		
16	Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (Geneva, 1976)	1978		2001		Re-registered in UN 2002
17	European Convention on Landscape (Florence, 2000)			2004		
18	**Convention on Protection of the World Cultural and Natural Heritage (Paris 1972)**			**1993**	**x**	
19	Energy Charter Treaty (Lisbon, 1994)			1997		
	Energy Charter Protocol on Energy efficiency and Related Environmental Aspects (Lisbon, 1994)			1997		
20	**European Convention on Protection of Wild Nature and Habitat (Bern, 1979)**	**1982**	**2006**		**x**	

World Bank Operational Policies

WB OP 4.01 Environmental Assessment is considered to be the umbrella policy for the Bank's environmental safeguard policies. These policies are critical for ensuring that potentially adverse environmental and social

consequences are identified, minimized, and properly mitigated. These policies receive particular attention during the project preparation and approval process. The World Bank carries out screening of each proposed project to determine the appropriate extent and type of EA to be undertaken and whether or not the project may trigger other safeguard policies. The Borrower is responsible for any assessment required by the Safeguard Policies, with general advice provided by the World Bank staff. The safeguard policies and triggers for each policy are presented in the Table 3 below.

Table 3: World Bank Safeguard Policies

Operational Policy	**Triggers**
Environmental Assessment (OP 4.01)	If a project is likely to have potential (adverse) environmental risks and impacts in its area of influence.
Forests (OP 4.36)	Forest sector activities and other Bank sponsored interventions which have potential to impact significantly upon forested areas.
Involuntary Resettlement (OP 4.12)	Physical relocation, land loss or restriction of land use resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location.
Indigenous Peoples (OP 4.10)	If there are indigenous peoples in the project area, and potential adverse impacts on indigenous peoples are anticipated, and indigenous peoples are among the intended beneficiaries.
Safety of Dams (OP 4.37)	If a project involves construction of a large dam (15 m or higher) or a high hazard dam; If a project is dependent upon an existing dam, or dam under construction.
Pest Management (OP 4.09)	If procurement of pesticides is envisaged; If the project may affect pest management in the way that harm could be done, even though the project is not envisaged to procure pesticides. This includes projects that may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk, (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and/or pose significant health or environmental risks.
Physical Cultural Resources (OP 4.11)	The policy is triggered by projects which, prima facie, entail the risk of damaging cultural property (e.g. any project that includes large scale excavations, movement of earth, surface environmental changes or demolition).
Natural Habitats (OP 4.04)	The policy is triggered by any project with the potential to cause significant conversion (loss) or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project).
Projects in Disputed Areas (OP 7.60)	The policy is triggered if the proposed project will be in a "disputed area".
Projects on International Waterways (OP 7.50)	If the project is on international waterway such as: any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states (or any tributary or other body of surface water that is a component of this waterway); any bay, gulf, strait, or channel bounded by two or more states or, if within one state, re-cognized as a necessary channel of communication between the open sea and other states-and any river flowing into such waters.

ISEP will finance construction and rehabilitation works on the irrigation schemes and will have certain social and environmental impacts. The project, therefore, triggers WB OP/BP 4.01 Environmental Assessment. For some of the ISEP activities, including reconstruction of the Meghri irrigation scheme, the EIAs shall be carried out and a positive conclusion shall be obtained from the Environmental Expertise of the Ministry of Nature Protection, while for the other activities - development of site-specific EMPs should be sufficient. Capacity building and project management activities of the ISEP are not associated with potential environmental and social risks.

Some of the ISEP activities may require temporary land usage, uprooting of trees and/or standing crops leading to loss of income. Design solutions were defined taking into account the option to avoid / minimize land related impacts. Temporary impacts on state / community lands are expected during construction period.

Heightening of the dam required for upgrading a reservoir feeding the Gegardalich scheme triggers WB OP/BP 4.37 Safety of Dams. Based on the requirements of this policy, the design of the dam will undergo a specialized professional scrutiny to ensure its quality. A system of regular monitoring of the technical condition of the dam will also be worked out to ensure that any faults in its operation are reveled at the early stage and corrective measures are taken on time to exclude tangible damage to the hydraulic structures and risk to the population and the national environment. OP/BP 4.37 does not apply to the rehabilitation of Meghri irrigation scheme.

OP 4.09 Pest Management is triggered, because some agricultural areas, which had been out of irrigation due to deteriorated infrastructure, will be brought back to irrigation as a result of reconstruction of the Meghri scheme and that is likely to stimulate use of pesticides. While there is no need of developing a Pest Management Plan, promotion of sound pesticide use practices and of the Integrated Pest Management is included into the project design.

OP/BP 7.50 Projects on International Waterways is triggered, because conversion of Meghri scheme implies construction of a new water intake point from river Meghri - a tributary of an international river Araks. According to the available design documents, the volume of water abstraction from the new intake point on river Meghri will be the same as the total designed capacity of present abstraction points on river Araks. ISEP intervention is not designed to increase volume of water abstraction from river Araks, but will rather substitute several points of abstraction from Araks with one point of abstraction from a tributary of river Araks. Therefore, communication to the riparian states is not deemed necessary.

<u>Comparison of the national legislation of Armenia and the World Bank Operational Policies</u>

The requirements of RA environmental legislation, as it pertains to the procedures required for the ISEP implementation, are in general comparable to WB policy approaches. However, there are also several differences between local legislation and WB policy requirements, the most tangible of which are summarized below. Armenian EIA terminology considers "environmental assessment" as the review process carried out by the Environmental Expertise of the Ministry of Nature Protection performed on the application of a project proponent for obtaining of the expert conclusion clearing the proposed activities, while the WB OP/BP 4.01 uses this term to describe the environmental impact study carried out by the project proponent.

Armenian EIA legislation does not require classification of activities into environmental categories A, B, and C as it is established in OP/BP 4.01, though it distinguishes between activities that require an EIA and those that do not. Reconstruction of Meghri irrigation scheme is subject to the environmental assessment and issuance of the conclusion derived through the environmental expertize.

The national legislation does not provide definition of the EMP and envisage its development, but it does require that the EIA document carries a list of environmental mitigation measures and describes procedures of their implementation. EMP is developed for reconstruction of Meghri irrigation scheme in line with the requirements of OP/BP 4.01.

The national legislation is mostly similar to WB requirements with respect to public disclosure of the ESIA documents, however does not include the requirement of at least 2 public consultations for Category A projects, which is the case with WB OP. Nonetheless, RA is a party to Aarhus convention and ensures availability of environmental information as well as public consultation on the environmental aspects of the proposed projects

in line with the principles of this convention. A public consultation meeting on the present ESIA report was held in project implementation area to solicit and take into account the opinion of the affected communities.

3.2 Institutional Framework

The roles of the government agencies that will be involved primarily from an environmental perspective in the Meghri Gravity Irrigation System project are briefly presented below:

Ministry of Nature Protection

The Ministry of Nature Protection (MNP) is responsible for the protection, sustainable use, and regeneration of natural resources as well as the improvement of the environment in the Republic of Armenia. In those areas, the MNP authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement. The MNP implements those functions through the following structural departments:

- Normative-methodological Department (including Division of Legislation and Division of Standards and Technical Regulations);
- Department of International Cooperation;
- Department of Environmental Protection (including Division of Biodiversity and Water Resources Protection and Division of Land and Atmosphere Protection);
- Department of Hazardous Substances and Waste Management;
- Department of Nature Protection and Environmental Economics;
- Department of Underground Resources Protection;
- Department of Meteorology and Monitoring of Atmosphere Pollution.

The MNP also undertakes several functions through the following bodies:

- Water Resources Management Agency with its six Basin Management Organizations is the key institution responsible for the water resources management including, but not limited to, the development and implementation of the National Water Policy, National Water Program and basin Management Plans; regulation of water use by issuance of permits for use of surface and ground water resources; assessment and classification of water resources by their use; participation in development of water standards and control of application, etc.
- State Environmental Expertise SNCO conducts environmental assessments of designs for construction, reconstruction, rehabilitation and maintenance of water infrastructures according to the requirements of the Armenian legislation and ratified International Agreements and issues experts' conclusions;
- State Environmental Inspectorate with its 11 regional offices oversees the implementation of legislative and regulatory standards in natural resources protection, use and renewal;
- Environmental Impact Monitoring Centre monitors surface water and air quality of Armenia through its network of observation points;
- Hydrogeological Monintoring Centre monitors groundwater quantity and quality through its network of observation points on the natural springs and on the drilled boreholes;

- Bio-resources Management Agency participates in the environmental impact assessment of designs for construction, reconstruction, rehabilitation and maintenance of water infrastructures. So do the Information Analytical Center and the Center for Waste Investigation SNCO.

Ministry of Energy and Natural Resources

The Ministry of Energy and Natural Resources is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the energy sector. The ministry is also responsible for the protection, sustainable use, and regeneration of natural resources, and implements its functions through the following bodies:

- Agency of Mineral Resources, and
- Subsoil Concession Agency.

Ministry of Emergency Situations

The Ministry of Emergency Situations elaborates and implements the policies of the Republic of Armenia Government in the area if civil defense and protection of population in emergency situations. Armenian State Hydro-meteorological and Monitoring Service SNCO is among the structural entities acting within the Ministry of Emergency Situations and conducts regular monitoring of meteorological and hydrological conditions of Armenia through its network of meteorological and hydrological stations and posts.

Ministry of Territorial Administration

Marzpetarans (regional administration bodies) are responsible for administration of public infrastructure falling under the regional jurisdiction. Bodies of local self-government (communities) are responsible for administration of public infrastructure of local significance registered as ownership of communities.

The State Committee of Water Systems (SCWS) under the Ministry of Territorial Administration has a mandate of improving the management of companies engaged in water activities. Amongst other objectives, the SCWS promotes improvement of water services to the consumers and implementation of further reforms in the water infrastructure and service delivery. SCWS has the following functions: participates in the development and implementation of the National Water Policy and Water National Program of the RA; submits to the RA Government annual reports on water utilization by a breakdown of sources and user companies; executes authorized management of state stocks in companies engaged in commercial activities, such as construction of hydro-technical structures, technical operation, water supply and sewerage services in the areas of irrigation, drinking water, sewerage as well as in state entities which implement investment projects in natural and artificial water basins in the above mentioned areas with foreign funding.

Ministry of Health. Within the structure of the Ministry of Health the State Health Inspectorate is responsible for coordination of all issues related to health (including those on noise and vibration) and for supervision over implementation of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens.

Ministry of Agriculture with its Melioration Development Department is responsible for the development, implementation and coordination of annual projects on construction, operation, rehabilitation and cleaning of collector-drainage systems.

The Ministry of Labor and Social Affairs among other things is responsible for development and implementation of the state policy, legislation and programs in the following areas: social security, labor and employment, social assistance, social assistance to disabled and aged people, social protection of families, women and children, etc.

National Water Council with its Dispute Resolution Commission is the highest advisory body within the water sector. It comprises representatives of major stakeholders from several ministries and is chaired by the Prime Minister. The role of the Council is the development of recommendations on the National Water Policy and Program and measures for implementation.

Public Services Regulatory Commission of the Republic of Armenia is responsible for establishment of tariff

policy in water relations and issuing of permits for the use of water systems.

4 Methodology of ESIA

The present ESIA was carried out according to the Terms of Reference agreed with the World Bank and covered the entire scope of the Project, including construction and operation phases of the Meghri Gravity System. The ESIA process included desk work to review project documents and scientific literature, as well as field work aimed at verification of the available data, collection of missing information, and meetings with the Project stakeholders. The botanist and the zoologist on the ESIA team walked over the irrigation scheme corridor and did visual observation of the site to verify baseline information available from the literature and to reveal any additional aspects not noted in the publications. To confirm identity of some plant species found in the project corridor, the ESIA team cooperated with the scientists of the Department of Plan Classification of the Institute of Botany under the National Academy of Science, and referred to the herbarium collection of this Department. The field work was carried out during the period of January-April 2013. The background information was compiled on the biophysical environment around the Project site, on the land tenure and land use along the route of the gravity system and its adjacent area, on the existence on the known or potentially present elements of historical and cultural heritage in the vicinity of the Project site. Appropriate photographic material was also collected.

Water balance in Meghri River was calculated based on the historic data on monthly water flow, on the irrigation water demand by Meghri scheme beneficiaries, and on the information available on other upstream and downstream water users. Environmental flow (minimal flow to be left in the river bed after abstraction) was determined as required by the national legislation and in accordance with the ***Decree of the Government of RA no. 927 dated 30.06.2011.*** According to this Decree, the environmental flow is defined as the average daily discharge of the 10 successive days with the lowest discharge. Such calculation was made to show the compliance with the requirements of the Armenian legislation, however as shown in several places of the present report the rehabilitated Meghri irrigation scheme will operate the way allowing to meet the actual water demand while leaving much more water in the river at all times than the environmental flow established according to the Decree. Importantly, the amount of water left in the river after water intake by the rehabilitated Meghri scheme will follow the natural dynamics of the river with coinciding peak, high-flow and low-flow periods.

5 Project Description and Justification

5.1 Objective of the Project

According to the final design of Meghri gravity scheme, it is planned to irrigate by gravity 686 ha arable lands of 6 beneficiary communities of Meghri region in Syunik Marz by eliminating 10 pumping stations currently serving the project area and saving annually 3.89 million kW/hour of electricity. Water source for Meghri gravity system is the Meghri River, stretch of Lehvaz community. The project area is served by "Meghri" WUA. The tables below include data on lands currently irrigated by mechanical method that will be irrigated by gravity as a result of project implementation (Table 4).

Table 4. Lands irrigated by Meghri gravity system per communities

N	Community	Lands, ha
1	Meghri	34
2	Agarak	172
3	Shvanidzor	112
4	Alvank	170
5	Karchevan	38
6	Nrnadzor	160
	Total	686

Currently operated pumping stations are in a poor technical state and fail to deliver designed volumes of water to the command area, while costs of operation and maintenance are high. There is a risk of further deterioration of the pumping system that would leave considerable area of irrigated lands without service.

During the design of Meghri gravity system FS/FD Consultant, with the participation of concerned organizations of Meghri region of Syunik Marz, studied the project area, evaluating the present technical state of the irrigation system and hydro-technical structures, composition of agricultural land and crops, hydrological criteria of the water source and the amount of water required for the operation of the system, selection of the proposed route and other hydro-technical structures based on geological, topographic and environmental conditions of the area etc. The consultant also made a topo-geodetic survey of the gravity system area.

Based on the above mentioned conditions and the existence of communication infrastructure of the area, the pipeline route was mapped within the width of 30-50m, according to the normative requirements.

The following points were considered while selecting the water pipeline route and conducting the topo-geodesic survey:

- Feasibility of the water conduit in the developed/urban areas;
- Conditions for operation of the pipeline and its structures in future;
- Existence/absence of privatized and leased lands along the route to avoid impacting the lands;
- Potential problems with the pressure pipeline in cases of emergency;
- Possible cases of intersecting with other existing routes;
- Organization of construction works in the developed area and with restricted topographic conditions;
- Environmental considerations;
- Keeping the existing irrigation systems in operational mode during the construction phase;
- Avoiding the threat of creating new landslide area, minimization of earthworks; and
- Flooding risks.

5.2 Description of Proposed Project Activities

According to the Final Design, Meghri gravity system is composed of a head intake structure and a pressure pipeline with its right and left branches (Figure 2). The pipelines are connected to the existing pipelines of the pumping stations currently serving the project area.

Head intake structure is located in the downstream of Meghri River bed at the level of 867.0 m, in the vicinity of Lehvaz community administrative area. Part of this area, located on the right bank of river Meghri, belongs to Lehvaz Community, and part of the area on the left bank belongs to Levhaz branch of Meghri Road Construction and Operation Company (RCOC) LLC. The owner of the RCOC has signed a Voluntary Servitude Contract for the use of the area of 500m^2 required for the construction and operation of the intake. The area is not used for any specific purpose by the owner (see Attachment H).

The site for head intake structure on Meghri River was selected based on geological structure of the area and elevations of the existing communication roads. Head intake structure is designed for 0.65 m^3/second water intake for irrigation purposes. This is less than the design capacity of the present Meghri scheme, which is based on pumped irrigation, and is close to the current water intake by this scheme which operates below its design capacity due to considerable dilapidation.

Based on geological, terrain and hydrological peculiarities, and also taking into consideration that water demand

of the designed system is not large, two types of head intake structure were considered during designing the head structure on Meghri River:

- Construction of a daily regulation reservoir with 220,000 m^3 storage capacity be an earth dam; and
- Construction of a mountain (Tyrolean) type head intake structure.

Considering that the earth dam construction requires bank-protection structures to maintain interstate road and inundates over 7 times greater agricultural lands, the mountain type of head structure was selected in the final design.

Meghri gravity irrigation scheme is composed of 3 lots: construction of water intake structure and main pipeline (lot 1), construction of left branch pipeline (lot 2) and construction of right branch (lot 3).

Head water intake structure is designed in Meghri Riverbed and comprises 2.6m high overfall dike /top mark 868.20m/, Tyrolean type water intake, settling reservoir, dissipating basin and a fish pass. The fish pass is designed on the right bank of the river.

In order to transfer the water required for irrigation into the main pipeline a deep plain gate is designed with metal grid (0.8x0.8m); the absolute bottom mark of the plain gate is 866.65m.

A chamber is installed at the end of the settling reservoir, from where the main pipeline will start.

The main pipeline starts from the head water intake structure, the total length of the pipeline is 8675m, diameter is 720x7mm, the required water discharge for irrigation is Q=0.65 m^3/sec, which is foreseen for the land area of 686ha. The 8310m long pipeline will be buried in a 1.6 m deep trench and will pass mainly along the Meghri-Kapan highway, or along earth roads through the areas of communities. A 160.0m long section of the pipeline passes parallel to Meghri River bed, by the aboveground installation of the supports (DM2+75-DM3+38, DM10+70-DM11+38, DM35+83-DM46+15), and a 179m long section is buried. It crosses Meghri River at two points (L=26m) aboveground, and Lehvaz-Meghri highway at 3 points (L=37.5m).

Construction of the main pipeline will imply works in community-owned lands as well as private or leased lands. The pipeline passes across 89m of private territory of Communal Service Rehabilitation Company which is in the town of Meghri and 47m of private territory of a Cheese Factory near Lehvaz Community. The owners have signed Voluntary Servitude Contracts for pipeline installation and construction works (see Attachment H).

The communal lands involved belong to the communities of Meghri, Agarak, Karchevan, Alvank, Shvanidzor and Nrnadzor. Written consent of affected communities has been obtained. In the area owned by Levhaz community the construction of the pipeline will imply removal of shrubs used by the community for the collection of non-wood forest products. The community agrees to the removal of plants, given that after completion of construction compensatory planting will be undertaken according to the ratio established for this project (1:3). Because the plants to be removed (Hawthorn and Eglantine, Rosaceae family) do not represent rare and/or valuable species and are not under special protection, their clearing is not unlawful.

Strengthened insulation with bituminous polymeric insulation paste is proposed in order to protect the internal and external surfaces of the main pipeline from corrosion.

The Left branch pipeline starts from the end of the main pipeline. The water quantity required for the irrigation is 0.45 m^3/sec, which is foreseen for irrigation of 476ha land. The required quantity of the water will be transferred to the left branch pipeline through the main pipeline to be carried out (D=720x6mm, L=8675m).

The following structures are included within the left branch pipeline:

- Pressure pipelines of Meghri N1, N2, N3 and N4 pumping stations;
- Pressure pipelines of Alvank 1-1 and Alvank 1 pumping stations;
- Pressure pipelines of Shvanizor N1 and N2 pumping stations;
- Pressure pipelines of Nrnadzor N1, N2 and N3 pumping station;
- Pressure pipeline of Bughdaduz 1 pumping station.

Left branch pipeline is designed mainly underground in 1.4m deep trenches. It is composed of steel pipes with total length of 23040m including D=530x6mm, L=8118m, D=426x6mm, L=11939m, D=219x4mm, L=2983m.

The pipeline will be laid parallel to the left-side of Meghri-Shvanidzor highway, crossing the highway at three points, after which it is laid parallel to the dismantled railroad bed which are state-owned lands under the RA Ministry of Transport and Communication. Their permission has been obtained (see Attachment H). Construction of the left branch pipeline will imply works in community-owned lands and the pipeline section of 117m will pass through the 0.275 ha which is leased by a citizen who grows pomegranates. The pipeline will not affect the trees. Maturity of the lease agreement is December 1, 2030. The lease holder has signed a Voluntary Servitude Contract for the temporary restriction of the land use right for the period of construction (Attachment H). The land belongs to Alvank community and the community has agreed to the use of land for the project (Attachment H). The communal lands involved belong to the communities of Meghri, Agarak, Karchevan, Alvank, Shvanidzor and Nrnadzor. Written consent of the affected communities has been obtained (Attachment H).

The relief of the area is diverse. The absolute elevations vary between 420-510meters. Longitudinal slopes of the left branch pipeline are 3^0-12^0.

No trees will be cut for construction of this branch. The construction site will be located in the vicinity of Meghri-Shahadzor highway (11km) and Shvanidzor-Bughdaduz dismantled railroad bed (12km).

Right branch main pipeline

The water quantity required for the irrigation is 0.2 m^3/sec, and the irrigated area is 210.00 ha, including 172 ha in Agarak town, and 38 ha in Karchevan village. The required water quantity will be transferred through D=720x6mm, L=8675m main pipeline to be carried out. The total length of the branch is 5761.0m, and will be carried out from D=425x5mm diameter steel pipes.

The right branch pipeline includes /pressure pipelines of Araks N1 pumping station/ implementation of the following structures:

- Distributor D-1 (920m long, starts from pressure pipelines of N2 pumping stations);
- Distributor D-2 (1112.0m long, starts from pressure pipelines of N1 pumping station);
- Distributor D-3 (335.0m long, starts from pressure pipelines of N2 pumping stations);
- Distributor D-3-1 (460.0m long starts from D-3 distributor);
- Distributor D-4 (625m long starts from Araks N1 pumping station pressure pipelines).

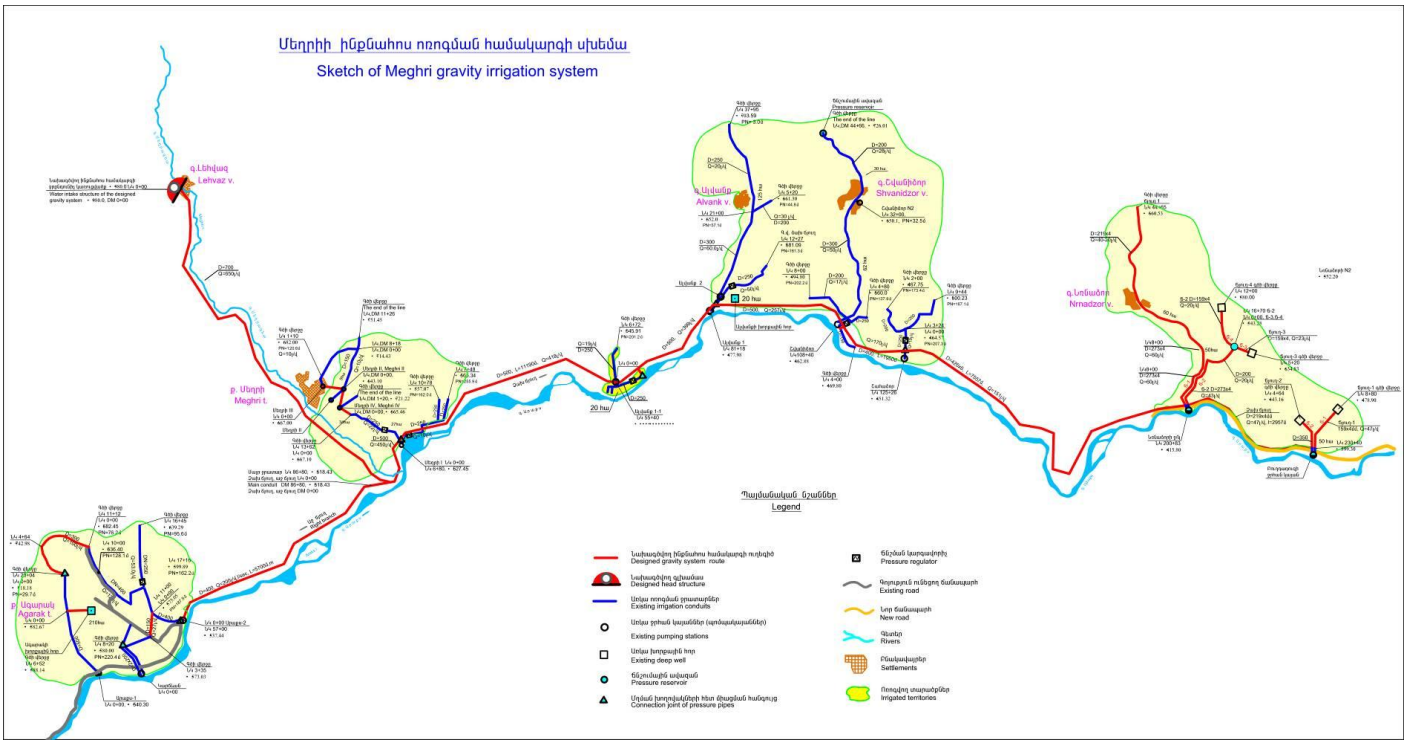
The right branch pipeline will be mainly underground, passing in the vicinity of the right-side of Meghri-Agarak highway, across the administrative areas of Agarak community or state land under the RA Ministry of Transport and Communication. Their permission is obtained (Attachment H).

The relief is complicated; the absolute elevations vary between 517-730 meters. Longitudinal slopes of the right branch are 5^0-15^0.

The irrigation pipeline will have flow meter wells, air valve wells and discharge basins. It is planned to coat the pipeline with polymer mastic to protect it from corrosion.

From engineering-geological, hydro-geological point of view the area is favorable for the implementation of the construction works that will be carried out in a way that will not disturb the irrigation of the adjacent areas.

Figure 2: Sketch of Meghri gravity irrigation system



The following construction works are designed to be carried out:

- cutting and excavation of soft soil;
- cutting of rocky soil;
- backfill by local soil;
- backfill with compaction;
- preparation of blinding layer from soft soil, sand and gravel soil;
- rock paving;
- arrangement of asphalt cover;
- placement of monolithic concrete and reinforced concrete;
- installation of pre-cast reinforced concrete structures;
- arrangement of joints;
- installation of steel pipes;
- installation of steel structures;
- insulation works.

Construction duration for the water intake head structure is estimated at 6.5 months and 12 months for water pipelines. Considering the seismicity factor and the factor for parallel implementation of works, the estimated duration will be: (12+6.5*0.3)*1.1 = 15 months. The estimated number of employees involved during peak periods of construction is 110 persons, including 10 engineering-technical personnel.

Table 5 below shows the general list of temporary construction facilities and structures. Table 6 shows the approximate amount of main machinery and devices used during construction phase. The storage and land required for set-up of temporary facilities during construction will be provided by the construction company recruited. As per their TOR, the Contractor will propose 4 construction sites complying with the relevant Republic of Armenia (RA) legislation and will discuss them with PIU prior to finalization of the sites. Voluntary servitude contracts will be signed between the communities owning lands used and the PIU. The use of communal lands for this purpose will be preferred. In the case of private land use, a

Resettlement Action Plan (RAP) will be prepared, as required, in compliance with the Resettlement Policy Framework.

Table 5. List of temporary construction facilities and structures

N:	Name	Number				Size, m	Notes
		TFSN1	TFSN2	TFS N3	TFSN4		
1	Foreman's office	+	+	-	-	8.6 x 3.1	container
2	Dormitory for 6 persons	+	+	+	+	10.7 x 2.4	movable
3	Warehouse for tools	+	+	+	+	6.7 x 3.0	container
4	Mechanical workshop	+	+	+	+	7.25 x 2.9	container
5	Concrete mixer	+	+	+	+	-	СБ-92А
6	Compressor	+	+	+	+	-	ДК-9
7	Compressor	+	+	+	+	-	ПР-10
8	Cloakroom with heating	+	+	+	+	6.7 x 3.0	movable
9	Camper with heating	+	+	+	+	3.9 x 2.4	movable
10	Shower wagon	+	+	+	+	10.4 x 3.1	container
11	Toilet for 1 person	+	+	+	+	D 1.3	-
12	Wagon – dining room For 20 workers	+	+	+	+	10.3 x 3.1	container
13	First aid station	+	+	+	+	10.0 x 2.4	container
14	Sheltered warehouse	+	+	+	+	10.0 x 5.0	-

Table 6. Approximate amount of main machinery and devices

N	Name	Type of the machine	Amount
1.	Dumper truck	Carrying capacity 7t	12
2.	Truck with side dumper	Carrying capacity 10t	3
3.	Auto concrete mixer	Capacity 4m^3	4
4.	Auto concrete mixer	Capacity 2m^3	2
5.	Auto concrete pump	-	1
6.	Sand blaster	-	1
7.	Asphalt spreading machine	-	2
8.	Truck for carrying bitumen	Capacity 7m^3	2
9.	Device for bitumen spreading	Capacity 3.4t	2
10.	Auto hoister	Carrying capacity 16t	4
11.	Truck for carrying cement	Capacity 20t	1
12.	Bulldozer	Power 96KWt	4
13.	Spreading Bulldozer	Power 96KWt	3

N	Name	Type of the machine	Amount
14.	Concrete mixing point	Efficiency 20m^3 /hour	1
15.	Roller	Weight 10t	4
16.	Compressor	Efficiency 10m^3 /minute	4
17.	Jack hammer	MO-10	6
18.	Manual pneumatic compactor	40kg	8
19.	Excavator	1m^3 capacity of bucket	4
20.	Deep vibrator	-	4
21.	Package of deep vibrators	-	1
22.	Welding apparatus	-	4
23.	MES – 60 (mobile electric station)	-	2
24.	MES – 30 (mobile electric station)	-	4
25.	Water extracting pump	Efficiency 40m^3 /hour	2
26.	Pebble distributor	-	2
27.	Gamma defect tracking device	Gamarid-25	2
28.	X-ray device	-	2
29.	Pipe layer	-	4

Construction works will be carried out within the alienation zone of the existing infrastructure (mainly roads) where temporary construction structures will be installed.

Construction works will be carried out in accordance with construction and other norms defined by the Republic of Armenia (RA) legislation and in compliance with the Environmental Management Plan included in the present ESIA report prepared in accordance with the World Bank's OP/BP 4.01 Environmental Assessment.

The construction works are to take place in four building sites simultaneously: 1. Water intake head structure, 2. Main pipeline, 3. Right branch, 4. Left branch. Table 7 below describes the earthworks and volumes by 4 construction sites. Communal land use for this purpose will be preferred. Once the sites are selected, the PIU will sign voluntary Servitude Contracts with the relevant communities. Should use of private lands be required, a Resettlement Action Plan (RAP) will be prepared, if required, in compliance with the Resettlement Policy Framework.

Table 7. Description of earthworks and volumes

	Description	Unit	Volume
	Water intake head structure		
1.1	Cutting of soft soil (category II-IV)	m3	405
1.2	Excavation of soft soil (category II-IV)	m3	3050
1.3	Backfill by soft soil with compaction	m3	620
1.4	Backfill by local soil	m3	300
1.5	Leveling of excessive soil in-situ	m3	2535
1.6	Rock strengthening, protective rock layer, apron, rock transportatio km	m3	308.3
2.	***Main pipeline***		
2.1	Cutting of top soil with its future restoration	m3	1700

2.2	Excavation of soft soil (category II-IV)	m3	18746.4
2.3	Blinding layer from soft soil, d=0,1 m	m3	1048.7
2.4	Backfill by soft soil with compaction	m3	7340
2.5	Backfill by local soil	m3	4331
2.6	Road fill with compaction	m3	200
2.7	In situ leveling of excessive soil	m3	5418.7
2.8	Removal of excessive soil to 2 km	m3	408
3.	***Left branch***		
3.1	Cutting of top soil with its future restoration	m3	1940
3.2	Excavation of soft soil (category II-IV)	m3	9891.8
3.3	Excavation of soft soil (category IV) under railway road (including removal and reinstallation of rail pack, removal and re-installation of ballast bed, removal of soil with future backfilling and compaction, strengthening of trench wall and removal of strengthening, leveling of trench bottom)	m3	161
3.4	Excavation of soft-rocky soil (category IVp)	m3	3430
3.5	Excavation of soft-rocky soil (category IVp) under railway road (including removal and reinstallation of rail package, removal and re-installation of ballast bed, removal of soil with future backfilling and compaction, strengthening of trench wall and removal of strengthening, leveling of trench bottom	m3	48
3.6	Excavation of rock soil (category V-VII)	m3	5459.8
3.7	Excavation of rock soil (category V) under railway road (including removal and reinstallation of rail package, removal and re-installation of ballast bed, removal of soil with future backfilling and compaction, strengthening of trench wall and removal of strengthening, leveling of trench bottom).	m3	96
3.8	Blinding layer from soft soil, d=0,1 m	m3	1279.4
3.9	Blinding layer from soft soil, d=0,1 m. The soil to be brought from a distance of 1 km.	m3	6.4
3.10	Backfill by soft soil with compaction.	m3	9493.3
3.11	Backfill by soft soil with compaction. The soil to be brought from a distance of 1 km.	m3	46
3.12	Backfill by local soil	m3	7289
3.13	Road fill with compaction	m3	50
3.14	In situ leveling of excessive soil	m3	969.6
3.15	Demolition of asphalt-concrete with removal to 2 km	m3	10.1
3.16	Gravely blinding layer d=0,15 m	m3	5.8
3.17	Coarse-graded asphalt concrete, d=5 cm	m2	52.8
3.18	Fine-graded asphalt concrete, d=3 cm	m2	52.8
3.19	Rock filling d=20 cm, rocks from quarry	m2	5.5
3.20	Dry rock paving d=22 cm, rocks from quarry	m2	15
4.	***Right branch***		
4.1	Excavation of soft soil (category II-IV)	m3	4813.2
4.2	Excavation of soft-rocky soil (category IVp)	m3	3107.8
4.3	Excavation of rock soil (category V-VII)	m^3	539
4.4	Blinding layer from soft soil, d=0,1 m	m3	657.2
4.5	Backfill by soft soil with compaction	m3	4036.4
4.6	Backfill by local native top-soil	m3	3016

4.7	Road fill with compaction	m3	580
4.8	In situ leveling of excessive soil	m3	168.4
4.9	Demolition of asphalt-concrete with removal to 2 km	m3	5.98
4.10	Sandy blinding layer, d=0,1-0,15 m	m^3	3.9
4.11	Bitumen impregnated gravel layer, d=18 cm	m^3	4.8
4.12	Coarse-graded asphalt concrete, d=5 cm	m2	24
4.13	Fine-graded asphalt concrete, d=3 cm	m2	23
4.14	Rock filling d=20 cm, rocks from quarry	m3	3
4.15	Dry rock paving d=22 cm, rocks from quarry	m2	6

Excavated earth volume:

- Main conduit-21445m^3,
- Head junction-3455.1m^3
- Left branch-42476.4m^3
- Right branch-14867.6m^3

Backfill

- Main conduit-14889m^3
- Head junction junction-920m^3
- Left branch-35179m^3
- Right branch-12312m^3

The topsoil volume originated as a result of earth works, which is only in the area of the main pipeline, will be 122m^3 in total. It will be stored in an area previously agreed with the local authorities.

The land use required for Meghri gravity scheme construction and its operation is described below:

Head water intake structure

Head water intake structure will be located in Meghri Riverbed, in the vicinity of Lehvaz community downstream of the river. It will occupy 0.015 ha. Part of this area, located on the right bank of river Meghri, belongs to Lehvaz Communitythe State, and part of the area on the left bank belongs to Levhaz branch of Meghri Road Construction and Operation Company (RCOC) LLC. The owner of the RCOC has signed a Voluntary Servitude Contract for land use rights of the area of 500m^2 property required for the construction and operation of the intake. The area is not used for any specific purpose by the owner (see Attachment H).

Main pipeline route passes across the administrative area of Meghri, Lehvaz, and Gudemnis communities, and the Meghri riverbed, where the land belongs to the State. The total land area under the main pipeline is 1.50 ha. The pipeline passes across 89m of private territory of Communal Service Rehabilitation Company which is in the town of Meghri and 47m of private territory of a Cheese Factory near Lehvaz Community. The pipeline will pass along the river bank by the edge of the factory land without affecting the factory operations or its land use. The owners have signed Voluntary Servitude Contracts for pipeline installation and construction works (see Attachment H).

Left branch pipeline route passes across the administrative area of Meghri community (2300m long), parallel to the left-side of Meghri-Shvanidzor-Nrnadzor highway, through the areas belonging to the State. The total area under the left branch pipeline makes 3.59 ha, of which 117m long pipeline section passes through the 0.275 ha which is leased by a citizen who grows pomegranates. The pipeline will not affect the trees. Maturity of the lease agreement is December 1, 2030. The lease holder has signed a Voluntary Servitude Contract for the temporary restriction of the land use right for the period of construction (Attachment H). The land belongs to Alvank community and the community has agreed to the use of land for the project (Attachment H).

The route of the **right branch pipeline** passes along the right-side of Meghri-Agarak highway, through lands belonging to the State and the administrative area of Agarak community. It occupies 1.0 ha land which is state-owned land under the RA Ministry of Transport and Communication. The permission from the Ministry and the administrative area of Agarak community has been obtained (Attachment H).

Overall, as shown in Table 8 below, the total area to be permanently taken by the Meghri scheme (area under the intake and pipes) amounts to 6.10 ha, while the approximate area to which access will be temporarily restricted during construction works, makes 32.6 ha.

Table 8. Land use during construction and operation of the Meghri gravity scheme

DM[5]	Length, m	Land use, ha		Description
		permanent	temporary	
Main Pipeline:				
0+00÷26+00	2600	0.45	1.56	The route passes the area between Kapan-Meghri highway and left bank of Meghri River, through a D=530 mm pipeline. Lands belong to Lehvaz community and a section of 89 m belongs to the Cheese Factory.
26+00÷28+00	200	0.035	0.12	The route passes the area between Kapan-Meghri highway and left bank of Meghri river, through trench. Lands belong to Gudemnis community and are not privatized.
28+00÷36+28	828	0.145	0.50	The route passes the area between Kapan-Meghri highway and left bank of Meghri River, through trench. Lands belong to Meghri community and are not privatized.
36+28÷40+46	418	0.07	0.25	The route passes parallel the right side of Kapan-Meghri highway. It is state-owned under the RA Ministry of Transport and Communication.
40+46÷48+69	823	0.14	0.49	The route passes the area between Kapan-Meghri highway and left bank of Meghri River, through trench. Lands belong to Meghri community and are not privatized.
48+69÷66+53	1784	0.310	1.07	The route passes along the inter-district road of Meghri town. The land belongs to Meghri community and a section of 47m belongs to Communal Service Rehabilitation Company.
66+53÷67+70	117	0.02	0.07	The route passes parallel the right side of Kapan-Meghri highway. It is state-owned under the RA Ministry of Transport and Communication.
67+70÷86+75	1905	0.33	1.14	The route passes parallel right and left banks of Meghri river and has 2 crossings over the river. The lands belong to Meghri community.
Total:	***8675***	***1.5***	***5.2***	
Right Branch				

[5] This is an indicator of a specific point along the water conduit, measured from the start of the canal, which is identified as DM0+00.

DM[5]	Length, m	Land use, ha		Description
		permanent	temporary	
0+00÷8+00	800	0.096	0.48	The route passes parallel to the right side of Meghri-Agarak highway, at a distance of 6m. Lands belong to Meghri community and are not privatized.
8+00÷57+60	4960	0.594	2.98	The route passes parallel to the dismantled railroad bed. Lands belong to Agarak community.
Distribution network				
	5240	0.31	3.14	The routes pass parallel to the edge line of inter-field roads. Lands belong to Agarak and Karchevan communities.
Total:	***11000***	***1.0***	***6.60***	
Left Branch				
0+00÷11+00	1100	0.120	0.66	The route passes parallel to the right side of Meghri-Shvanidzor highway. Lands belong to Meghri community.
11+00÷50+00	3900	0.428	2.34	The route passes parallel to the left side of Meghri-Shvanidzor highway. Lands belong to Meghri community.
50+00÷103+50	5350	0.588	3.21	The route passes parallel to the left side of Meghri-Shvanidzor highway. Lands belong to Alvank community and 110m will pass through a pomegranate orchard leased by a citizen from Alvank community.
103+50÷121+50	1800	0.198	1.08	The route passes parallel to the edge line of earth road. Lands belong to Shvanidzor community.
121+50÷197+50	7600	0.836	4.56	The route passes parallel to the dismantled railroad bed. Lands belong to Shvanidzor community.
197+50÷230+40	3290	0.360	1.97	The route passes parallel to the dismantled railroad bed. Lands belong to Nrnadzor community.
Distribution network				
	12960	1.06	6.99	The routes pass parallel to the edge line of inter-field roads. Lands belong to Meghri, Alvank, Shvanidzor and Nrnadzor communities.
Total	***36000***	***3.59***	***20.80***	
Grand Total	***55675***	***6.09***	***32.6***	

Overall, the area that falls under temporary and permanent land take makes 6.09 ha + 32.6 ha = 38.69 ha.

5.3 Baseline Information

Climate

The climate of the command area of Meghri gravity system is moderate-warm, with mild winter and dry subtropical summer at the sites adjoining to the river Araks. There are no meteorological stations at the vicinity of the Meghri River water basin area nearby the proposed project site. Therefore the description of climatic elements is given according to the «Climatic Atlas of the Armenia»[6] and according to data of meteorological station of the town of Meghri, which may be used for estimation of climatic elements.

Average annual air temperature is 4C°, in January – 7C°, in April – 2C°, in July – 14C°, in October – 4C°, annual temperatures amplitude is 23C°. The absolute minimum temperature observed in January is -30C° and the absolute maximum is 31C° observed in July. The dates of the mean annual air temperatures exceeding certain ranges and the number of the days within those ranges are given in Table 6.

Table 8. Data on temperatures exceeding certain ranges

Temperatures higher than the mentioned ones		Temperatures lower than the mentioned ones		Number of Days >T°C ÷ < T°C
>T°C	Date	< T°C	Date	
0°C	1/III	0°C	10/XII	280
5°C	1/V	5°C	10/XI	190
10°C	10/V	10°C	5/X	145
15°C	1/VII	15°C	15/IX	75

The last spring frost occurs in average in April 24 and the first autumn spring – September 1. The non-frost period is 180 days. The duration of the heating season is 170 days. The mean annual temperature of the land surface is 6°C, -8°C in January, 4°C in April, 24°C in July, and 7°C in October. Maximum soil freezing depth is 31cm. Mean annual air pressure is 820mb.

Winds blowing towards southeast are prevalent during the year and their mean speed during the year varies within 4-4.5m/sec, and 19m/sec wind probability is 5%. Annual precipitation makes up 550mm. Maximum precipitation is observed in May-101 mm and the minimum is in August - 14 mm. The 60mm precipitation probability is 2%. The number of days with precipitation of 0.1mm and more is 115 days. Frozen precipitation makes up 275mm. The stable snow cover is set from December 15 and disappears on April 1. The snow cover stays 100 days a year. The height of the highest ten-day snow layer is 50cm. Annual evaporation is 325mm and evaporability is 800mm.

The annual parameters of several main components of the area's climate based on the data of Meghri meteorological station are presented in the Table 9 below.

Table 9. Annual distribution of several components

Climate Components	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Air temperature, °C	1.4	3.3	7.9	13.8	18.9	23.0	26.1	25.7	21.2	15.2	9.2	4.0	14.1
Air absolute temperature, °C	23	25	30	33	38	41	40	41	38	33	30	25	41
Air minimum temperature, °C	-18	-14	-11	-3	2	4	10	11	2	-4	-7	-14	-18
Land temperature, °C	0	3	10	16	24	30	33	32	25	16	8	3	17
Wind speed, m/sec	1.6	1.7	1.7	1.6	1.5	1.7	2.0	1.9	1.8	1.3	1.4	1.6	1.6
Air relative humidity, %	63	61	62	61	61	55	49	50	60	67	67	65	60
Precipitation, mm	18	18	32	41	52	30	10	7	13	23	24	15	283
Evaporation from water surface, mm	-	-	48	84	122	148	160	153	104	60	30	-	-
Evaporation from land, mm	-	-	17	35	52	56	53	48	40	35	19	-	-

[6] National Atlas of Armenia; Yerevan, 2007.

Relief

Meghri gravity system is located in the Meghri region of Syunik Marz, in medium and low streams of the Meghri River. From geo-morphological perspective the area has very irregular terrain with absolute elevations of 1043-1055 m.

Soils and land use

According to soil zoning, the project area is included in forest and steppe soil zone, which is specified by forest brown and valley-steppe types of soils. According to cadastral classification of agricultural soils the investigated area is included into Syunik region.

Forest brown typical and carbonate subtypes of soils are characterized by weak differentiation of genetic horizons. According to mechanical texture, these soils have mainly light and moderate sandy-clayey content. The clayey and clayey-sandy soils are less common. According to the degree of stoniness, the lands under the project area are characterized mainly by low surface profile to average stoniness, in distinct small places one may encounter also average and strong stony areas.

The agricultural lands of the project area are mainly characterized by little strength (about 66%) - their strength is 0-39 cm, while other lands have average strength of about 40-60 cm. The strong lands with the strength of over 60 cm, are rare (about 7%). According to erosion degree most of irrigated lands are slightly eroded, especially the upper layers of arable lands. In some relatively steep slopes there are average, sometimes strongly eroded areas.

The content of humus in the irrigated lands of the project area is insignificant and varies between 1.31-2.92, the soil pH varies between 6.8-8.2. Thus the lands have weak acid or alkaline reactions.

Valley-terrace soils of the project area are spread in the left valley of the Araks River. These irrigated lands are mainly devoid of underground water feeding. They have a weakly developed, mostly weak surface and deep average stony profile. These soils have mainly clayey-sandy mechanical composition. They make up to 72% of the area. About 23% of the area has clayey composition, and the remaining area is occupied by soils with sandy-clayey mechanical composition.

The flat areas are represented by valley-terrace soil. Erosion is weakly expressed in these areas.

No soil salinization, alkalization, bogging and pollution with toxic substances are observed within agricultural lands of the project area. Ecological state of the lands depends on the chemical composition and the degree of mineralization of the irrigation water. Water for Meghri gravity system will be taken from the Meghri River. The waters of Meghri River have been investigated and analyzed from time to time by the Monitoring Centre of the MoNP. The river is not polluted with neither mineral nor organic pollutants and cannot adversely impact the ameliorative state of the irrigated lands.

Geological structure

Geological structure of the Meghri gravity system area is represented by formations of Eocene and Quaternary age. The oldest rocks of the region are gabbro-diorites and gabbro-syenite of Middle Eocene age that have wide occurrence on the left slope of the Meghri River and within river bed.

These intrusive rocks of Eocene age are covered by Quaternary sediments represented by large and small rock debris, pebble and loam of diluvial and alluvial origin with overall thickness of 6.0-10.0m (sometimes 18-20m terrace-alluvial gravely-pebble soil).

Meghri River basin has a trough-like shape in the location of head intake structure. The slopes are 75-80m high and 20-23° steep. The width of the bed and flood plain is 10-15m. The dam left side is made of gabbro-syenite rocks (Layer 5) are covered by 1.5-1.8 m thick terrace-alluvial gravely-pebble soil (Layer 3). The bed and the floodplain of the river also are made of intrusive gabbro-syenite rocks (Layer 5) covered by 5.0-6.0m thick alluvial pebbly-gravel soil with up to 25% sand matrix (Layer 2). The right side area of the dam is represented by intrusive gabbro-syenite (Layer 5) up to the elevation of 1060-1065m. This rock is weathered and fissured to the depth of 2.0-2.5m.

The areas of the main pressure pipeline and the areas under its right and left branches consist of gravely-pebble soil with up to 10% inclusion of river rocks and up to 25% sandy loam matrix.

Hydro-geological conditions of the area are specified by presence of water that fills fissures in the bedrocks, which have gentle sloping towards the river.

Engineering-geological conditions

The geological-engineering conditions of the project area are characterized by engineering geological elements (layers) shown below. They were identified by the FS/FD Consultant as a result of review of available materials and topographic and field geophysical surveys conducted for the assessment of engineering-geological characteristics of the Megri gravity project area in Syunik Marz.

Layer 1^a, dlQ$_{IV}$ Topsoil with inclusion of small rock debris, coarse sand and sandy loam. Thickness - 0.3-0.4 m. Soil workability category - 9^c/8^c according to CSR IV-2-82, 1 and 3.

Layer 1, aldlQ$_{IV}$ Loam soil with up to 10% inclusions of gravel. This soil is distributed mainly within reservoir bottom. Soil workability category – 33^d/33^d:

Layer 2, alQ$_{IV}$ Alluvial sediments represented by pebble with up to 25% sand and sandy loam matrix This soil is distributed mainly in the Meghri River bed. Thickness – up to 5.0 m. Soil workability category – 6^d/9^d:

Layer 3, alQ$_I$ Alluvial-diluvial sediments represented by gravely-pebble soil with up to 25% sand and sandy loam matrix. This soil is distributed in the Meghri River valley and reservoir bottom. Thickness - 3-10 m. Soil workability category – 6^d/9^d:

Layer 4^a, dl Q$_{IV}$ Large and small rock debris with inclusions of large fragments and up to 25% sandy loam matrix. Thickness up to 4.5 m. Soil workability category – 13/14.

Layer 4, elQ$_{IV}$ Alluvium represented by rock fragments and debris with up to 15% sandy loam matrix. Soil workability category – 12/13.

Layer 5, αβQ$_I$ Gabbro-diorites that are exposed on the right side and the bed of Meghri River. On the right side of the river this layer is covered by volcanic-sedimentary strata (Arevik Strata). Soil workability category – 18^c/19^c.

Seismicity

According to the Republic of Armenia seismic zoning map[7], the investigated area is within the seismic zone of 9-grade intensity, with 0.4g ground acceleration. Project design is produced with full consideration of the seismic risks of the project affected area (acc. to RABC II.6.02.2006)

Hydrology

The drainage network of the area belongs to the transboundary Araks River basin. Meghri River starts from the eastern slopes of Zangezur mountain range, from Kaput Lake at the height of 3283.4 m. It falls into the Araks River at the distance of 317 km from the estuary. The river is 36km long, drainage basin surface is 336 km^2. Table 10 below presents several main morphometric components of Meghri River designed section.

Table 10. Morphometric components of the Meghri River in the designed section

River Length, km	Drainage Area Surface km^2	River Source Unit, m	Calculated Section Unit, m	Mean Height, m	Riverbed Inclination, $^o/_{oo}$
23.5	237.5	3570	980	2275	110

[7] National Atlas of Armenia, Yerevan, 2007.

The Meghri River flow was studied at two sections: Lichk and Meghri gauging stations. Table 11 below presents key features of gauging stations in the Meghri River.

Table 11. Gauging Stations

River Section	Distance from the estuary, km	River basin surface, km²	Mean height, m	Operation period		Gauging point "o"-unit
				start	end	
Meghri-Lichk V.	26	21.0	2960	1/I - 1946	1/I - 1989	1737.99 BS
Meghri-Meghri Town	6.2	274.0	2200	1/ - 1945	1/ - 1947	765.6 BS
Meghri-Meghri Town	6.0	274.0	2200	1/I - 1949	operating	692.22 BS

FS/FD Consultant used the data of the observations for 1949-2011 of gauging station Meghri-Meghri Town observation point to make hydrological statistical calculations.

To calculate the mean runoff, first the natural runoff of the river was recovered taking into consideration irrevocable losses: 85% from irrigation and 30% from water supply. Further, the mean annual flows for the period of 1949-2011 were subjected to statistical processing. The calculations of the mean flow and the variation coefficient were carried out taking into consideration the presence of the extreme yield (87.5m³/sec) in the hydrological observation series. The calculated values of the maximum flows were transferred from the Meghri-Meghri town Gauging station to the designed sections through the surface reduction coefficient (n=0.6), as presented in Table 12.

Table 12. Maximum flows by various probability of occurrence

River Section	Flow (m³/sec) according to probability, P %							
	0.01	0.1	0.5	1	3	5	10	25
Meghri-Meghri Town	244	150	101	84	60	50	38	24
Meghri-Designed section	218	134	90	75	54	45	34	21

Only mean daily flows were studied among the minimum flow characteristics of the Meghri River. The largest mean daily flow of 0.95m³/sec was observed on 22 January 1994, and the lowest one, 0.08m³/sec - observed on 18 February 2002.

The observation series of **minimum mean daily flows** for 1949-2011 was statistically processed by the method of moments. Minimum mean daily flows were extrapolated to the designed sections through the same surface coefficient K=0.95. The results are presented in Table 13.

Table 13. Mean Daily Yields of Different Provision

River Section	Yields (m³/sec) according to provision, P %								
	50	60	70	75	85	90	95	97	99
Meghri-Meghri Town	0.41	0.35	0.30	0.27	0.24	0.16	0.11	0.09	0.05
Meghri-Designed section	0.39	0.33	0.28	0.26	0.23	0.15	0.10	0.08	0.05

Water management calculations have been carried out through the combined balance methods of probable and actual years. Baseline data for the water management calculations are the following:

1. The average annual discharge of the Meghri River at the water intake structure is 2.2 m³/sec and the annual flow at 75% probability at the same point is 69.44 mln m³.

2. Estimation of water supply volumes used for drinking and household purposes was based on the number of population of the towns and villages. The drinking water standard is 0.3 m³/sec for the urban inhabitant and 0.2 m³/sec for the village inhabitant is. The demand of

the water used for the household purposes, according the trial data, is 45% of the drinking water. Taking into account the leakages, the water supply volume is increased by 1,2 times.

3. Environmental flow was determined using methodology set forth in Decree N927 of RA Government dated June 30, 2011 according to which the environmental flow is defined as the average daily discharge of the 10 successive days with the lowest discharge. Based on the observations conducted within 1949-2011, the period of 10 successive days with minimal discharge at the given section of Meghri River occurs in February and the average makes 0.16 m^3/sec.

4. The value of sediment runoff in Meghri River as accepted at 50% of the suspended load value as this considered more reasonable value by some of authors (I. V. Eghiazarov, G. N Khmaladze, H. K Gabrielyan). Assuming the volume weight of the suspended weight of 1.2 t/m^3, and of the bed silt of 2.4 t/m^3, the total volume of the mean annual sediment runoff may be calculated (Table 14).

Table 14. Sediment Runoff Calculation

River Section	Suspended Load Yield, kg/sec	Volume of suspended load (Wk.) m^3	Bed Silt Yield kg/sec	Bed Silt Volume (Wh.) m^3	Total Sediment Runoffs W=Wk.+Wh.
Meghri - intake section	0.62	16296	0.31	4074	20370

The granulometric composition of the load in the Meghri River is studied only in the hydrological observation site in Meghri town (Tables 15 and 16), and these data were used in the process of the project design considering this limitation.

Table 15. Granulometric Composition of Suspended Load

Particles Content (%) according to diameter, mm							
1-0.5	0.5-0.2	0.2-0.1	0.1-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001
12.5	57.6	20.6	5.1	3.4	0.4	0.4	0.0

Table 16. Granulometric Composition of Bed Silt

Particles Content (%) according to diameter, mm											
>100	100-50	50-20	20-10	10-5	5-2	2-1	1-0.5	0.5-0.2	0.2-0.1	0.1-0.05	<0.05
26.4	21.1	22.2	22.5	-	0.1	0.0	4.5	1.9	0.9	0.2	0.0

Water temperature depending on the air temperature fluctuations reaches its maximum in July-August, and the minimum is observed in January-February (Table 17).

Table 17. Water Mean Monthly Temperature, °C

River Section	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meghri-Meghri Town	1.3	1.7	4.7	8.9	12.0	13.5	19.1	17.0	15.8	11.4	6.4	2.8

The river does not freeze. The glacial phenomena (riverside ice, cut) in the Meghri-Lichk observation site start on 25 November and ends on 22 March.

Irrigation Water Use

There are 4 communities in Meghri region of Syunik Marz located upstream of headwork (above 980 m) whose agricultural lands are irrigated from Meghri River by gravity:

1. Lehvaz - 30 ha;

2. Vardanidzor - 50 ha;
3. Lichk - 96 ha;
4. Tashtun - 27 ha.

The total area is 203 ha.

There are two other communities located downstream the headwork which also irrigate their agricultural lands by gravity from Meghri River:

- the town of Meghri town - 160 ha;
- Lehvaz v. - 90 ha.

The total area is 250 ha.

About 686 ha of 6 communities are irrigated by 10 pumping stations located on the Araks River. This area is distributed between communities as follows:

1. Meghri town - 34 ha;
2. Agarak town - 172 ha;
3. Karchevan v. - 38 ha;
4. Alvank v. -170 ha;
5. Shvanidzor v. -112 ha;
6. Nrnadzor v. -160 ha.

The total area is 686 ha.

These hectares also include lands irrigated by Agarak and Alvank tubewells: 12 ha and 5 ha, respectively.

The abovementioned lands are located at different elevations, therefore crops are grown in the different zones, and water demand is determined based on irrigation regimes N 31; 33; 34 and 37. The crops irrigated by gravity are located within the zone of irrigation regime N 31.

According to the information provided by "Meghri" WUA, the crop patterns on the area of 686 ha irrigated through pumping is as follows:

Orchards	480 ha
Vineyards	185 ha
Vegetables, gourds	21 ha
Total	686 ha

The water discharge of the main pipeline is calculated based on the ordinate of water demand hydromodulus diagram q=0.000672 m^3/sec per ha, and the system efficiency output η=0.71:

$$Q = \frac{\omega \cdot q}{\eta} = \frac{686 \cdot 0.000672}{0.71} \approx 0.65 \text{ m}^3/\text{sec}$$

Water demand was calculated for the flow with 75% probability of occurrence, which is in line with the accepted standards. Following are the assumptions used for water management calculations:

- ecological flow - 5.16 mln m^3/year
- domestic and economic water supply - 2.201 mln m^3/year
- irrigation for 1139 ha - 11.348 mln m^3/year, including 7.183 mln m^3/year for 686 ha gravity irrigation system (Refer to Table 18).
- river annual flow (at 75% probability) - 69.44 mln. m^3/year.

Table 18. Water demand of 1139ha lands irrigated from Meghri River according to the hydromodulus

Irrigated lands	Irrigation area, ha	Established irrigation regime no. acc. to irrigation standards	Irrigation norm (gross) m^3/ha	Annual water demand, mln.m^3	Including per months, mln.m^3								
					Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Upstream head intake	123	37	6480	0.797	-	0.011	0.090	0.135	0.218	0.254	0.086	0.003	-
Upstream head intake	50	34	8730	0.436	-	0.043	0.040	0.084	0.104	0.106	0.05	0.006	0.003
Upstream head intake	30	33	10511	0.315	0.01	0.02	0.027	0.054	0.074	0.068	0.046	0.013	0.003
Total	203	37,34,33	7626	1.548	0.01	0.074	0.157	0.273	0.396	0.428	0.182	0.022	0.006
Downstream head intake	250	31	10470	2.617	0.033	0.274	0.128	0.427	0.591	0.611	0.339	0.173	0.041
Lands to be turned to gravity irrigation	686	31	10470	7.183	0.09	0.753	0.352	1.171	1.623	1.677	0.93	0.476	0.111
Total	1139	37,34,33,31	9963	11.348	0.133	1.101	0.637	1.871	2.610	2.716	1.451	0.671	0.152

Table 18. Meghri River Hydro hydro-economic balance for irrigation of 1139 ha at Meghri River intake section for the low-water year with 75% probability, in mln.m³

Months	Meghri River flow in intake section (75% probability)	Environmental flow	Water withdrawal		Irrigation demand for existing 203 ha upstream the headwork	Total demand before the upstream headwork	Covered		Balance	Irrigation demand for existing 250 ha (downward the downstream headwork)	Irrigation demand for 686 ha served by Araks pumping stations	Covered		Balance
			Communal	Industrial			From river	deficit				From river	Deficit	
Jan	2.20	0.43	0.129	0.058	-	0.617	0.617	-	1.58-3	-	-	-	-	1.583
Feb	1.67	0.43	0.116	0.052	-	0.598	0.598	-	1.072	-	-	-	-	1.072
Mar	3.32	0.43	0.129	0.058	0.010	0.617	0.617	-	2.703	0.033	0.09	0.123	-	2.580
Apr	8.62	0.43	0.125	0.056	0.074	0.685	0.685	-	7.935	0.274	0.753	1.027	-	6.908
May	13.29	0.43	0.129	0.058	0.157	0.774	0.774	-	12.516	0.128	0.352	0.480	-	12.036
Jun	17.51	0.43	0.125	0.056	0.273	0.884	0.884	-	16.626	0.427	1.171	1.598	-	15.028
Jul	7.64	0.43	0.129	0.058	0.396	1.013	1.013	-	6.627	0.591	1.623	2.214	-	4.413
Aug	3.81	0.43	0.129	0.058	0.428	1.045	1.045	-	2.765	0.611	1.677	2.288	-	0.477
Sep	2.38	0.43	0.125	0.056	0.182	0.793	0.793	-	1.587	0.339	0.93	1.269	-	0.318
Oct	3.67	0.43	0.129	0.058	0.022	0.639	0.639	-	3.031	0.173	0.476	0.649	-	2.382
Nov	2.87	0.43	0.125	0.056	0.006	0.617	0.617	-	2.253	0.041	0.111	1.152	-	2.101
Dec	2.46	0.43	0.125	0.058	-	0.617	0.617	-	1.843	-	-	-	-	1.843
Total:	69.44	5.16	1.519	0.682	1.548	8.899	8.899	-	60.541	2.617	7.183	9.80	-	50.741

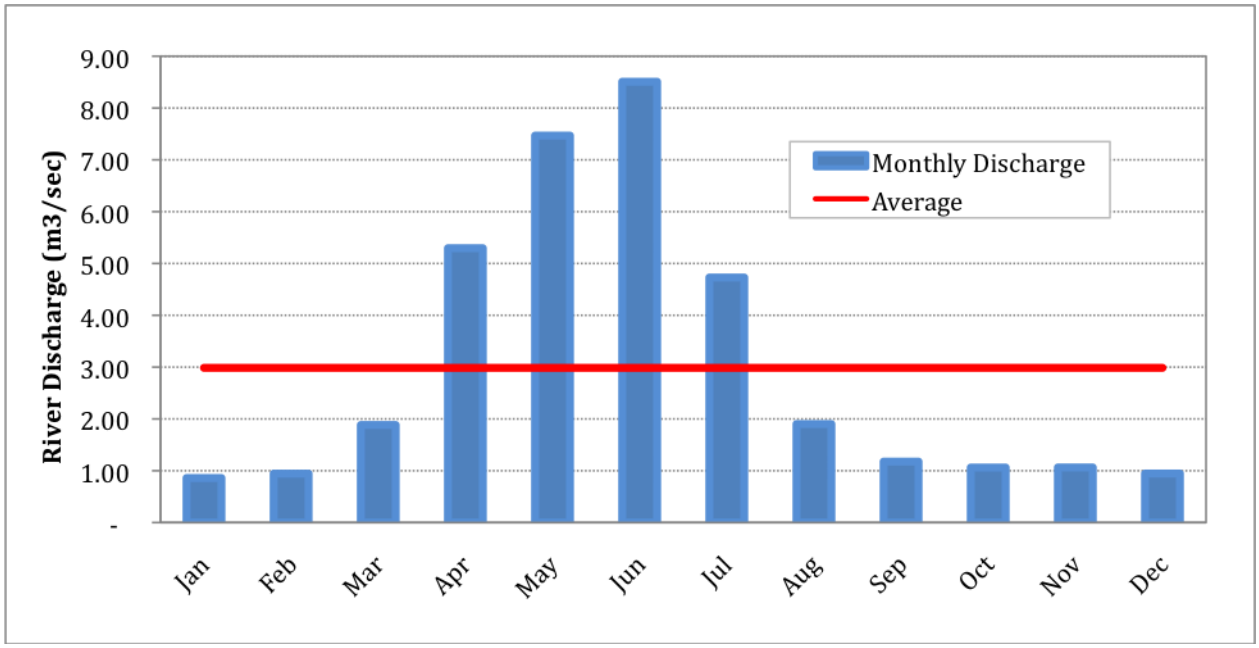
To record the river flow cyclic changes in the water balance, the 1973-1988 hydrologic series have been selected as a cycle, and monthly water calculations also have been carried out for each year of the mentioned hydrologic series.

Environmental flow

The national regulation currently in force in the RA establishes the environmental flows as the average daily flow of the 10 successive days with the lowest flow. Applying the established methodology, the environmental flow of Megri River in the section of the water intake by the rehabilitated Meghri irrigation scheme and downstream is set at 0.166 m^3/sec.

The natural discharge of the Meghri River basin is estimated based on the flow measurements at the Meghri-Meghri river gauging station over the period of 1949-2011, the measured and estimated water intakes, and the estimated return flows. The results of the calculation of the natural river flow at the proposed intake site are presented in Figure 3 below.

Figure 3: Monthly Natural Discharge at the Intake



According to the Feasibility Study, the water demand for the 686 ha to be irrigated by the Meghri Gravity System is estimated as 7.183 million cubic meters. This estimation is based on the cropping mix of 70% orchards, 27% vineyards, and 3% vegetables. The estimated 40% water loss is also factored in. This is the same amount that is being currently withdrawn from a transboundary Araks River by pumps to irrigate the 686 ha targeted by the project. Thus, rehabilitation of the Meghri scheme will have zero transboundary impact.

As for the Meghri River, the average water demand over a year is presented in Table 19.

Table 19: Water Demand Meghri Gravity Scheme (in m3/sec)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-	-	0.094	0.231	0.136	0.452	0.626	0.647	0.359	0.184	0.043	-

Figure 4 below illustrates natural river flow vs. flow remained after abstraction by the gravity scheme at the proposed intake. As can be seen from this figure, river discharge after the project represents 100% of the average winter flow and between 71-72% of the average flow during August and September. As can be seen from this figure, the discharge after the project is well above the environmental flow, even if the international best practice was applied.

Figure 4: Comparison of the Natural River Flow vs. Flow Remaining after Abstraction by the Gravity Scheme - At Intake

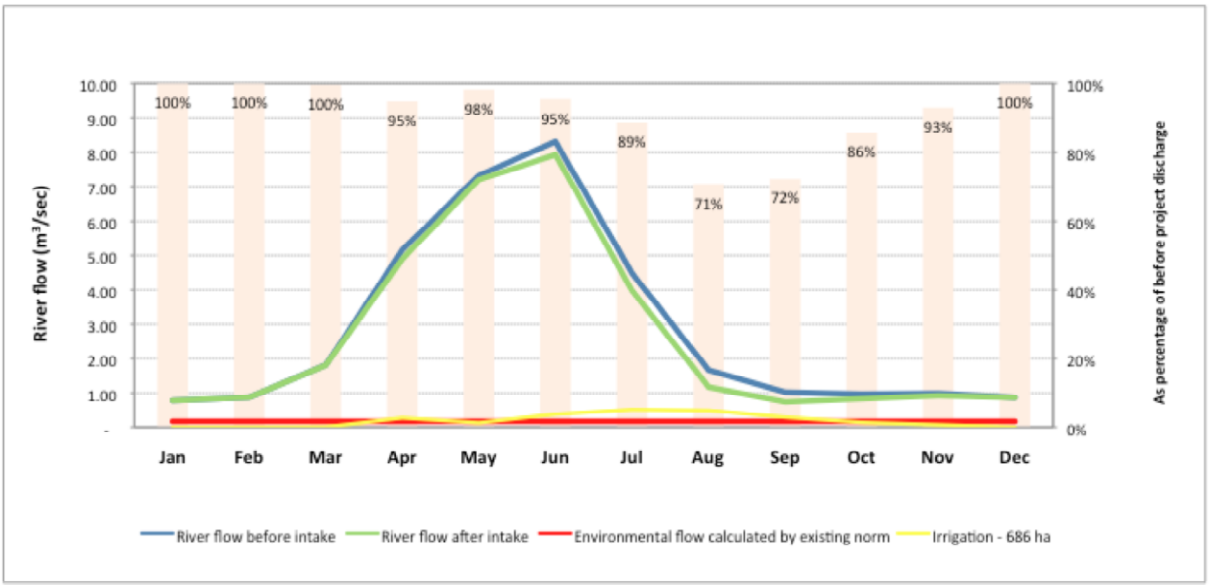
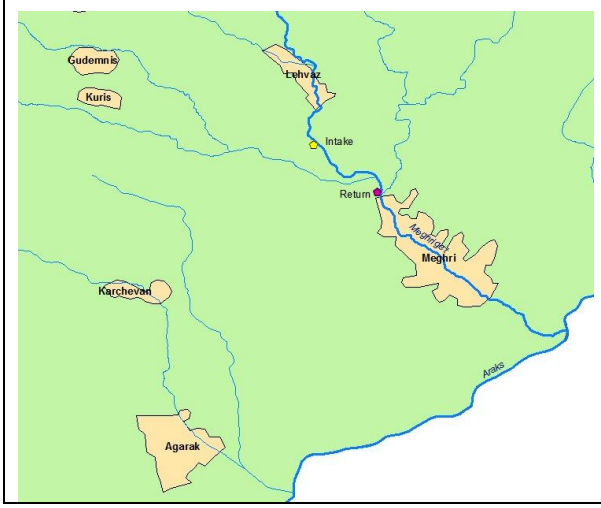


Table 20: Water Balance Before and After Project at Proposed Water Intake

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meghri river natural flow at head intake section	0.86	0.94	1.88	5.29	7.47	8.51	4.73	1.90	1.18	1.06	1.06	0.95
Irrigation demand for 203ha upstream head intake	-	-	-	0.07	0.06	0.13	0.17	0.17	0.08	0.01	-	-
Drinking water	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Other water demand	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
River flow before intake	0.79	0.88	1.81	5.16	7.33	8.31	4.49	1.66	1.03	0.98	1.00	0.87
Irrigation demand = 686 ha	-	-	0.01	0.27	0.13	0.37	0.51	0.49	0.29	0.14	0.07	-
River flow after intake	0.79	0.88	1.80	4.89	7.21	7.94	3.98	1.18	0.74	0.84	0.93	0.87
As percentage of river flow before project	100%	100%	100%	95%	98%	95%	89%	71%	72%	86%	93%	100%

About 1 km below the water intake point of the Meghri Gravity System there is a small HPP operated by QH LLC, with overall production capacity of 840 kWt. The HPP operates since 2004 with an annual permitted quantity to abstract up to 24 million m^3 of water. The distance of water abstraction and return point by the HPP is less than 1500 m. Thus, the proposed 686-ha Meghri Gravity System project will have the most impact on the flow in the 1500 m section between the water intake and water return point of the QH HPP (Figure 5).

Figure 5: Map and photo of the water intake and return point of QH small HPP

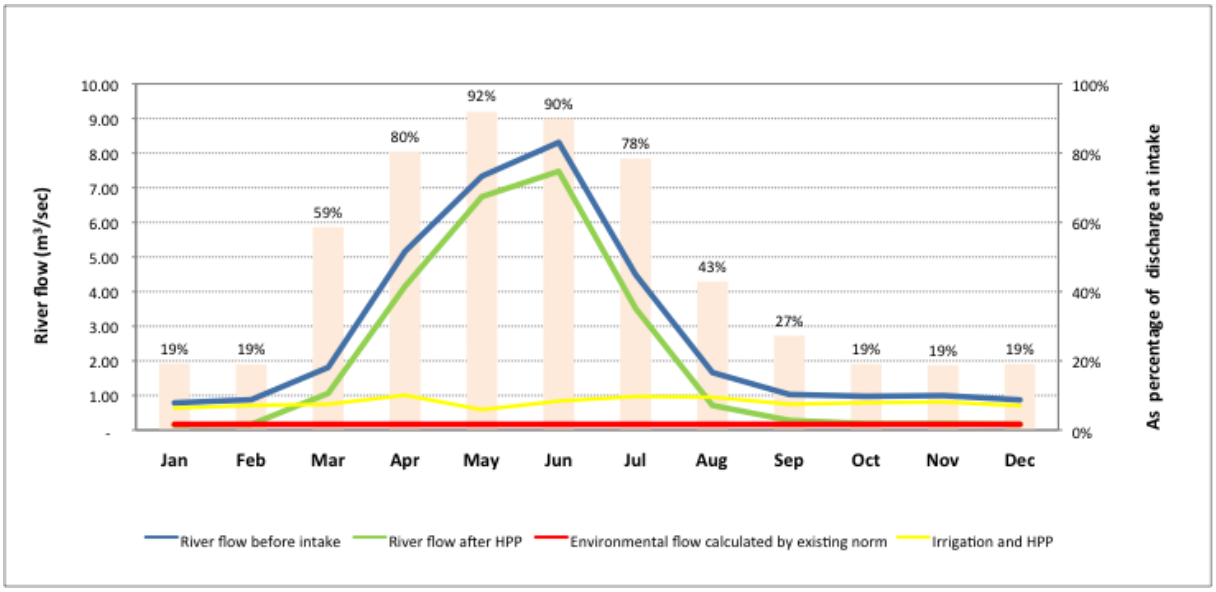


However, even in the above-mentioned section the environmental flow is well maintained. To be on a safe side, particularly during dry years, the Water Resources Management Agency of the Ministry of Nature Protection of Armenia and QH LLC discussed and successfully agreed on the terms of a new water use permit with the QH-owned small HPP. Under the new permit, minor changes are made in the schedule of the water abstraction the by HPP, particularly in the period of time ranging from May through September, when there is a peak of irrigation season. This, however, will not impact the total annual volume abstracted by the HPP.

Recent field visit and interview with the HPP staff revealed that such revision in the schedule of water abstraction will not have any negative impact on the operation of HPP as long as HPP abstracts annually up to 24 million m³ of water as permitted. This privately owned HPP has up to 10 employees, most of which are seasonal workers. Their status will remain the same as under the previous water use permit. According to the management of the HPP, all employees are paid according to electricity produced, and thus no social or other impact is expected after the project, including retrenchment/loss of livelihood.

Calculations taking into consideration the new schedule of water abstraction by the QH HPP show that in the section between the water abstraction and discharge point of the HPP (1500 m) no significant impact is expected after the Meghri Gravity System project and the environmental flow, as well as the dynamics of the environmental flow throughout the year is quite well maintained (Figure 6).

Figure 6: Discharge Before and After Project below the point of abstraction by the HPP



Biodiversity

The biodiversity and ecosystems of Armenia are very rich due to the geographical location, complicated geological structure, altitude and availability of diverse natural climatic zones. Intense human activity has adversely impacted the rich biodiversity of Armenia's ecosystems and their components. Being one of the biggest economic activities, agriculture is also considered to be the activity that most upsets the balance of nature components, endangering the biodiversity.

The region of Syunik is characterized by rich natural ecosystems. The region of Meghri is unique with its rich biodiversity, for the protection of which was formed Arevik national park by N1209-N decree of RA Government, dated 15.10.2009. Endemic, rare and disappearing species of wild plants and animals are common mainly in higher elevations of southern slopes of Meghri mountain range and eastern slopes of Zangezur mountain range.

The territories of the designed system belong mainly to the steppe and semi desert zone, where the river-valley-lawn type lands are common, presented by pebbles, gravels and poor vegetation.

Excavation of trenches designed for Meghri gravity irrigation scheme may impact the areas under trenches and surrounding natural vegetation. The earth works may impact the fauna through disturbance of bird nesting areas and hatching areas of mammals and reptiles. Temporarily the construction noise may disturb animal migration and access to watering points. The following mammal species may be influenced in the areas of the pipelines: common mouse (Muridae); pine vole (Msubterraneus); mole (Talpa europaea orientalis); from reptiles - meadow lizard (Lacerta praticola).

The laying of the pipeline foresees two crossings over the river. The pipe will be fixed to the existing bridge structures. Therefore there will be no construction within the river bed and no significant impact on the aquatic life is expected.

During the construction work the impacts on fauna and flora will have a temporary significance and may be mitigated by the environmental measures foreseen in the EMP.

Based on the location description of separate sections of the gravity system and the local environmental observations, it becomes clear that the project areas are far from the Special Protected Nature Areas of the region.

<u>Flora</u>

Flora of the Syunik region is rather diverse due to natural-historical development, original geographical location and mountain character of territory.

Distribution of flora is specified by vertical zoning, however the borders between these zones are not sharp and flora species of one zone penetrate into another zone depending upon water, soil and microclimatic characteristics of the zone.

The sharp rocky slopes of the lower part of Megri area up to the elevation of 800-1000m are specified by prevalence of xerophilous (friganoide) vegetation of semi desert type. These plants often are called "The Vegetation of Skeletal Mountains" and they bear the influence of Iranian deserts. The most typical kind of semi-desert vegetation is Fragrant wormseed (Artemisia fragrance). In the spring these territories become covered by Ceratocephala falcata, Anisantha tectorum. The communities of mountain xerophilous plants are extended on slopes, for which the climbing types of plants, undersized trees, mixed light forest and bushes (prickly thrift, locoweed, melilot, buckthorn, almond) are typical.

At higher elevations the Alpine vegetation with meadow association becomes more common: Campanula tridentate Schreb., Carrx tristis Bieb., Taraxacum stevenii DC., Plantago saxatilis Bieb., Colpodium araraticum Tarutv., Poa alpina L., Nardus glabriculmis Sakalo, Sibbaldia parviflora Willd. The forest community is specified by platyphyllous types of plants, in particular, beech (Fagus orientalis Lipsky), oak (Quercus iberica Stev., Q. macranthera Fisch. Et Mey. Ex Hohen), hornbeam (Carpinus betulus L., C. Orientalis Mill), ash tree (Fraxinus excelsior L.), lime tree (Tilia begoniifolia Stev).

The flora within the area of Meghri irrigation system is presented by sage-brush and ephemerous subtypes of semi desert vegetation: sage-brush sweetscented, brome-grass, crucifer and other types of sage-brush and mountainous dry type, such as: almond-tree, cherry-tree, buckthorn, with participation of astragalus, prickly-thrift, coniferous, and melilot. Pincushion types of plants, low grown trees, mixed juniper sparse forests and bushes are also available on slopes.

Based on the field works carried out along the proposed route of the irrigation pipeline, no plants included in the Red Book occur in the corridor. After the pipeline is laid, the area will be restored through backfilling and topsoil spreading, to allow natural regeneration of the vegetative cover.

In order to ensure protection of plants and to mitigate the impact on species (that are spread everywhere) available in the selected areas, earth and construction works optimal time schedule will be defined depending on early or late vegetation period, allowing extraction of the plants with their roots and replant in the neighboring areas having no vegetation.

Fauna

The main diversity of fauna of Syunik province, including Meghri region, is mostly observed in the protected areas ("Arevik" National Partk, "Shikahogh" State Reserve, and "Khoustup", "Boghaqar", "Zangezur" State Sanctuaries), and includes species registered in the Red Book of Armenia, such as: Armenian moufflon, bezoarian goat (Capra aegagrus), Hystrix indica, Felis silvestris, Vipera raddei, Lutra lutra, Tetrao mlokosiewiczi, numerous types of eagles, and vultures of hawk type. Other mammals include Microtus arvalis (field mouse), Martes martes (marten), Vulpes vulpes (fox), Erinaceus auritus (big-eared hedgehog), Nyctalus noctula (Noctule bat), Vespertilio ognevi, and Plecotus auritusas. There are also sixteen 16 species of invertebrates entered into the Red Book, including the grasshopper (Gomphocerus armeniacus) and blue butterfly (Agrodiaetus neglectus). The latter two species are endemic and listed among endangered species according to IUCN.

Given that the Meghri irrigation scheme pipeline corridor has undergone significant transformation from anthropogenic factors (construction of settlements, supporting infrastructure, etc.) over a long time, and it has not been a habitat for the above-mentioned fauna species.

During field investigations birds of prey, such as eagles, griffons and falcons were encountered within the irrigation scheme corridor. Over 30 species of prairie zone birds are present in the area. Sparrows (Passeriformes) and hawks (Falconiformes) are spread everywhere, including the project area. Pheasant (Phasianus colchicus), Black francolin (Francolinus francolinus), Desert wheatear (Oenanthe xanthoprymna) occupy rather limited territories.

The herpetofauna is represented by 26 kinds, 11 of which are lizards, 13 kinds of snakes and 2 kinds of turtles. Darevsky raddei, Ophisops elegans, Eumeces schneideri, Mabuya aurata, Lacerta strigata (lizards), Elaphe hohenackeri, Telescopus fallax, Eryx jaculus, Vipera lebetina, Vipera raddei, Malpolon monspessulanus, Eirenis collaris, Typlops vermicularis, Eirenis punctatolineata, Elaphe quatuorlineata, Pseudocyclophis persicus(snakes), Greece tortoise (Testudo graeca).

During field work surveys Lacerta armeniaca, L. dahli, Ophisops elegans (lizards), Vipera erivanensis, Vipera lebetina V.raddei (snakes) were found in the corridor.

The invertebrates of this territory are represented by species of Mediterranean, Iran-Turanian, Crimea-Caucasian and Caucasian origin, which are indigenous for the project area. They include Phytodrymadusa armeniaca (cricket), Nocarodes armenus (grasshopper), Dictyla subdola, Geotomus punctulatus (wood louse), Amphicoma eichleri, Cantharis araxicola (bugs), Tomomyza araxana, Bombilius schelkovnikovi (dipterans), Shadinia akramowskii, Gabbiella araxena, Pupilla bipapulata (mollusks), Zodarion petrobium (the spiders).

During field work surveys, crickets and grasshoppers were found in Meghri River basin, and larvas, spiders have been met in the clear space of stones, the existence of which depends on the presence of weed.

The river trout, as well as other species of fish, e.g. Salmo trutta fario, Capoeta capoeta, Barbus lacerta

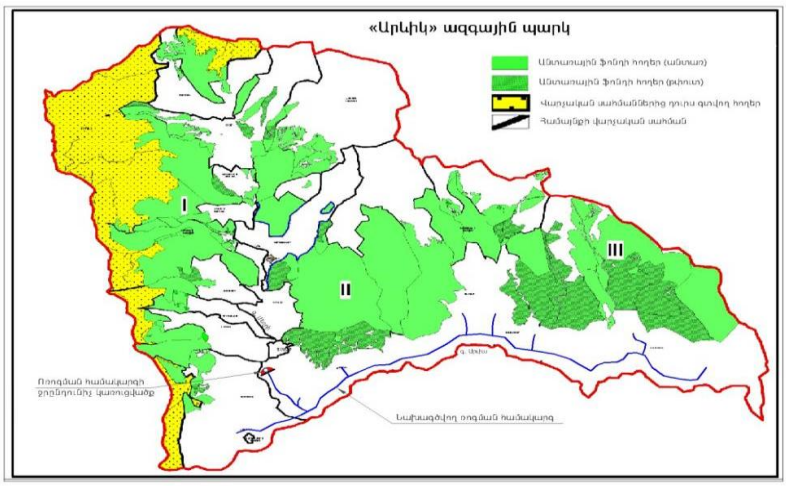
cyri, etc. are found in the mountain rivers of the region Occurrence of the species is registered in mountainous rivers draining into the Meghri River. In recent years as a result of human activities trout has not been seen in the lower sections of Meghri River, where the project intervention is planned. A fish pass is foreseen in the designed system with the purpose of protecting the fish species. As for the section downstream of intake structure, the following fish species are observed: Salmo trutta fario, Cuprinus carpio (rare in Meghri river), Varicorhinus, Barbus goctschaicus, Oxinemacheilus angorae (widely spread in Meghri river), Alburnoides bipunctatus, Carassius auratus gibelio (abundant in Meghri river). Because water intake by Meghri irrigation scheme will not significantly alter the volume and pattern of the natural water flow in Meghri River, no significant impact is envisaged on these fish species.

A schedule of earth works implementation should be developed for each landscape zone to protect the fauna of the area. The period of winter sleep and reproduction for animals will be omitted: from the middle of October to the middle of April.

Specially Protected Natural Areas

The nearest specially protected natural area to the project site is the Arevik National Park founded under the decree N1209-N of the Government of RA dated on October 15, 2009 (Figure 7).

Figure 7: Map of Arevik National Park



It is located on the southern slope of Meghri mountain of Zangezur mountain range in the water intake basins of Meghri, Shvanidzor and Nuvadi rivers. It encompasses the upper and middle flows of Meghri River beginning from Tashtun village up to Lehvaz and Vahravar village communities and farther to the state owned lands with total surface of 34401.8ha. The entire project area, including the including water intake point are located downstream of Arevik National Park, starting from about 1 km down, and, thus the planned works can not have any impact on the biodiversity of the national park. .

Socio-economic conditions

Two urban and three rural communities will become immediate beneficiaries of Meghri gravity system construction. The project will be implemented within the service area of Meghri WUA of Syunik Marz. The table below presents general data on the beneficiary communities.

Table 19. Beneficiary Communities under the Meghri gravity system

Community	Permanent Population[8]	Permanent households	Gender composition	Number of water users	Families entitled for social support
Meghri	4801	1280	43 %-male 57 % -female	238	130
Agarak	4840	1217	51 %- male 49 % - female	925	85
Shvanidzor	282	107	49% - male 51% - female	174	16
Alvank	360	144	57% - male 43 % - female	153	16
Karchevan	273	251	51% - male 49 % - female	149	-
Total:	10556	2999		1639	247

Main occupation of population in this area is agriculture which is the basic source for household income. Mostly older generation is involved in agricultural works as younger generation tends to migrate. The number of female headed families is not so high on the other hand. About 10% of families are poor and receive social support.

There are refugees living in the communities of Meghri and Agarak, as well as in Alvank. These refugees are direct beneficiaries of this project, as they are involved in agricultural activities and their main income comes from agriculture.

To describe the present social conditions and lands in the beneficiary communities, the FS/FD consultant conducted public discussions with participation of the leaders of the beneficiary communities and WUAs at the preliminary design phase. These discussions highlighted that based on people's perception, improved irrigation opportunities will result in increased crop yields and higher incomes among water users as well as decreased migration rates. The project affected area is not entirely irrigated at present due to low precipitation, unstable work of the pumping stations and disrupted irrigation water supply, the distance of the lands from the communities and limited financial means of the landowners. Irrigated lands decrease annually, resulting in adverse impacts on the community people's incomes and increasing emigration from rural areas.

Data on minority groups are shown for a Marz assuming that it is typical also of the affected communities and is described as follows: Russians - 0.16% of total population, Ukrainians - 0.03% and other nationalities - 0.12%. Minority groups along with ethnic Armenians have equal rights and will equally benefit from the Project results.

[8] National Statistical Service of the Republic of Armenia. Marzes of the Republic of Armenia in Figures, 2008. Official web-site of the NSS of the RA: http://www.armstat.am/en . Accessed in March 2009.

6 Project Alternatives

Project alternatives are considered from two perspectives. First, the "No Action" alternative is considered from the perspective of not developing the Project. Second alternative is examined in the Feasibility study to arrive at a "Final Design" for construction of Meghri gravity system. Both perspectives are described below.

6.1 "No Action" Alternative

The "No Action" alternative refers to a situation in which the Meghri gravity system is not built. As might be expected, a without project scenario has negative economic and environmental consequences.

In case of this scenario the equipment of the existing 8 pumping stations that are frequently replaced with expensive foreign equipment due to "abrasive" properties of Araks River will gradually wear out. Termination of currently operating 10 pumping stations in practice will turn 686 ha arable lands dry (these are currently irrigated mechanically). Socio-economic and environmental consequences will be as follows:

- Communities will face shortage of irrigation water,
- Costs for operation and maintenance of the pumping stations will increase,
- Area of irrigated lands will decrease,
- Emigration from rural areas will increase,
- Physical-chemical properties of the lands will worsen etc.

Considering that "No Action" alternative deprives the communities of project gravity water source, reduces further operation reliability of irrigation water sources of the existing mechanical method that is power driven and does not serve the improvement of agricultural production in the project area and poverty reduction, this alternative was not considered further.

6.2 Proposed Alternatives

The FS/FD consultant, using the following technical, social and environmental standards, examined several options for the Meghri gravity system during the design phase. The options are determined by the arrangement of the route on the relief. Three possible approaches have been considered:

1) The pipe is laid within the river bed. This option was turned down as a poor engineering solution. It would also be detrimental for the aquatic ecosystem.

2) The route passes parallel to the river at the edge of the flood plain zone with several river crossings.

3) The route passes parallel to the river at the edge of the flood plain zone on the left and right banks with two river crossings under the bridges bypassing settlements to avoid land take.

The third option was selected as it was considered least detrimental for the river, allowing to avoid water turbidity and adversely impact on biodiversity. And this option is the most realistic due to the relief and existing engineering structures.

6.3 Justification of the Selected Option

The technical condition of the pumping stations currently supplying water to the users is getting worse every year and they cannot continue functioning without having been re-equipped. However operation of pumps is energy consuming and carries high annual maintenance costs.

No-project scenario was rejected, because it would leave considerable area of arable land without irrigation and would have significant negative economic and social consequences.

An option of rehabilitating the scheme by its original design and retaining the existing electric pumping system was rejected and an option of switching to the gravity irrigation was picked to cut down energy demand and to simplify maintenance of the scheme.

Reconstruction of the scheme to switch it from pumping to gravity requires construction of a new water intake and new sections of piping. The above described three options were considered for aligning the new pipes. An option of laying pipes along the river bank at the edge of the flood plain with two river crossings (option 2 above) was selected as the best engineering solution with least cost, which also carries least environmental risks and minimal need for land take.

The final design of the Meghri gravity system envisages providing irrigation water by gravity to 686 ha irrigable lands of the same 5 communities of Syunik Marz that are currently under mechanical irrigation. These include: Meghri and Agarak towns, and Shvanidzor, Alvank, Nrnadzor and Karchevan communities. The system starts at Meghri River section in Vardanidzor community with mountain type head water intake structure at 867 m above sea level. The total length of the gravity system with its right and left branches makes 33 km that will be implemented with iron-concrete elements, steel pipes and various structures. The total water demand for irrigating 686 ha of 5 beneficiary communities is estimated at 0.65 m^3/sec, which will be abstracted from Meghri River.

The final option of the Meghri gravity system design has been selected based on the following justification: the system is completely gravity; and it has a reliable water source.

Main technical and economic parameters of the final option are provided in the table below.

Table 20. Main technical and economic parameters of Meghri gravity system

N	Title	Unit rate	Parameter
1	Area subject to gravity irrigation	ha	686
2	Water required for the irrigation	m^3/sec	0.65
3	Annually saved electric power	Million kW/ hour	3.89
4	Capital investment	Thousand $	10500
5	Economic rate of return (ERR)	%	19.6%
6	Construction period	month	15

Public discussions on social, economic and financial issues conducted by the FS/FD consultant at the preliminary and final design stages of the project show that social and economic gains, which are cumulative, outweigh the potential negative consequences of the "No Action" alternative. Participants of public discussions expressed concerns about possible nuisance from noise and dust from construction sites. These impacts are easy to mitigate by observing working hours, maintaining construction machinery in good technical condition, and watering construction sites in dry weather. These and other likely negative environmental impacts, which are described in detail in the following sections, are expected to be short-term and localized during the construction phase of the project. These can be mitigated by a timely and proper implementation of the mitigation measures presented in the EMP (Annex A). The expected positive impacts are envisaged to be enhanced by implementation of the measures recommended in this document.

7 Beneficial and Adverse Impacts

Replacement of the existing pumping station under the Meghri gravity system will bring positive changes to delivery of irrigation water and water users will more easily obtain the required quantity of irrigation water in a timely manner. In addition, there will be significant cost savings from reduction in energy use, including ecological benefits through prevention of atmospheric pollution associated with energy consumption, including the benefit of climate change mitigation by elimination of energy use for pumps. The replacement of the undependable pumping stations by gravity system will increase the reliability of irrigation water resources, thereby increasing farmer incentives to cultivate high value crops. The expected overall positive environmental and social impacts from the construction of Meghri gravity system will be long-term and cumulative in nature, ultimately contributing to the increased social and economic benefits of the communities affected.

The potential adverse environmental and social impacts are described for the construction and operation phases as well as for decommissioning of the Meghri gravity system.

7.1 Environmental impacts at the construction phase

During the construction phase some negative influences may be observed on the environment, such as surface and ground water pollution, degradation of lands and landscape, land erosion, which may be a result of excavated/extracted earth, not proper removal/placement of the disposed soil and construction waste, leakage of fuels and lubricants and other materials during the construction, use of temporary construction site (const. camps, car parks, storages, etc.), operation of the mines, temporary pollution of the air caused by the dense traffic schedule during the construction, noise and vibrations during the excavation work, also possible impacts on the vegetative cover.

The expected possible environmental impacts expected during the construction are given below:

(a) Ambient Air Pollution

Emission of inorganic dust from excavation-loading works and emission of harmful substances and dust from combustion of diesel used by transportation means and machinery occur during the construction works. Asphalt and bitumen laying works result in hydrocarbon emissions, petrol use for bitumen thinning causes petrol fume emissions. Welding works cause welding aerosol and manganese monoxide emissions. Concrete mixers work result in concrete dust emissions.

The main sources of emissions are below.

- inorganic dust emissions at excavation-loading works,
- dust emission during the vehicular traffic emission at construction machinery operating,
- emissions at asphalt laying works,
- emissions at concrete mixture making works,
- petrol fumes,
- emissions at welding works.

The results of the emission calculations for all the districts and stationary sources are provided in Annex E. The construction works will be carried out at rather far distance from the populated areas and harmful substances brought forth will not practically pollute the urban-industrial environment.

(b) Impact on Water Resources

Generally, in the construction phase the impacts on water resources may be expressed by implementation of direct construction works in the river bed, the construction materials stored in the construction site, hanged materials, items, oil-products, pollution of river water, construction effluents water, as well as generation of hard wastes in the result of workers' activity during the construction phase.

Water use and wastewater discharge

During the construction work water is used for drinking purposes and domestic needs of the administrative staff and workers as well as for building site watering and vehicle servicing. Water use and wastewater volumes were calculated, which are presented below.

Calculation of public-domestic water consumption and wastewater

The individual norms of public-domestic water consumption and wastewater are determined by the water amount, which is consumed for satisfying necessary domestic-economic demands. The annual public-domestic water consumption, which depends on the purpose of its use, is conditionally divided into two groups:

- Drinking water consumption is referred to the first group; it depends on the number of team members.

- Water consumed for open areas and building sites watering is referred to the second group; its amount is calculated proceeding from the building sites area surface.

The amount of the public-domestic water consumption and wastewater is calculated by the following method:

a. Calculation of public-domestic water demand

The water consumption for drinking and domestic demands is calculated as following:
W c.t. = (n x N x + n_1 x N_1) x T, where
n – administrative workers (EP) number is 10 men
n_1– workers' (workers, drivers, watchmen) number – 100 men
N– EP's water consumption norm is 0.016 m^3day/man
N_1 – workers' water consumption norm is 0.025 m^3day/man
T– the number of working days during the construction period is 375 days
W c.t. = (10 x 0.016 + 100 x 0.025) x 375 = 997.5 m^3/const. period
Average per day- 2.66 m^3/day (0.3 m^3/hour)

b. Calculation of water demand for open areas watering

The building sites according to the construction work implementation schedules move in along the water conduit stretch, though the construction is carried out on the areas of the same size, which surface makes about 1200 m^2
W o.a. = 0.0005 x S x k x T
S = 1200 m2, k = 1,T = 260 days
S – area surface
k -amount of watering per day
T – watering days number during the construction
W o. a. = 0.0005 x 1200 x 1 x 260 = 156 m3/ const. period
Average per day 0.6 m3/day

c. The public-domestic water consumption will make
Q_{total} = Wc.t. + Wo.a.
Q_{total} = 997.5 + 156 = 1153.5 m^3/ const. period
The optimal cost per day will make 3.26 m^3/day.

d. Calculation of public-domestic wastewater

Drinking and catering centre water drain calculation is made by the following formula
WW.D.c.Cc. = Wc.t. – LP, where
LP $_{drinking}$ – loss in percent – 5%
LP $_{drinking}$= Wc.t. x0.05 =997.5 x0.05= 49.88 m^3/const. period

WW.D.C.CC. = 997.5– 49.88 = 947.62m^3 / const. period

e. *Calculation of subsidiary water use and wastewater*

The number of the employed vehicles will make 56 units. Water consumption of the fleet depends on the vehicle servicing (cooling systems charge). Vehicle washing is carried out at car washing facility.

Water consumption is calculated by the following formula:
$Vt = A \times (g_1+g_2) \times k \times T_1$ formula, where
A – number of vehicles by conditional units, 56
g_1, g_2 –washing and charging norms
k – load factor
T_1 – washing and charging numbers
A = 56 x 1.25 = 70
g_1 =0,15 **g_2**=0.06 **m**^{3}/vehicle, k = 0.65, **T_1 =** 0**, T_2=** 35

Thus, **Vt =** 70 x (0.15 + 0.06) x 0.65 x 35 **=** 344.4 m^3/ const. period (9.84 m^3/day)

Water consumption for the vehicle service is referred to the irrevocable water consumption and is not considered to be a leakage.

F. Calculation of water required for making concrete

The whole volume of the concrete mixture is envisaged to be 2218 m^3.

Average coefficient of the water content makes 0.25, thus the necessary water amount will make 2218 x 0.25 = 554.5 m^3/const. period.

Table 21. Volume of the public-domestic, economic and subsidiary water consumption and wastewater

Water consumption demand	Water consumption, m3/cons. period			Wastewater, m^3/cons. period		
	Total	Of drinking quality	Of service quality	Leakage	Loss	Irrevocable water consumption
Drinking and domestic	997.5	997.5	-	947.62	49.88	-
Open area watering	156	156	-	-	-	156
Fleet	344.4	344.4	-	-	-	344.4
Water required for making concrete	554.5	554.5	-	-	-	554.5
Total	*2052.4*	*2052.4*	-	*947.62*	*49.88*	*1054.9*

Total water consumption will comprise:

- 2052.4 m^3/const. period,
- Average per day - 14.57 m^3/day

Total wastewater will comprise:

- 947.62 m^3/const. period,
- Average per day - 6.7 m^3/day

The waste water will be collected in holding tanks made of impermeable materials. Based on the volumes of the wastewater to be generated during the construction phase it is anticipated to have a 50 m^3 septic tank which will contain inflow over the 7 days. The tanks will be emptied every week by special vehicles which will transport the wastewater to a centralized wastewater collector with prior agreement with the local authorities.

The above mentioned impacts during the construction phase will have a temporary, but recoverable character and will not violate the construction and environmental norms defined by RA legislation. These impacts will be mitigated as a result of measures, to be carried out properly and in a timely manner, which are presented in the Environmental Management Plan, in the following section of this document and in Annex A.

(c) Works near the waterway

The pipeline includes two crossings over Meghri River. The pipeline will be connected to the structures of the existing bridges over the river. Hence pipeline laying will not require works within the water stream. Therefore in the result of implementation of construction the river water pollution is not expected.

(d) Earth works

Trench excavation works designed for Meghri gravity system may have temporary negative impact on the natural vegetation within the pipeline corridor due to surface disturbance and storage of excavated material till its backfilling.

Earth works will require clearing of vegetation along the pipeline corridor, including removal of shrubs and limited number of trees. Cutting of trees will be carried out mainly in the head section – in left and right banks of Meghri River and in the section of main pipeline with 2,800 m length. According to the botanical researches tree types of project areas are not included in RA Red Book of plants. Decorative or fruit trees growing on the cultivated private land plots may also need removal. Rough estimation of damage through tree cutting amounts to 36.900 USD.

(e) Extraction of construction materials

Aggregates required for construction will be preferably obtained from the licensed providers from the already licensed and operational quarries. However, Contractor will have a free choice and may wish to open an own quarry, in which case the risks of landscape degradation, erosion, loss of a natural site's aesthetic value, damage to aquatic life (in case of extraction from a river bed), deterioration of water quality, and stimulation of erosion of river banks may arise.

(f) Generation of construction waste

Construction of the hydraulic structures and the pipeline will generate various types of waste, though not in vast amounts. Clearing of the pipeline corridor will require clearing of vegetation and will generate organic waste in the form of the removed grass, shrubs, and trees. Earth works will generate modest amount of excess material, because most of the excavated earth and topsoil will be used for backfilling. Other types of waste, typical for general construction activities, are also expected in moderate amounts, including metallic and plastic construction waste, bad butches of concrete and asphalt, household waste from the work camp(s) or yards, as well as certain amount of hazardous waste such as operational spills of fuel and lubricants; and used oils, filters and tires from vehicles and machinery.

(g) Biodiversity

Data on biodiversity is provided in details in the section "Biodiversity" (page 39). According to analysis of data of existing literature and the results of the field surveys, there are no flora and fauna species in the project area, recorded in the Red Data Book of Armenia. Such species are observed only in protected areas of Meghri Region and Syunik province in general, which are located far from the pipeline corridor. For these species special protection regimes are defined contingent upon their category of protection (state reserve, national park, state sanctuary). Meghri gravity system project area is mostly inhabited and contains infrastructure related to settlements, and thus is not considered to be even a migration route of the fauna and flora species observed in Meghri region.

Since during the construction phase no significant alteration of the flow of Meghri River is envisaged, and given that the main fish species in the project area are observed in Meghri River, no significant impact is expected on them at this stage. In addition to that, in order to avoid any other potential negative impact, state environmental inspectoral control, control by the design company, and continuous control and monitoring by the PIU is envisaged throughout the entire construction phase.

The main potential negative impact expected during the construction phase relates to plant species. Taking into consideration the equipment to be used and construction volumes, in certain areas partial tree cutting would be unavoidable. This judgment was proved during several site visits to the project area. According to the field observations, the negative impact is expected on Willow (Osier) (Latin: *Salix*) with its several sub-species. This species is widely distributed in Meghri region (almost everywhere) and is not included in the Red Data Book of Flora of the Republic of Armenia. Moreover, in case of cutting the tree species the constructor is obliged to plant the same species at the ratio of 1:3.

Installation of the pipeline will imply two river crossings above the river surface. The pipe will be attached to the structures of the existing bridges. Therefore, works will not be performed within the waterway, and will have minimal temporary impact on the aquatic ecosystem.

7.2 Social impacts at the construction phase

During the conducted public discussions, some raised concerns about the negative impact of noise and dust on the health of communities residing in immediate proximity to the scheme construction area. People were worried that construction works may disturb their rest and cause discomfort. However, it was well appreciated that this would be a temporary nuisance confined to the construction period. At the same time, local communities were hopeful about temporary job opportunities during construction. Any potential jobs are appealing to population, because of a high unemployment rate.

(a) Construction related traffic increase and other nuisance to local communities

Short time temporary disturbance of local communities is expected from the movement of construction vehicles and operation of machinery that generates noise and dust. Works will be planned the way to of avoid interruption of the irrigation service provision to the clients that currently receive water for irrigation from the existing Meghri scheme.

(b) Temporary impacts on land use

The precondition for the design implementation was to avoid alienation and resettlement impacts. However, some temporary influence is expected during works. Temporary use of the land may comprise up to 32.6 ha. The influence zone will cover the unused community lands. For these lands the servitude agreements[9] will be signed by the PIU with the appropriate community/regional authority to ensure access to the land plots. Communal land use for this purpose will be preferred. In the case of private land use, a Resettlement Action Plan (RAP) will be prepared, if required, in compliance with the Resettlement Policy Framework. At the end of the works the land plots will be restored and returned for use to owner/user. The servitude agreement will also provide the right to operator to access the land to address emergency and outstanding issues related to pipeline maintenance, once such need arise in future.

During the preliminary phase of the project design, the FS/DD consultant discussed temporary land use with the potentially affected communities and received feedback that indicated the willingness of these communities to temporarily give up user rights to their land on voluntary basis, due to expected benefits from improved irrigation service provision.

(c) Temporary local employment

The positive social impact of the construction phase is the temporary employment opportunity of local non-qualified labor. About 80% of the work force will be comprised of local population hired for a period of about 18 months. These will mostly be workers and drivers.

[9] Servitude is one of the rights of land use, which allows one of the parties to use the owner's property without alienating it. The owner will continue to own the land plot, but the party, which has the servitude right (in this case, the WUA), will have the right to use that section during the operation of the gravity system to address emergency and outstanding issues.

7.3 Environmental impacts at the operation phase

Operation of the reconstructed irrigation scheme will carry common risks associated with irrigation for agriculture.

(a) Soil erosion, salinization and alkalization

Operation of Meghri gravity scheme may have some negative impact on the lands of project affected area, particularly in terms of soils natural balance (increase of salination, alkalization, toxicity and absorption index) which may be due to irrigation water pollution and/or richness of salt or other chemical compounds, and erosion in case improper irrigation techniques are applied. Such impacts may be long term and cumulative. The quantitative and qualitative studies of irrigation water source for feeding of the Meghri gravity scheme were carried out by FS/DD consultant at the design phase and lead to the following conclusions:

- The aquifers within the area served by the system are located at the depth of 7-12 m and will not have a significant impact on the ecological balance of "soil-plant-water" system. It is expected that the penetration of irrigation waters into ground water will not influence the chemical composition of the latter.

- The irrigated arable lands of the affected area are generally not prone to erosion. Usually the top layer is subject to erosion. Moderate and, in extreme cases - severe - erosion is observed on the steep slopes.

(b) Deterioration of irrigation water quality

The lands to be irrigated by Meghri gravity scheme are located within the range of 600-1,000 m above sea level. There are no industrial and significant residential polluters upstream the designed water intake. Testing of Meghri River water quality, carried out for the purpose of developing the Meghri gravity scheme, shows that the water is not polluted with organic, mineral, or toxic pollutants. Deterioration of the water quality is unlikely over the course of the proposed scheme's lifetime, and no significant accidental spills can occur upstream either.

(c) Damage to aquatic life from excessive water intake

Survival of animal and plant species in rivers depends on the water balance. In case of significant disruption of the hydrological pattern of the river, the aquatic ecosystem will suffer a negative impact.

(d) Increased use of pesticides

Improved provision of irrigation services and return of some area to irrigation after years of discontinued service are likely to intensify farming in the Meghri scheme command area. This may indirectly influence the pattern of agrochemical's use. Potentially increased and improper use of pesticides carries risks of environment pollution and threats to human health.

7.4 Social impacts at the operation phase

(a) Economic gains of communities in the coverage area

Discussions with the project beneficiaries showed that vast majority believes their overall living quality increase as a result of the project implementation. More specifically, reconstructed irrigation scheme will lead to better service provision and will result in higher yields. Communities believe that this will have direct impact on family incomes, will positively influence their health and push up their social status. Increased income opportunities will also motivate more young people to stay within the area, to improve their agricultural skills and modernize their farms.

Increase in water user fees as a result of public investment into the scheme's rehabilitation is not expected. On the contrary, there is a possibility of decrease in user fees in long term, due to less power demand and reduced water losses.

(b) Competition for water use

Water availability is not an issue in the Meghri watershed and there is no competition for water use due to absence of large settlements, hydropower plants or other industrial users. Therefore, no conflicts are anticipated over the water use neither between various types of users nor among irrigation water users. The requirement of retaining the established ecological flow in the river can also be respected without generating shortage of water intake for irrigation.

7.5 Impacts at Decommissioning phase

Useful life of Meghri gravity system is estimated at 50 years. At the decommissioning phase of the Meghri gravity system, waste will be generated from dismantling pipelines and other structures which may have a temporary or permanent impact on adjacent lands. Soils may be disrupted in the process of dismantling the pipelines and other structures, causing further degradation if not restored. Social and economic welfare of water users served by the Meghri gravity system may be adversely affected if no alternative means of water supply are provided.

As a result of timely and proper implementation of the Environmental Management Plan with the appropriate mitigation measures, as well as environmental and social clauses of the civil works contracts all these likely negative impacts can be prevented or minimized.

8 Mitigation and Enhancement Measures

Mitigation and enhancement measures are proposed for the design, construction and operation phases of the Meghri gravity system project that shall be undertaken by executing agencies to prevent and/or minimize the likely adverse environmental and social impacts listed above.

8.1 Design Phase

Environmental and social mitigation requirements are incorporated in the final design, technical specifications and bidding documents to be implemented by the construction contractor and the system operating entity to avoid, prevent, minimize, or rehabilitate the potential impacts.

The final design documents include a list of approved borrow pits and agreed spoil disposal sites; agreements obtained from the relevant state and local authorities for use of water resources to feed the gravity system, borrow pits and sites for disposal of excavated spoils as appropriate; list of construction preparation temporary sites such as access roads, construction camps, transport and machinery sites, storage facilities, etc.

The design documents provide technical solutions for minimizing impact on the water bodies (banks, bed, water flow and quality) not hindering water provision with relevant quantity and quality of different sections of the river.

During the design of the pipeline route in Meghri area a solution that excludes the earth works on cultivated lands was selected, while non-productive areas will be used for temporary storage of construction material and excavated soil.

8.2 Construction Phase

Environmental Impact Mitigation

Measures to prevent and/or minimize the degradation of landscapes and soil erosion, pollution of surface and groundwater resources and soils by construction run-off shall be implemented by the contractor during the construction phase. This must include, but not be limited to:

- the use of already existing quarries and disposal sites, where possible, according to the requirements set in the appropriate permits and agreements obtained at the design phase; zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment shall be maintained by the contractor;

- ditches with gradient over 5% shall be reinforced by surface protection, steep slopes shall be strengthened by vegetation, grass and plants, concrete plates or gabions to avoid erosion; all vegetative cover shall be restored to its original condition preceded with appropriate stripping and storage of the top-soils in the preliminary approved sites;

- sites for storage of oil and chemicals shall be properly equipped to minimize the risks of polluting soils and waters; dust and noise from the construction site shall be minimized especially in residential areas, public places, near schools, by using closed/covered trucks for transportation of raw/construction materials and debris. All earth works are expected to be carried out by machinery and equipment supplied with dust collectors. The vehicles and machinery must be regularly checked, tuned up and equipped with effective exhaust mufflers. Water shall be used to wet road-metal, stored and removed soils and eliminate dust as well as watering of the construction site and gravel access roads as required, except during winter and months with high precipitation.

- Provision of entrance and exit principles for the traffic and construction sites, defining the precise routes, parking areas and work implementation schedule.

- Temporary construction and domestic waste location outside the river water area to exclude

waste **penetration** high overflow into the river. Possibly avoidance of construction works in the used river section to exclude harmful impacts on the river ecosystem. The constructor should provide special protective measures to prevent the transformation of Meghri River flow, bed and banks and to prevent the degradation (for example barriers, using nets intended for the mud in order to reduce the turbidity downstream of the river, etc.).

Construction camps

Each construction camp should be created after the consultation with the environment specialists of the supervision consultant. Construction camps must be organized in the areas with no vegetation, temporary structures must be located parallel to the track in the areas with no vegetation, higher than the ground surface, and on the supports. Construction waste must be periodically removed.

Removal of vegetation

Before the commencement of the construction, decorative and fruit trees and bushes must be removed. The best period for replanting the vegetation is late autumn and winter, which are the best period from the aspect of reducing the impact on fauna and flora to the minimum. According to the botanical investigations, the tree types of the project area are not included in the Red Book of RA.

Cutting of the trees are foreseen mainly in the head part; in the left and right bank sections and the 2,800 m long section of the main conduit.

Taking into account that, the trees and bushes along the road are important from the environmental point of view, and it is a difficult work to grow trees in natural condition, it is necessary to avoid cutting trees as much as possible. Instead of the trees to be cut during the construction work, new trees will be planted at a ratio of 1:3. It is very important to use the types of trees, which are resistant to the dry climatic conditions and dust emissions.

Calculation-estimation list has been developed for cutting the tree-bush vegetation, the aggregated index of which is an amount in drams corresponding to 36.900 USA dollars.

Cutting of the trees and replanting must be carried out in a specified order in case of the availability of the corresponding agreements.

Removal of the earth layer and excess topsoil

Given that during non-vegetation period in case of damage the roots of the trees are recovered much easier than during vegetation period, the excavation of the trenches will be carried out before or after the vegetation period of the trees in the pipeline corridor area. This will mitigate or exclude the possible negative impact of the foreseen work on the natural topsoil and tree-bush vegetation.

The top layer of the earth in the areas with vegetation cover will be cut by scraper and accumulated in the areas with no vegetation, and after the backfill and leveling of the trenches it will be restored to its pervious place.

The use of the excess soil for the purpose of planting and restoration of roads must be agreed with the authorities of the adjacent communities.

Formation of solid and fluid waste

The solid waste originated during the construction phase including remainders of the surplus cover, wrapping materials, household and other waste must be collected, removed or accumulated in accordance with the agreement provided by the local authorities.

The liquid waste includes petroleum products, recycled oils and household wastewater, etc. Household wastewater will be accumulated in temporary tanks built of waterproof materials, and will be periodically emptied as defined, in accordance with current regulations. Recycled oils will be handed to the corresponding organizations for double use.

Oil and fuel leakage

Oil and fuel leakage is possible when storing or refilling the machinery. A temporary fuel filling point must be organized in the construction camp during the construction work with the capacity of 1.0-2.0 ton. It will have a temporary nature and will be placed on the corresponding concrete covered platform, which will be completed with a system of leakage collecting to protect the earth cover, surface waters from pollution by the petroleum products. It will be dismantled after the completion of the work. In case of leakages treatment work is to be carried out and MoNP must be informed.

Social Impact Mitigation

Public awareness

The construction realizing person should properly inform about the beginning of construction works to the sides subjected to affect, in the result of which the levels of powder and noise may be added, the roads may temporary be closed and created overcoming routes. Accessible complaint procedures and/or grievance redress mechanisms through which the public can voice questions, concerns, grievances or provide other feedback about the construction process to the PIU and the contractor, and have this feedback addressed and responded to in a timely and systematic manner, will also be ensured by the contractor and PIU.

Noise

By the consequence of other acts connected with the construction and machine equipment work, noise will appear during the construction. Its noise will be more tangible for people living nearby the roads or working in other structures. Some softening measures are defined to reduce the noise level. Those measures are the following:

- Installation of construction camps as far as possible from the inhabited areas,
- Noisy works should be carried out during day hours and making works during night hours should be avoided,
- Reduce the usage of heavy technique near the inhabited areas as possible,
- Noise absorber plants should be installed on machine equipment.

Safety measures

The construction work will be carried out according to the requirements and safety regulations defined by RA legislation, as well as the requirements provided in separate sections of this document.

Mitigation of Impacts on Cultural Heritage

If during construction work historical-cultural monuments or other cultural materials are discovered, the Contractor will immediately interrupt the work and present a corresponding report to the State agency for protecting historical-cultural monuments. The specialists of the agency will carefully study the discovered material and give their professional conclusion, based on which the works will either go on, or the design will be reviewed.

8.3 Operation Phase

Prevention of flooding from poor maintenance of hydraulic structures

During operation it is essential that the head water intake structure, pipelines, and other structures be regularly inspected and be periodically maintained to ensure proper conveyance, avoid stagnation and prevent waterlogging. The water intake should be regulated to provide the water usage as permitted.

Preventing alkalization, salinization, and erosion

Because flood irrigation is the main technology applied in the service area of the Meghri scheme, there is a risk of erosion and waterlogging that may also lead to salinization or alkalization of soil. To prevent

erosion in the command area of the Meghri gravity system, anti-erosion measures should be built into the crop cultivation practices. These imply sowing horizontally across the slopes, applying dense sowing practice, furrowing and bedding, and irrigating by short furrows according to the established norms.

Command areas that are characterized with high water table or are otherwise prone to waterlogging, should be provided drainage systems allowing timely evacuation of excessive water from the plots.

Maintaining the quality of irrigation water

Quality of the water to be supplied through the Meghri gravity scheme will depend on its source, which is Meghri River. Monitoring of Meghri River water quality is carried out by the Environmental Impact Monitoring Centre (EIMC) of RA Ministry of Nature Protection. There are several static sampling points in various sections of the river flow, and the drawn samples are being analyzed in the laboratories of the EIMC. Water quality monitoring data appear on the web-sites of EIMC and RA Ministry of Nature Protection and are available for the interested parties. The information is updated on monthly basis. Meghri WUA will follow the information provided in these sites and will inform the community leaders about the water quality fluctuations.

In an unlikely case of tangible deterioration of irrigation water quality, WUA will approach the Ministry of Nature Protection, and/or local authorities for identifying sources of pollution, addressing causes of pollution to the extent possible, and undertaking relevant corrective measures for land reclamation.

Managing impact on aquatic life from excessive water intake

Meghri River flow has severely expressed seasonal prevalence. To minimize the negative impacts of irrigation water intake on the river ecosystem, ecological flow calculation of the river has been carried out with the specified order of RA government using the minimum outlet indexes of the river both for winter and summer times. According to the calculations the minimum flow is 0.16m3/sec or 5.1 mln m^3/month. Observance of the ecological water flow will prevent significant negative impacts on the aquatic ecosystem. The seasonal variation of the natural water flow in the river will be retained, as the highest natural water flow in the Meghri River does not coincide with the highest demand for irrigation water.

Meghri WUA implements the management of the irrigation water supply; system operation and maintenance, prevention of the pollution of the water resources and their restoration. the Measures of the water intake are defined, as well as calculations of the intake are controlled based on the approval of the "Water resource management and maintenance" authorized body. Calculation of the supplied water is carried out by a water meter.

After the State Environmental Examination of the Meghri scheme design, the Meghri WUA must provide the local environmental inspection the approved Management Plan, and the local inspection will supervise adherence to the Management Plan thereinafter, including maintenance of the ecologic flow in the river.

Managing impacts of improved irrigation service delivery on agro-production

Amelioration LLC, working for the State Committee of Water Economy, supervises the quantity of agrochemical and pesticide use; assures safe land use; and monitors composition, structure and salt content of ameliorated lands.

Promotion of good pest and pesticide management practices is included into the project design. A library of brochures, fliers, and posters on the sound and safe handling of pesticides, including information on the Integrated Pest Management (IPM), has accumulated as a depository of outputs from a number of rural development projects implemented in Armenia with support of the World Bank and other international/bilateral financiers. This material is readily available for reproduction for the needs of ISEP. Posters promoting good pest and pesticide management will be displayed in the premises of WUA offices. Brochures and leaflets will also be available at the WUA offices and the points of trade of agrochemicals. Selected publications on the environmental and public health implications of pesticide use will be used as a supplemental teaching material in rural schools. WUAs will play pivotal role in promotion of good agricultural practice. Additional technical assistance for the extension of IPM will be sought through other ongoing agricultural projects, including the Bank-financed Community Agricultural Resource Management

and Competitiveness.

8.4 Decommissioning Phase

Waste generated during the dismantling of Meghri gravity system shall be stored and disposed in accordance with the requirements of the permits and/or agreements to be obtained from the State authorities. Disrupted soils (excavated soils, trenches, camps. etc.) shall be restored to their original state in order to prevent their degradation and temporary air pollution and disturbance of population and biodiversity of adjacent areas related to the transportation of dismantled gravity system shall be regulated by implementation of the specific measures developed (schedule of the construction works, traffic management plan, etc.). Alternative means of irrigation water supply shall be provided for command areas in order to maintain the social and economic welfare of the affected communities.

9 Institutional Responsibilities

9.1 Agencies

Executing agencies

Executing agencies are responsible for carrying out mitigation measures prescribed through the ESIA report and EMP. The design phase executor-the designer consultant should guarantee that before declaring competition for construction works all the required permissions and agreements have been acquired from the corresponding authorized state and local authorities (such as- about the usage of water resources and systems, the areas of excavated soil, wastes and construction waste removal).

The construction phase executing agencies (construction contractors) will be responsible for executing monitoring measures provided in EMP as well as for requiring all the permissions and agreements concerning the construction works (such as – acquire agreement with state agency of history and protection of cultural monuments, in case if historical/cultural/ancient monuments or other cultural materials unexpectedly appear during construction works).

All this will be carried out according to the demands of RA current Environmental and Social Legislation. Besides, the construction contractors should realize the special technical conditions included in their contracts so as they are presented in the Annex of the given document.

Supervising agencies

Acting in the capacity of the Project implementing entity, SCWS will have an overall responsibility for the Project oversight, and will provide supervision of its implementation through the PIU. The PIU will hire a supervising company licensed to carry out technical supervision of construction which will include oversight on the environmental and social compliance of works. According to RA legislation, the technical supervision of construction may be carried out exclusively by a license company. Such company shall have an adequate skill mix of staff so that environmental and social monitoring is undertaken at the same level of professionalism and diligence as other technical aspects of works. Additional oversight will be provided by the local community of project stakeholders and NGOs.

The role of the PIU will be quality control of the supervision company's work and will imply periodic field visits of the PIU's in-house staff with the purpose of verifying information provided by the supervisor. PIU shall review and provide feedback on the supervision company's reports, as well as take timely and effective actions on the issues raised in the supervisor's reports. PIU will also track procedures of obtaining all necessary permits, licenses, and agreements by the works contractor and will follow compliance of works with the terms and conditions that these permits, licenses, and agreements.

According to RA legislation, environmental supervision in the entire territory of the republic is carried out by the State Environmental Inspectorate operating under the Ministry of Nature Protection of RA, which also has a corresponding territorial department in the region of Syunik. The specialists will implement environmental supervision in the Project implementation area both during the construction and future operation stages.

State enforcement agencies

State agencies mandated to enforce the national legislation, norms, and standards pertaining the planned works of Meghri irrigation scheme are the following:

- State Environmental Inspectorate tracks water intake from natural water bodies and river pollution, and
- Sanitary service provided by RA Ministry of Health inspects sanitary conditions at the construction sites.

Monitoring executing agencies

Monitoring executing agencies are responsible for the realization of mitigation and improvement measures and efficiency level monitoring and also for further correspondence of the project in case if required.

Monitoring executing agencies are responsible for the realization of all the required measures. State agencies may also carry out monitoring within their authority.

9.2 Reporting Responsibilities and Schedule

Author of the scheme design and the construction supervision consultant report to PIU on the progress of construction works. Environmental and social monitoring of works in included in the assignment of the supervision consultant. The consultant reports to PIU on the project progress on monthly basis. Monthly progress reports include, inter alia, a chapter on the environmental and social performance of works contractor. Textual part of the report describes general status of safeguards compliance, fleshes out main issues, and describes actions taken for addressing these issues. Completed field environmental monitoring checklists (template attached to this ESIA report) are to be attached to the monthly progress reports too. The consultant's obligations also include reporting to PIU on any accidents that may occur during construction (accident report form also attached hereby in Annex C) immediately upon occurrence of such accident. PIU provides the World Bank with by-annual project progress reports that include, inter alia, a chapter on the safeguard compliance. This chapter provides assessment of the contractor's environmental and social performance as well as assessment of the supervision consultant's environmental monitoring work. PIU's environmental and social reports will be based on the inputs from the supervision consultant, but will also carry information on the PIU's own field work aimed at verification of information incoming from the supervision consultant and at addressing any outstanding issues flagged by the consultant.

9.3 Budget

The Environmental Management Plan (EMP) attached to the present ESIA report will be included into the bidding documents once the civil works are tendered, so that bidders are able to include costs of the required mitigation measures into their bills of quantities.

10 Public Consultation

In the design phase the FS/DD consultant organized informal public consultations and surveys in the affected area of the project in order to obtain principal baseline data. The aim of these consultations is to estimate the existing social problems, as well as expected social influences, which is the result of the provide the representatives of project area communities with information related to proposed Meghri gravity system, learn their opinion and concerns in order to take those into account while finalizing the ESIA report and design documents. Discussions have been carried out with the village major, local WUA, as well as the Marzpetaran (regional authority) and community authorities during the social and economic studies. The following issues have been discussed:

- choice of the shortest route to minimize the construction works.
- avoidance of resettlement as much as possible.
- avoidance of traffic disruption along the local roads along the pipeline route.
- possibility of installing a new pipeline parallel to the existing conduits and canals in order to use the lands provided for them.
- census of land owners of the conduit area.
- handling issues of temporary land take during construction.

According to FS/DD consultant's report, there are 6 communities included in the affected area of Meghri gravity system. All of them, in particular, Meghri and Agarak towns, Shvanidzor, Alvank, Nrnadzor and Karchevan communities, will benefit from the positive impacts once the gravity system is put into operation.

In 2008 within the scope of the preliminary design of MCA project related to the construction of Meghri gravity irrigation system public consultations were held in Aarhus environmental information centre in Kapan, which was attended by the deputy of the head of Syunik region, the deputy of the head of the environmental and agricultural department of the region, representatives of the local interested organizations, media and TV. The details of the works to be implemented within the scope of the project, possible negative influences, designed mitigation measures, the importance of the project for the inhabitants, expected results, etc. were presented and discussed during the consultation.

In 2013, April 5 environmental Public consultations about Meghri gravity system project have been carried out in Alvank town. 23 people from Meghri and Agarak towns, Karchevan, Alvank and Shvanidzor communities took part in community consultations. The report on public consultation with photographs is presented in the Annex G.

The aim of the public consultation was the discussion of environmental and social issues connected with Meghri gravity system. The general description of the works carried out in the scope of Irrigation System Improvement Project, the details of the suggested construction works, possible negative influences, foreseen mitigating measures, the importance of the project works for the population, expected results and other questions were discussed and presented during the discussion.

In general, the participants have highlighted the importance of the work to be carried out within the project of ISE. They were interested in all the details; work schedule, intended sum, whether the designed construction work will not interfere the irrigation work of farmers, etc.

On the 15th of August 2013 within the ISE project public hearings and consultations have been carried out on the "Environmental Impact Assessment" in Agarak and Shvanidzor communities. Among the participants there were authorities of the affected communities, more than 140 water users, shareholders/beneficiaries. The participants raised several questions and received satisfactory replies. Overall, they emphasized that the ISE project and construction of Meghri gravity system will bring positive changes to their area. Minutes of the public hearings and consultations (including photos) are presented in the Annex G.

The present ESIA report was disclosed countrywide through the websites of the RA Water System Committee and WSPIU, and locally through distribution of hard copies at the municipalities of Alvank,

Nrnadzor, Shvanidzor and Meghri. The announcements on holding public consultation on the final draft ESIA report were posted at public places (local municipalities, post offices, culture clubs, etc.) a week prior to the scheduled meeting, and published in the national newspaper "Hayastani Hanrapetutyun" (Armenian daily). Public consultation meetings were held on June 17, 2014 in Alvank and in Shvanidzor with participation of Meghri and Nrnadzor communities' representatives. Records on the public consultation process are attached to the present ESIA report.

11 Environmental and Social Clauses for Civil Works' Contracts

The majority of impacts occurred during the construction will be mitigated by confirming appropriate provisions in the contracts of construction works. These provisions are presented in Annexes.

EMP and RPF will be included in the official documents of civil works and be an integral part of works contract. Monitoring of environmental and social performance of works contractor will be part of the ToR of the technical supervision company hired by PIU.

In case of damage to the environment due to failure to observe requirements of EMP (in particular, damage to the topsoil, covering the area with rubbish and construction waste etc.) and the national legislation of the RA, penalties will be applied according to the Criminal Code of the Republic of Armenia, Code of Administrative Violations, and Republic of Armenia law "On Compensation Payments for the Damage to Flora and Fauna".

Thus, the clauses 281-298 of Chapter 10 ("Crimes against the environmental safety) of the Criminal Code of the Republic of Armenia refer to the preservation of water and soil, atmospheric air, fisheries, and other natural resources and establish punitive sanctions for affecting the health of natural environment. Articles 42-95 of the Code of Administrative Violations cover violations of sanitary-hygienic rules and damage to the natural wealth of the State represented by mineral resources, water, forests, flora and fauna. Finally, the Law on Compensation Payments for the Damage to Flora and Fauna determines specific rates of compensation. Particularly clauses 6, 7, 8 of chapter 3 of the Law define the calculation of the amount of compensation, as well as procedures for collection of compensation.

The size of the penalties, fines and compensations due to the above-mentioned regulations are periodically revised and increased, and thus provide sufficient disincentive for the companies not to violate the requirements of the EMP.

All these law and regulations will be fully applicable to the physical works undertaken by contractors for the reconstruction of Meghri irrigation scheme. As this EIA/ESIA report and EMP have undergone an expert environmental examination and are provided to the local natural protection State inspectorate bodies, the above mentioned measures are supervised by them. If any violation is revealed, they form an appropriate administrative violation act mentioning the violated law item and the corresponding penalty.

Annexes

Annex A: Environmental Management Plan: Mitigation Measures

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
CONSTRUCTION PHASE					
Damage to the fertile layer of soil	- Remove topsoil prior to commencement of earth work and store it separately for the use at reinstatement stage; - Disallow unregulated movement of construction vehicles across the earth surface. Allow movement only along existing or designated temporary roads; -After the completion of works, clean up the area, level the surface, and spread over the topsoil	Contactor	Upon commencement and throughout earth works	PIU through supervision consultant	Included in the general cost estimate
Landscape degradation and erosion	- No quarries are operated without having a valid license obtained (unless material is purchased from a vendor); - Sections of quarries reinstated upon completion of extraction.	Contractor	During borrowing	PIU through supervision consultant	Included in the general cost estimate

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
Loss of biodiversity	- Minimize impacts on plants by planning and undertaking bulk of earth works beyond the active period of vegetation; - Limit disruption of habitats by confining construction activities to the narrow corridor along the pipeline alignment. Disallow movement of vehicles/machinery, and placement of construction materials/waste carelessly over an excessively broad area around the project site; - Strictly control clearance of vegetation along the pipeline alignment to prevent impacts beyond the designated corridor.	Contractor To involve relevant specialist	Upon commencement of works and during earth works	Supervision consultant Ministry of Nature Protection	Included in the general cost estimate
Removal of trees and shrubs for clearing the right of way	- Carry out inventory of trees marked for removal and agree it with the construction supervisor; - Keep accurate record of removed trees; - Produce a plan of compensatory tree planting and agree it with construction supervisor; - Carry out compensatory tree planting following the established ratio of 1:3; - Ensure maintenance of plantations as required under local conditions and for the sufficient period of time.	Contractor Supervision consultant	Before, during, and after tree cutting	PIU	10 000AMD per sapling

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
River water pollution with excavated soil	- Pile up excavated soil and excess material away from river banks, - Use maximum amount of excavated material for backfilling, - Move excess material to the designated final disposal sites promptly upon completion of earth works.	Contactor	During and upon completion of earth works	PIU through supervision consultant	Included in the general cost estimate
River water pollution with solid waste	Prevent river pollution with fragments of construction materials and waste that may be accidentally or purposefully be discarded to the river bed during works on the bridge	Contactor	During construction of pipeline overpass across the river	PIU through supervision consultant	No additional cost implied
River water pollution with construction site runoff	- Organize servicing and fueling of construction vehicles and machinery at service centers, if available; - Allocate special sites for servicing and fueling of construction vehicles and machinery away from watercourses; - Place impermeable or absorptive surface beneath fueling points; ensure confinement of accidental spills; - Disallow washing of construction vehicles and machinery in the natural water courses. Allocated a designated area away from water bodies to prevent direct discharge of waste water.	Contractor	Throughout construction works	PIU through supervision consultant	Included in the general cost estimate
Operation of construction camps	- Select vegetation free areas for construction camps; - Provide water supply and sanitation for construction camps and maintain these	Contractor	Before and throughout the construction	PIU through supervision consultant	Included in the general cost estimate

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
	systems in good technical condition at all times; - Provide construction camps with trash bins and make arragements for out-transportation of waste on regular basis. - - Disallow open burning of waste by construction workers.				
Generation of construction and household waste	- Store waste on-site in designated locations, away from waterways, and remove waste to the sites of permanent disposal on regular basis; - Obtain consent of local administrative/environmental authorities on the permanent disposal of construction waste and strictly follow terms of agreement; - Agree with local municipalities on the arrangements for collection and disposal of household waste from construction sites; - Disallow open air burning of any type of waste; - Consider recycling of waste to be extent possible.	Contactor, Syunik Marzpetaran, Local authorities	Throughout construction works	PIU through supervision consultant	Included in the general cost estimate
Air pollution with machinery exhausts and construction dust	- Keep vehicle and machinery fleet in adequate technical condition to avoid excessive exhaust; - Avoid idling of engines; - Always cover trucks loaded with construction material	Contactor	During the construction works	PIU through supervision consultant	Included in the general cost estimate

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
	and waste; - Sprinkle construction site in dry weather and while conducting of works that generate large volumes of dust.				
Disruption of traffic due to movement of construction vehicles and machinery	- Organize movement of construction vehicles and machinery by designating entrances and exits to and from the construction sites, defining passages and temporary roads, parking lots, and establishing time-bound schedule as necessary. - Install warning signs and traffic regulation signs in the sections of rods where interference with local traffic is likely. Deploy flagmen as necessary	Contactor	During the construction works	PIU through supervision consultant	Included in the general cost estimate
Nuisance to local communities from construction noise	- Keep vehicle and machinery fleet in adequate technical condition to avoid excessive noise; - Establish and enforce limited working hours in the locations closest to settlements, and during the period of excessively noisy works; - Establish and operate a viable grievance system for the use by project affected people.	Contactor, Supervision consultant	During the construction works	PIU	Included in the general cost estimate
Temporary use of community / private land for construction	- Do not enter private or community owned land plots unless written consent on the terms of the use of this land is	Contractor, Supervision consultant	Before the beginning of the construction	PIU Syunik Marzpetaran,	Included in the general cost estimate

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
works	available; - Ensure effective and meaningful information of communities and land owners on the duration and nature of works in their plots; - Restore work sites to their quazi-original condition to the extent permitted by the nature of interventions.		works	Local authorities	
Work site accidents due to violation of health and safety rules	- Provide personnel and workers with uniforms and adequate personal protection gear; - Ensure use of protective gear at work sites in an instructed way; - Ensure that workers operating special machinery have got relevant training, hold respective licenses, and are insured - Keep first aid medical kits and contact information for local emergency service at designated and well accessible locations.	Contactor	During the construction works	PIU through supervision consultant	Included in the general cost estimate
OPERATION PHASE					
Flooding due to poor maintenance of hydraulic structures	Maintain hydraulic structures on regular basis to prevent overflow, flooding, and erosion.	Water Supply Agency (WSA), WUA	Throughout operation of the scheme	State Commission on Water Systems (SCWS)	State Budget
Erosion and degradation of soils due to improper	- Respect good farming practices for erosion prevention and follow recommended techniques of irrigation;	WUA	Throughout operation of the scheme	SCWS, Ministry of Nature	State Budget

Potential Negative Impact	Mitigation Measures	Responsible Institution	Timing of Mitigation Measures	Supervising Institution	Cost of Mitigation Measure
irrigation	- Keep on-farm irrigation infrastructure in good technical condition to avoid overflow.			Protection (MoNP)	
Pollution and damage of agricultural fields due to accidents leading to deterioration of irrigation water quality	Promptly notify MoNP on the noticed signs of water quality deterioration and abstain from water use until laboratory tests prove safety of water use.	WSA, WUA	Throughout operation of the scheme	MoNP EIMC	State budget
Increased use of pesticides leading to pollution of agricultural fields and crops in the Meghri scheme command area	Promotion of good pest and pesticide management practices.	Communities, Relevant territorial bodies of Ministry of Agriculture	Throughout operation of the scheme	Amelioration LLC	State budget Proceeds of the CARMAC-2 Project

Annex B: Monitoring Plan

This monitoring plan will be used to determine compliance with the Environmental Management Plan (Annex A).

Mitigation measures	Monitoring Indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
CONSTRUCTION PHASE				
Soil excavated from trenches is piled in the areas comparably smooth and free of vegetation, and used for backfilling after pipe laying	Visual appearance of earth work sites	During earth works	Visual inspection	PIU through Supervisor, Syunik marzpetaran
Construction vehicles move along the existing local roads or temporary access roads, not passing through earth surface in an unregulated manner	Visual appearance of earth surface in and around construction sites	Throughout construction period	Visual inspection	PIU through Supervisor, Syunik marzpetaran
No quarries are operated without Contractor holding a valid license (unless material is purchased from a vendor), and sections of quarries reinstated upon completion of extraction	Presence of licenses, Inspection of quarries	During extraction	Verification of licenses, Checking compliance with license conditions, Visual inspection of quarry sites	PIU through Supervisor, State Environmental Inspection under the Ministry of Nature Protection of RA.
Excess soil is used for leveling the existing earth road and/or disposed in another location agreed upon with the local government	Visual appearance of spoil disposal sites, Agreement documents	During and after completion of earth works	Visual inspection	PIU through Supervisor, Syunik marzpetaran
On-site management of construction materials and waste	Construction materials and waste are stored in especially designated locations within work sites, No excessive amounts of construction waste are accumulated	Throughout construction works	Visual inspection	PIU through Supervisor

Mitigation measures	Monitoring Indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
	on-site			
Protection of water streams from solid pollutants	Construction waste and trash not visible in the river bed within and near the construction sites, Construction materials and waste piles are kept away from waterways	During works near waterways	Visual inspection	PIU through Supervisor
Contractor agrees tree cutting with Supervisor to ensure its minimum scale and keeps accurate record of trees removed	Supervisor's reports Contractor's records	Daily during clearing works	Review of reports and records, Verification of reported information through field visits	PIU through Supervisor, Syunik marzpetaran
Tree planting along the pipeline	Compensatory planting plan produced and endorsed, Records on purchase of seedlings available, Selected sites are planted with adequate number of saplings, Survival rate of saplings	Upon completion of tree planting	Review of planting plan to ensure 1:3 ratio of compensatory planting, Review of tree cutting records, Planting site inspection, Verification of reported information through field visits	PIU through Supervisor, affected communities
Cowered trucks are used for transporting construction materials and waste	Condition of trucks	Entire construction period	Visual inspection along transportation routes	PIU through Supervisor, Traffic Inspectorate
Dust control through sprinkling of work sites.	Conditions at work sites	During the construction in dry weather	Visual inspection	PIU through Supervisor

Mitigation measures	Monitoring Indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
Vehicles are in adequate technical condition and equipped with mufflers	Technical conditions of vehicles	Daily	Sound level meter	PIU through Supervisor, Ministry of Nature Protection, Ministry of Healthcare
The lubricants and other oil products are properly stored and kept at a special designed confined location. Used oils are handed over to specialized service provider for recycling.	Conditions at vehicle servicing areas, Hand-over documents	Once a month	Visual inspection	PIU through Supervisor, Ministry of Nature Protection, Ministry of Healthcare
Signing of servitude agreements with communities / local authorities for the lands to be temporarily used for construction purposes.	Availability of servitude agreements at Meghri WUA	Prior to Contractor's mobilization to work sites	Document review	PIU through Supervisor, Meghri WUA, SCWS
Observing of workers' health and safety standards	Workers equipped with and use personal safety gear, Personnel operating complex machinery has received adequate training, Work sites are supplied with the first aide medical kits and fire extinguishing equipment, No serious work-related accidents occurred.	Throughout construction	Visual inspection, Review of personnel training records and licenses held for operation of machinery	PIU through Supervisor
Establishment of a viable grievance mechanism for handling questions and complaints of affected population	Posters with the name and contact information of Contractor available at work sites, Local communities confirm absence	Throughout construction	Visual inspection, Inquiry of local communities	PIU through Supervisor, PIU directly

Mitigation measures	Monitoring Indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
	of complaints, or confirm that they were able to voice their concerns and satisfactory action followed.			
Work site reinstatement by removal of residual waste, topsoil backfilling, leveling and landscaping	Construction corridor restored to quazi-original state; No residual amounts of construction materials and waste and no trash found on site.	Final phase of construction activity on site	Visual inspection	PIU through Supervisor, PIU directly
OPERATION PHASE				
Regular maintenance of hydraulic structures and pipes/canals of the scheme	Hydraulic structures and pipes/canals of the scheme are in good operating condition, No congestion of the scheme and no flooding of command area occurs	Throughout operation of the scheme	Visual inspection	SCWS
Application of good agricultural practice and use of adequate irrigation methods	Irrigated fields are protected from erosion	Throughout operation of the scheme	Visual inspection	Ministry of Agriculture, Amelioration LLC
Revealing of signs of a dramatic deterioration of water quality and discontinuing water supply till water is proven safe for irrigation	No cases of pollution of agricultural fields and contamination of produce due to accidental pollution of water sources	Throughout operation of the scheme	Visual inspection	WUA, MoNP
Observation of ecological water flow in rivers at all times of irrigation season	River aquifers do not suffer from excessive extraction of water for irrigation	Throughout operation of the scheme	Log books with water intake records, Results of ecosystem monitoring	MoNP

Mitigation measures	Monitoring Indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
Conduct of public awareness campaign and provision of ago-consulting services for safe use of pesticides and application of IPM system.	Improved irrigation service provision does not result in damage to soils and public health due to excessive or otherwise unsafe use of pesticides	Throughout operation of the scheme	Data on the quality of soils and agricultural produce	Ministry of Agriculture Amelioration LLC MoNP

Annex C: Incident Report Form

CONSTRUCTION OF MEGHRI GRAVITY SYSTEM

1	Date:	
2	Gravity System Section:	
3	Location:	
4	Construction Contractor:	
5	Marz (Region):	
6	Water Supply Agency/WUA	
7	Incident Type:	
8	Severity:	☐ High ☐ Medium ☐ Low
9	Reported By:	
10	Description of Incident Root Cause:	
11	Corrective Action Taken:	
12	Corrective Action to be Taken:	
13	Action Taken to Prevent Recurrence:	
14	Corrective Action Carried Out By:	
15	Close Out By:	
16	Close Out Date:	
17	Person Involved:	
18	Machine Involved:	
19	Contractor/Sub Contractor Involved:	
20	Third Party Involvement:	
21	Photo Reference – Attached:	*The photos with appropriate descriptions should be presented as an Attachment to the Incident Report*

For WS PIU use only

Date	
Received by:	
Decision/Action made:	

Annex D: Monthly Field Environmental Monitoring Checklist

Site location					
Name of contractor					
Name of supervisor					
Date of site visit					
Status of civil works					
Documents and activities to be examined	Status				Comments
	Yes	Partially	No	N/A	
Contractor holds license for extraction of natural resources					
Contractor holds permit for operating concrete/asphalt plant					
Contractor holds agreement for final disposal of waste					
Contractor holds agreement with service provider for removal of household waste from site					
Work site is fenced and warning signs installed					
Works do not impede pedestrian access and motor traffic, or temporary alternative access is provided					
Working hours are observed					
Construction machinery and equipment is in standard technical condition (no excessive exhaust and noise, no leakage of fuels and lubricants)					
Construction materials and waste are transported under the covered hood					
Construction site is watered in case of excessively dusty works					
Contractor's camp or work base is fenced; sites for temporary storage of waste and for vehicle/equipment servicing are designated					

Contractor's camp is supplied with water and sanitation is provided					
Contractor's camp or work base is equipped with first medical aid and fire fighting kits					
Workers wear uniforms and protective gear adequate for technological processes (gloves, helmets, respirators, eye-glasses, etc.)					
Servicing and fuelling of vehicles and machinery is undertaken on an impermeable surface in a confined space which can contain operational and emergency spills					
Vehicles and machinery are washed away from natural water bodies in the way preventing direct discharge of runoff into the water bodies					
Construction waste is being disposed exclusively in the designated locations					
Extraction of natural construction material takes place strictly under conditions specified in the license					
Excess material and topsoil generated from soil excavation are stored separately and used for backfilling / site reinstatement as required					
Works taken on hold if chance find encountered and communication made to the State agencies responsible for cultural heritage preservation					
Upon completion of physical activity on site, the site and contractor's camp/base cleared of any remaining left-over from works and harmonized with surrounding landscape					

Annex E: Emission Calculations

Table 1. Quantity of harmful emissions into the atmosphere during the construction period (Head junction)

Phases of the construction work	Quantity of harmful emissions into the atmosphere, g/sec (t/construction period)									
	Dust	CO	CH	NO_2	NU	SO_2	Petrol fume	Welding aerosol	Mn	Cement dust
1	2	3	4	5	6	7				9
1. Excavation-loading works	0.277 (1.14)	-	-	-	-	-	-	-	-	-
2. Emissions of vehicular traffic	0.66 (3.57)	-	-	-	-	-	-	-	-	-
3. Emissions related to the diesel fume	-	4.12 (15.12)	0.42 (1.5)	2.0 (7.32)	0.2 (0.74)	0.28 (1.04)	-	-	-	-
4. Asphalt laying and bituminizing works	-	-	0.1 (0.01)	-	-	-	0.007 (0.005)	-	-	-
5. Concrete mixer device	-	-	-	-	-	-	-	-	-	0.36 (0.66)
6. Welding work	-	-	-	-	-	-	-	0.01 (0.027)	0.001 (0.0027)	-
Total	0.99 (4.93)	4.12 (15.12)	0.52 (1.51)	2.0 (7.32)	0.2 (0.74)	0.28 (1.04)	0.007 (0.005)	0.01 (0.027)	0.001 (0.0027)	0.36 (0.66)

Table 2. Emissions of harmful materials and the description of the emission sources (Head junction)

Name of the construction site	Description of the emission source					Name of the pollutants	g/sec	t/const. period
	N	H, m	D, m	V, m/sec	T^{O}C			
Platform of the construction work	A1	2.0	30.0	1.2	20	• dust • hydrocarbons • petrol fume • welding aerosol • manganese oxides • cement dust	0.277 0.1 0.007 0.01 0.001 0.36	1.14 0.01 0.005 0.027 0.0027 0.66

Table 3. Quantity of harmful emissions into the atmosphere during the construction period (Main pipeline)

Phases of construction work	Quantity of harmful emissions into the atmosphere, g/sec (t/const. period)									
	Dust	CO	CH	NO_2	NU	SO_2	Petrol fume	Welding aerosol	Mn	Cement dust
1	2	3	4	5	6	7	8	9	10	11
1. Digging-loading works	0.926 (7.04)	-	-	-	-	-	-	-	-	-
2. Emissions of vehicular traffic	0.66 (3.57)	-	-	-	-	-	-	-	-	-
3. Emissions related to the diesel fume	-	4.12 (9.78)	0.42 (0.966)	2.0 (4.74)	0.2 (0.48)	0.28 (0.67)	-	-	-	-
4. Asphalt laying and bituminizing works	-	-	0.1 (0.01)	-	-	-	0.007 (0.005)	-	-	-
5. Concrete mixer device	-	-	-	-	-	-	-	-	-	0.36 (0.66)
6. Welding works	-	-	-	-	-	-	-	0.01 (0.027)	0.001 (0.0027)	-
Total	1.63 (10.95)	4.12 (15.12)	0.52 (1.51)	2.0 (7.32)	0.2 (0.74)	0.28 (1.04)	0.007 (0.005)	0.01 (0.027)	0.001 (0.0027)	0.36 (0.66)

Table 4. Emissions of harmful materials and description of emissions sources (Main pipeline)

Name of the construction site	Description of emission sources					Name of the pollutants	g/sec	t/ construction period
	N	H, m	D, m	V, m/sec	T^{O}C			
Platform of the construction work	A2	2.0	30.0	1.2	20	• dust • hydrocarbons • petrol fume • welding aerosol • manganese oxides • cement dust	0.926 0.1 0.007 0.01 0.001 0.36	7.05 0.01 0.005 0.027 0.0027 0.66

Table 5. Quantity of harmful materials emitted into the atmosphere during construction period (right branch)

Phases of construction work	Quantity of harmful emissions into the atmosphere, g/sec (t/construction period)									
	Dust	CO	CH	NO_2	NU	SO_2	Petrol fume	Welding aerosol	Mn	Cement dust
1	2	3	4	5	6	7	8	9	10	11
1.Digging-loading works	0.65 (4.94)	-	-	-	-	-	-	-	-	-
2.Emissions of vehicular traffic	0.66 (3.57)	-	-	-	-	-	-	-	-	-
3. Emissions related to the diesel fume	-	4.12 (9.78)	0.42 (1.5)	2.0 (4.74)	0.2 (0.48)	0.28 (0.67)	-	-	-	-
4. Asphalt laying and bituminizing works	-	-	0.1 (0.01)	-	-	-	0.001 (0.0008)	-	-	-
5. Concrete mixer device	-	-	-	-	-	-	-	-	-	0.1 (0.12)
6. Welding works	-	-	-	-	-	-	-	0.01 (0.018)	0.001 (0.0018)	-
Total	1.04 (6.61)	4.12 (9.78)	0.52 (1.51)	2.0 (4.74)	0.2 (0.48)	0.28 (0.67)	0.001 (0.0008)	0.01 (0.018)	0.001 (0.0018)	0.1 (0.12)

Table 6. Emissions of harmful materials and description of emissions (Right branch)

Phases of construction work	Description of emission sources					Name of the pollutants	g/sec	t/const. period
	N	H, m	D, m	V, m/sec	T^{o}C			
Platform of the construction work	A3	2.0	30.0	1.2	20	• dust • hydrocarbons • petrol fume • welding aerosol • manganese oxides • cement dust	0.65 0.1 0.001 0.01 0.001 0.1	4.94 0.01 0.0008 0.018 0.0018 0.12

Table 7. Quantity of harmful emissions into the atmosphere during the construction period (Left branch)

Phases of construction work	Quantity of harmful emissions into the atmosphere, g/sec (t/const. period)									
	Dust	CO	CH	NO_2	NU	SO_2	Petrol fume	Welding aerosol	Mn	Cement dust
1	2	3	4	5	6	7	8	9	10	11
1.Digging-loading work	1.83 (13.6)	-	-	-	-	-	-	-	-	-
2. Emissions of vehicular traffic	0.66 (3.57)	-	-	-	-	-	-	-	-	-
3. Emissions related to the diesel fuel	-	4.12 (9.78)	0.42 (1.0)	2.0 (4.74)	0.2 (0.48)	0.28 (0.67)	-	-	-	-
4.Asphalt laying and bituminizing works	-	-	0.04 (0.03)	-	-	-	0.003 (0.002)	-	-	-
5. Concrete mixer device	-	-	-	-	-	-	-	-	-	0.22 (0.26)
6. Welding works	-	-	-	-	-	-	-	0.01 (0.018)	0.001 (0.0018)	-
Total	2.04 (14.07)	4.12 (9.78)	0.46 (1.03)	2.0 (4.74)	0.2 (0.48)	0.28 (0.67)	0.003 (0.002)	0.01 (0.018)	0.001 (0.0018)	0.22 (0.26)

Table 8. Emissions of harmful materials and description of emission sources (Left branch)

Phases of construction work	Description of emission sources					Name of the pollutants	g/sec	t/const. period
	N	H, m	D, m	V, m/sec	T^{O}C			
Platform of the construction work	A3	2.0	30.0	1.2	20	• dust • hydrocarbons • petrol fume • welding aerosol • manganese oxides • cement dust	1.83 0.1 0.003 0.01 0.001 0.22	13.6 0.01 0.002 0.018 0.0018 0.26

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Annex G: Minutes of public consultations

I. MINUTES of PUBLIC CONSULTATIONS
on the preparation of final design for Meghri Gravity Irrigation Scheme

April 5, 2013 **Alvanq community**

PARTICIPANTS:

Varuzhan Hovasapyan	HGSN Director
Heriknaz Mkrtchyan	HGSN Environmental Specialist
Davit Aleksanyan	Meghri town
Yervand Meliksetyan	Meghri town
Sargis Khachatryan	Meghri town
Mkrtich Mkrtchyan	Nrnadzor community head
Gevorg Simonyan	Nrnadzor community
Artashes Azizyan	Nrnadzor community
Hovhannes Ohanyan	Shvanidzor community head
Hayk Gtigoryan	Shvanidzor community
Hovhannes Tovmasyan	Shvanidzor community
Arthur Voskanyan	Shvanidzor community
Yurik Stepanyan	Shvanidzor community
Anushavan Ohanyan	Alvank community
Ashot Harutyunyan	Alvank community
Semyon Chopuryan	Alvank community
Garnik Galstyan	Alvank community
Onik Balasanyan	Alvank community
Sargis Karyan	Alvank community
Arshak Buniatyan	Alvank community
Volodyan Arestakesyan	Agarak community
Melsik Hayrapetyan	Agarak community
Rubik Ohanyan	Agarak community

SUBJECT: Public awareness environmental and social impacts on the construction of Meghri gravity irrigation scheme

DISCUSSIONS:

1. Mr.Varuzhan Hovasapyan

Presented the milestones and details of the project. Explained the gravity irrigation scheme, including water used, environmental flows, principles and junctions of laying the pipeline in the route; provided with water calculation and justifications.

2. Ms. Heriknaz Mkrtchyan

Presented in details environmental issues, informed that the design passed the environmental expertise in 2008 with positive decision. She informed also that the present design includes changes due to the location

of the head intake and other factors. Environmental impact reduction measures included in the design had been also described by Ms. Mkrtchyan.

3. Mr.Hovhannes Ohanyan, Shvanidzor community head

He presented the view, according to which the project would bring to significant positive changes in the community Shvanidzor as the gravity irrigation system will allow in the future to reduce the irrigation water cost, to increase the reliability in continuous water supply to irrigated areas, as Araks river water supplied by pumps contains large quantity of sand, and pumps can be operated no longer that 1 year. He mentioned also Meghri River water was environmentally clean and did not contain hazardous materials. Therefore, the quality of Shvanidzor community fruits and vegetable would have significant changes.

4. Mr. Onik Balasanyan, Alvank community resident

He requested that several options for the pipeline route be presented and the best option be studied and discussed. He said that in the whole, the project was very important and required for Nrnadzor, Shvanidzor, Alvank rural communities.

5. Mr.Varuzhan Hovasapyan

Provided justifications, according to which the proposed options had been studied at previous phases and the final feasible one had been selected.

6. Mr.Mkrtich Mkrtchyan, Nrnadzor community head

Mr.Mkrtchyan presented perspective for development of Nrnadzor irrigated areas and irrigation water shortages in the areas irrigated by pumping stations, which are due to frequent disruption of pumping units, sand traps maintenance difficulties and quality issues of pumped water.
Mr.Mktrchyan proposed to support the project.

7. Mr. David Aleksanyan, Meghri town resident

Mr.Aleksanyan explained the importance of the system, mentioning the resulting positive environmental impact on fruits and vegetables of the area. He considered that construction of the irrigation system in the region was very important in terms of increasing security of irrigation system and producing ecologically pure agricultural products. He mentioned also the possible future irrigation water cost changes due to energy saving and system reliability enhancement.

8. Mr.Ashot Harutyunyan, Alvank community resident

Mentioned the need to rehabilitate the pressure pipeline of Alvank village which is currently in insufficient technical state.

9. Mr.Gevorg Simonyan, Nrnadzor community resident

Raise a question of insufficient technical state of the secondary pressure pipeline of Nrnadzor village.

10. Mr. Rubik Ohanyan, Agarak town resident

Expressed his confidence in the project as the best solution for Agarak town irrigation system in terms of environmental and urban development.

11. Mr.Varuzhan Hovasapyan

Answered all questions mentioning that the project covers the pipelines reconstruction requirement without changing their current routes.

II. Public Meetings and Discussions

on Meghri Gravity Irrigation System Design

Based on the preliminary technical and environmental assessment, preliminary designs of the Meghri irrigation system have been elaborated and arranged by the workgroups of HGSN Consulting Company for the beneficiary communities situated within the impact area.

At first the Consultant held meetings with the heads of the beneficiary communities. They were introduced to the works on the final design of Megri gravity irrigation system within the framework of «Irrigation Rehabilitation Emergency Project (Additional financing) funded by WB. Their agreement was obtained on organizing FG and public discussions, place and time to be held in their communities, as well as participants.

At the discussion the participants were introduced to the works, drawings and schemes of the two options of gravity irrigation system aiming at preparing the final design of Megri gravity irrigation system. The schemes' graphics introduce the existing and proposed new roads, current water conduits and the routes of the designed gravity systems. Numerous questions and suggestions were asked and introduced by the residents. The facilitators recorded all questions and suggestions introduced at the discussions as well as notions and remarks to be considered in future.

Besides the discussions in the communities, talks were also held with randomly chosen groups and individuals, informing them about the project design for the community gravity irrigation system.

Focus Group discussions on the preparation of final design of Megri gravity irrigation system

December 24, 2012

Shvanidzor Village Council

Total number of participants - 28

(The head of the village, the chairman of the staff, village school director, teachers, cattleman and dwellers)

The population of Shvanidzor rural community considers the irrigation water availability to be of great importance since more frequent irrigation of plots will result in higher yield.

The participants asked whether a new pipeline would be built or the damaged sections would be repaired. They also worried about the timing of Project implementation since the issue of water supply had been discussed long before and not found any solution yet. The village residents wish the Project would come true, not remain on the paper. The village would be rich if there will be drinking and irrigation water availability. The participants' questions were answered and explained by the experts.

December 25, 2012

Nrnadzor Village Council

Total number of participants - 11

(The community governor, the deputy head of village, the head of Bughdadouz penal jurisdiction, Nrnadzor school teachers, and gardeners)

The participants of the discussion held in Nrnadzor community considered the issues of the building reservoir and pump station repair. Some of the participants raised the issues of a lack of drinking and irrigation water. They hope the new irrigation system will solve their problem.

December 25, 2012

Alvank Village Council

Total number of participants - 15

(the village head, the chairman of the staff, the village school director deputy and village dwellers)

The participants of the discussion held in the Alvanq rural community asked whether the water supplied from Vanadzor would be sufficient, and would reach them. They inquired if the pump would remain, and whether the irrigation water would be free or paid and at what price. They were informed that if they irrigate their plots by the pipeline laid by the community efforts mentioning that the electricity is subsidized; water charge is 11 drams per 1 cubic meter, and that it is Government who determines the water charge. The community river water will help to construct mini reservoirs which will provide full seasonal irrigation. They asked whether the expenses of the WUA would raise the irrigation water charges. They would not like to see a price increase. The participants inquired about the time of the Project implementation since they had been waiting for normal water supply for long 20 years.

December 26, 2012

Karchevan Village Council

Total number of participants – 12

(The head of the village, the chairman of the staff, village school teachers, copper-molybdenum plant personnel and village dwellers)

During the discussion the participants of the Karchevan community complained of water shortages. The inhabitants said that the most part of their lands is within Agarak territory. The irrigation is very difficult to perform. The waste waters flow directly into the pipes. The village plots are irrigated by drinking and river waters.

December 26, 2012

Meghri Town Hall

Total number of participants – 22

(The mayor, the staff of the Town Hall, authorities, town dwellers and military personnel)

The mayor invited for the public discussion randomly selected town dwellers, no matter who, to let them express their opinion. So that the people participated at the discussion were of different age and specialties including also women and youngsters. Some of the participants were concerned whether the water will be enough for them after it is taken for the gravity irrigation system. The facilitators of the meeting explained that Meghri water users will also be the beneficiaries of the new system. They asked questions about the length of the pipeline, about pipes repair works, about the intake site. They suggested building a **reservoir** as well.

December 27, 2012

Agarak Town Hall

Total number of participants - 23

(The mayor, the staff of the Town Hall, teachers of Agarak Art School and basic schools and town dwellers)

It was suggested to transfer water from the Araks River to Agarak by gravity which will be the basic solution of the irrigation issue. In Agarak and Karchevan 100% irrigation is performed by pumping system. For agriculture development in Agarak it is essential to change the mechanical system into gravity.

III. Public Consultation
on Environmental and Social Impact Assessment (ESIA) report for
Meghri Gravity Irrigation Scheme project

Alvank village **June 17. 2014**

Venue **Village hall of Alvank**

Hours: 14:00 –15.30

PARTICIPANTS:

1	Ashot Danielyan	Teacher	Alvank
2	Andranik Duryan	Farmer	Alvank
3	Hovik Arustamyan	Community member	Alvank
4	Miro Gyurjinyan	Community member	Alvank
5	Nvard Gevorgyan	Village council member	Alvank
6	Anahit Asatryan	Community member	Alvank
7	Rafik Movsisyan	Farmer	Alvank
8	Arsen Ishkhanyan	Village council member	Alvank
9	Haykanush Hovsepyan	Farmer	Alvank
10	Anushavan Ohanyan	Community member	Alvank
12	Ashot Harutyunyan	Community member	Alvank
13	Semyon Chopuryan	Community member	Alvank
14	Garnik Galstyan	Teacher	Alvank
15	Onik Balasanyan	Community member	Alvank
16	Sargis Karyan	Village council member	Alvank
17	Arshak Buniatyan	Community member	Alvank
18	Davit Aleksanyan	Meghri WUA Head	Meghri
19	Martiros Nalbandyan	PIU Environmental Specialist	Yerevan
20	Marine Vardanyan	PIU Social Specialist	Yerevan
21	Misak Kansuzyan	Head of the working group	Yerevan
22	Hasmik Aslanyan	Specialist of public relations	Yerevan
23	Christine Sahakyan	Environmental specialist	Yerevan
24	Varuzhan Tumanyan	Head of Alvank community	Alvank

PRESENTATIONS:

Hasmik Aslanyan, the PR Specialist of HGSN LLC, opened the meeting and presented the agenda and the objectives of the consultation meeting then she introduced the delegation members to the participants: the representatives of Water Sector PIU, specialists of HGSN LLC and head of "Meghri" WUA and added that the participants could apply to the specialists of the delegation in case of any questions.

Head of HGSN LLC working group Misak Kansuzyan. He introduced the details of the project. He explained the technical solutions referring to the gravity irrigation scheme, which would supply the community with the same amount of water as the previous system, the principles and junctions for the installation of the pipeline in the route. He introduced the indexes of the water economic calculations for the used sections of river Meghri and that the construction of the gravity irrigation system for the settlements of 6 beneficiary communities would have great importance and as a result of the project implementation the water users would receive high quality clean irrigation water without interruptions.

Environmental specialist HGSN LLC Christine Sahakyan. She presented the outcomes of ESIA of the observed areas, connected with the project implementation. She introduced environmental risks and damages for the project affected zone and adjacent areas during the construction works foreseen by the design, the negative impacts expected during the works and the mitigation measures. She mentioned that the negative impacts of the construction works would be temporary. She assured all the works would be controlled during the implementation of the construction and called the inhabitants to control the works as well.

M. Nalbandyan, Environmental specialist of PIU asked whether the environmental flow of Meghri River could insure the conservation of river's biodiversity especially for period July-September.

C. Sahakyan, Environmental Expert of Design Company answered the calculations were done according to the RA Governmental Decision(N 927, 2011) and are based on information from Hydromet Center of Ministry of Emergency Situations. The results of calculations show that the water quantity after head intake of Meghri gravity scheme is enough to insure the ecological flow.

Marine Vardanyan, PIU Social Specialist presented social impact assessment outcomes and mitigation measures. She presented socioeconomic benefits of the stakeholders of the project and temporary working opportunities for local population at construction period. She also added that the waterline would mainly pass through community or state lands and the consultant had got permission letters from the corresponding parties and the PIU had signed Voluntary Easement Agreements with the directors of 3 private enterprises and one landowner for laying a waterline through their lands.

The member of Alvank community Haykush Hovsepyan mentioned that the project is a good one for the whole community, and there might be some inconveniences during the construction, and the inhabitants should approach the issue with understanding and tolerance, as this work is carried out for them.

The member of Alvank community council Ashot Danielyan raised a question referring to the pressure and gauge of the pipeline coming from Lehvaz. Misak Kansuzyan answered the question and presented the design data in detail.

The water user Rafik Movsisyan worried that they wouldn't receive water. He was interested how the water would be transferred to them. If the main route passes through the old site – across 2 land areas, it will not be convenient for them. Misak Kansuzyan explained from where the water intake of the gravity irrigation system starts. He gave the answer to that question showing the scheme for laying the irrigation water conduit on the exact drawing.

The inhabitants of the community asked if the project implementers should apply to the landowners for their permission, or not.

The director of Meghri WUA Davit Aleksanyan introduced the importance of the system, and mentioned the environmental positive impact on the fruits and vegetables grown in that region, in the end. He considered that the construction of the project was absolutely necessary for raising the security of the irrigation system and for getting ecologically clean agricultural production. He mentioned that the water amount will be sufficient. At present the water is given with 40% loss, and as a result of the project the water will be of the same amount - without any loss. He assured that there would be no problem relating to the pump, Alvank would receive 60l/sec. water, and the community would receive twenty-four-hour irrigation water.

The RA Water Sector PIU environmental specialist Martiros Nalbandyan assured the participants

that they would support the villagers. In case of questions or worries, people can apply to them being certain that their opinions will be taken into consideration. They would be glad to have feedback from the community water users. He gave the participants their contact information for communication and feedback.

The facilitators answered all the questions of the participants related to environmental and social risks and mitigation measures and thanked them for their participation.

Head of the working group of public hearings	Misak Kansuzyan
Specialist of "HGSN" LLC public relations	Hasmik Aslanyan
Head of Alvank community	Varuzhan Tumanyan
June 17, 2014	

Public Consultation
On Environmental and Social Impact Assessment (ESIA) report for
Meghri Gravity Irrigation Scheme project

Shvanidzor v.	**June 17. 2014**
Venue	**Cultural centre of Shvanidzor**
	Hours: 16: 00 - 17:50

PARTICIPANTS:

1	Artak Tumanyan	Teacher	Shvanidzor
2	Samvel Arakelyan	Farmer	Shvanidzor
3	Edgar Pahlevanyan	Community member	Shvanidzor
4	Misak Sargsyan	School Director	Shvanidzor
5	Nvard Gevorgyan	Village council member	Shvanidzor
6	Anahit Asatryan	Community member	Shvanidzor
7	Rafik Movsisyan	Farmer	Shvanidzor
8	Hovhannes Ohanyan	Farmer	Shvanidzor
9	Hayk Gtigoryan	Community member	Shvanidzor
10	Hovhannes Tovmasyan	Village Council member	Shvanidzor
11	Arthur Voskanyan	Village Council member	Shvanidzor
12	Yurik Stepanyan	Community member	Shvanidzor
13	Margar Avetisyan	Teacher	Shvanidzor
14	Karo Voskanyan	Teacer	Shvanidzor
15	Karen Hayrapetyan	Military officer	Shvanidzor
16	Mkrtich Mkrtchyan	Community head	Nrnadzor
17	Gevorg Simonyan	Farmer	Nrnadzor
18	Artashes Azizyan	Community member	Nrnadzor
19	Yurik Stepanyan	Farmer	Nrnadzor
20	Narine Mirzoyan	Community member	Nrnadzor
21	Narek Khachatryan	Teacher	Nrnadzor
22	Vilik Alexanyan	Community member	Meghri

23	Hakob Avetisyan	Farmer	Meghri
24	Hrach Hovhannisyan	Community member	Meghri
25	Davit Aleksanyan	Meghri WUA Head	Meghri
26	Martiros Nalbandyan	PIU Environmental Specialist	Yerevan
27	Marine Vardanyan	PIU sociologist	Yerevan
28	Misak Kansuzyan	Head of the working group	Yerevan
29	Hasmik Aslanyan	Specialist of public relations	Yerevan
30	Christine Sahakyan	Environmental specialist	Yerevan
31	Hovhannes Ohanyan	Head of Shvanidzor community	Shvanidzor

PRESENTATIONS:

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Environmental specialist HGSN LLC Christine Sahakyan. She presented the outcomes of ESIA of the observed areas, connected with the project implementation. She introduced environmental risks and damages for the project affected zone and adjacent areas during the construction works foreseen by the design, the negative impacts expected during the works and the mitigation measures. She mentioned that the negative impacts of the construction works would be temporary. She assured all the works would be controlled during the implementation of the construction and called the inhabitants to control the works as well.

Head of HGSN LLC working group Misak Kansuzyan. He introduced the details of the project. He explained the technical solutions referring to the gravity irrigation scheme, which would supply the community with the same amount of water as the previous system, the principles and junctions for the installation of the pipeline in the route. He introduced the indexes of the water economic calculations for the used sections of river Meghri and that the construction of the gravity irrigation system for the settlements of 6 beneficiary communities would have great importance and as a result of the project implementation the water users would receive high quality clean irrigation water without interruptions.

A teacher from Shvanidzor community Karo Voskanyan worried about the water decrease in Meghri River in September. Davit Aleksanyan answered the river water was sufficient for the whole irrigation season.

C. Sahakyan, Environmental Expert of Design Company answered the calculations were done according to the RA Governmental Decision(N 927, 2011) and are based on information from Hydromet Center of Ministry of Emergency Situations. The results of calculations show that the water quantity after head intake of Meghri gravity scheme is enough to insure the ecological flow.

Marine Vardanyan, PIU Social Specialist presented social impact assessment outcomes and mitigation measures. She presented socioeconomic benefits of the stakeholders of the project and temporary working opportunities for local population at construction period. She also added that the waterline would mainly pass through community or state lands and the consultant had got permission letters from the corresponding parties. and the PIU had signed Voluntary Easement Agreements with the directors of 3 private enterprises and one landowner for laying a waterline through their lands.

Hovhannes Ohanyan asked on behalf of Shvanidzor community to involve also the inhabitants of the village as workers during the construction works, if possible.

Martiros Nalbandyan promised to remind the head of the construction company to hire working hands from Shvanidzor when they start working in the community as it was considered in ESIA as social mitigation measure.

The organizers answered to various questions raised by the participants. There were also questions out of the project scopes, especially referring to the demand of constructing water reservoirs in Meghri region, particularly in Shvanidzor.

A teacher from Shvanidzor community Margar Avetisyan asked a question to Christine Sahakyan. He mentioned that 36 mines were going to be opened and asked what measures they were going to undertake related to it. Christine Sahakyan answered the mentioned question refers to a general environmental problem and it was not related to the new gravity system.

The facilitators answered all the questions of the participants related to environmental and social risks and mitigation measures and thanked them for their participation.

Head of the working group of public hearings	Misak Kansuzyan
Specialist of "HGSN" LLC public relations	Hasmik Aslanyan
Head of Shvanidzor community	Hovhannes Ohanyan

June 17, 2014

Annex H: Agreements on Land Use

I. Voluntary Easement Contract for Meghri Gravity Scheme - RCOC

VOLUNTARY EASEMENT CONTRACT

Place of signing: **t. Meghri** **Date: 11.04.2014**

Entity/Citizen Meghri RCOC LLC (hereinafter the Owner),
(Name, surname)
Registered at the following address: 89 Gortsaranayin st. t. Meghri
(Registration address)
Passport: -
(Passport (Identification Card) data)
on the one hand, and the State Agency "Water Sector Project Implementation Unit" of the State Committee of Water System of the RA Ministry of Territorial Administration (hereinafter "PIU") on the other hand, signed the present Contract on the following:

1. With this Contract the Owner of the Real Estate provides the PIU with the limited right of use for the Real Estate mentioned in this Contract (hereinafter the Easement), particularly gives the right to lay a pipeline for a designed gravity irrigation system through the territory belonging to him/her by the Right of Ownership (arable land, grassland, etc.).

2. **The Real Estate burdened with Easement has the following:**

a) **Type:** (arable land, grassland, spare/unused land, orchard, etc.):

b) **Address:** 6/2 v. Lehvaz, Syunik Marz, RA

3. The plan of the Real Estate burdened with the Easement, with the mark of Location of the Easement, is attached to the present Contract and makes integral part of it.
4. **Objective of Providing an Easement:** Water delivery system for pump stations (construction of pipeline for gravity irrigation system).
5. **Payment for Easement:** No payment is set for providing an Easement. This Easement is voluntarily provided.
6. **Contract Dates:** The Contract validity is termless /or indicate end date of contract.
7. The PIU shall construct and develop the pipeline and take all possible precautions to avoid damage to adjacent land/structure/other assets and replace all ground cover displaced during construction works.
8. The Owner confirms that he/she has the transferable right of the land/structure/asset described above.
9. The Owner testifies that the land/structure described above is free of squatters or encroachers and not subject to other claims.
10. The Owner confirms that he/she is not dependent on the land described above as an important source of livelihood or residence.
11. Acting Legislation of the Republic of Armenia is applied to the relations not regulated by this Contract.

Parties

Person Requiring an Easement
A. Ghazaryan

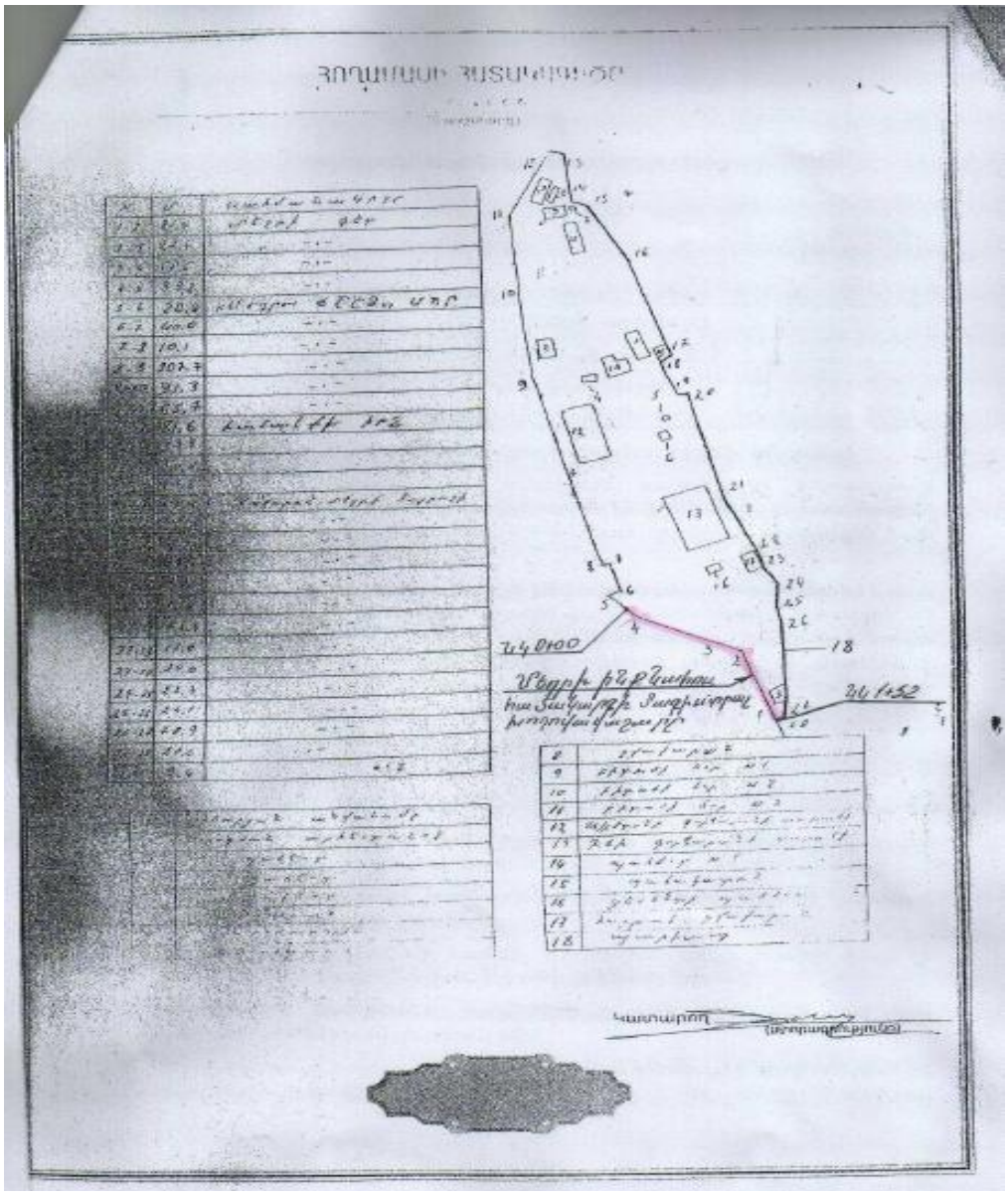
Director of the State Agency
"Water Sector Project Implementation Unit"
of the State Committee of Water System
of the RA Ministry of Territorial Administration

/signature/
/Official Seal/

Owner of the Real Estate
A. Gasparyan

Director of RCOC LLC

/signature/



II. Voluntary Easement Contract for Meghri Gravity Scheme Communal Service Rehabilitation

VOLUNTARY EASEMENT CONTRACT

Place of signing: t. Meghri **Date: 11.04.2014**

Entity/Citizen Meghri Communal Service Rehabilitation OSC (hereinafter the Owner),
(Name, surname)
Registered at the following address: 41 Andraniki st., t. Meghri
(Registration address)
Passport: _____-_____
(Passport (Identification Card) data)
on the one hand, and the State Agency "Water Sector Project Implementation Unit" of the State Committee of Water System of the RA Ministry of Territorial Administration (hereinafter "PIU") on the other hand, signed the present Contract on the following:

1. With this Contract the Owner of the Real Estate provides the PIU with the limited right of use for the Real Estate mentioned in this Contract (hereinafter the Easement), particularly gives the right to lay a pipeline for a designed gravity irrigation system through the territory belonging to him/her by the Right of Ownership (arable land, grassland, etc.).

2. **The Real Estate burdened with Easement has the following:**

c) **Type:** (arable land, grassland, spare/unused land, orchard, etc.):

d) **Address:** 41 Andraniki st., t. Meghri, Syunik Marz, RA

3. The plan of the Real Estate burdened with the Easement, with the mark of Location of the Easement, is attached to the present Contract and makes integral part of it.
4. **Objective of Providing an Easement:** Water delivery system for pump stations (construction of pipeline for gravity irrigation system).
5. **Payment for Easement:** No payment is set for providing an Easement. This Easement is voluntarily provided.
6. **Contract Dates:** The Contract validity is termless /or indicate end date of contract.
7. The PIU shall construct and develop the pipeline and take all possible precautions to avoid damage to adjacent land/structure/other assets and replace all ground cover displaced during construction works.
8. The Owner confirms that he/she has the transferable right of the land/structure/asset described above.
9. The Owner testifies that the land/structure described above is free of squatters or encroachers and not subject to other claims.
10. The Owner confirms that he/she is not dependent on the land described above as an important source of livelihood or residence.
11. Acting Legislation of the Republic of Armenia is applied to the relations not regulated by this Contract.

Parties

Person Requiring an Easement
B. Ghazaryan

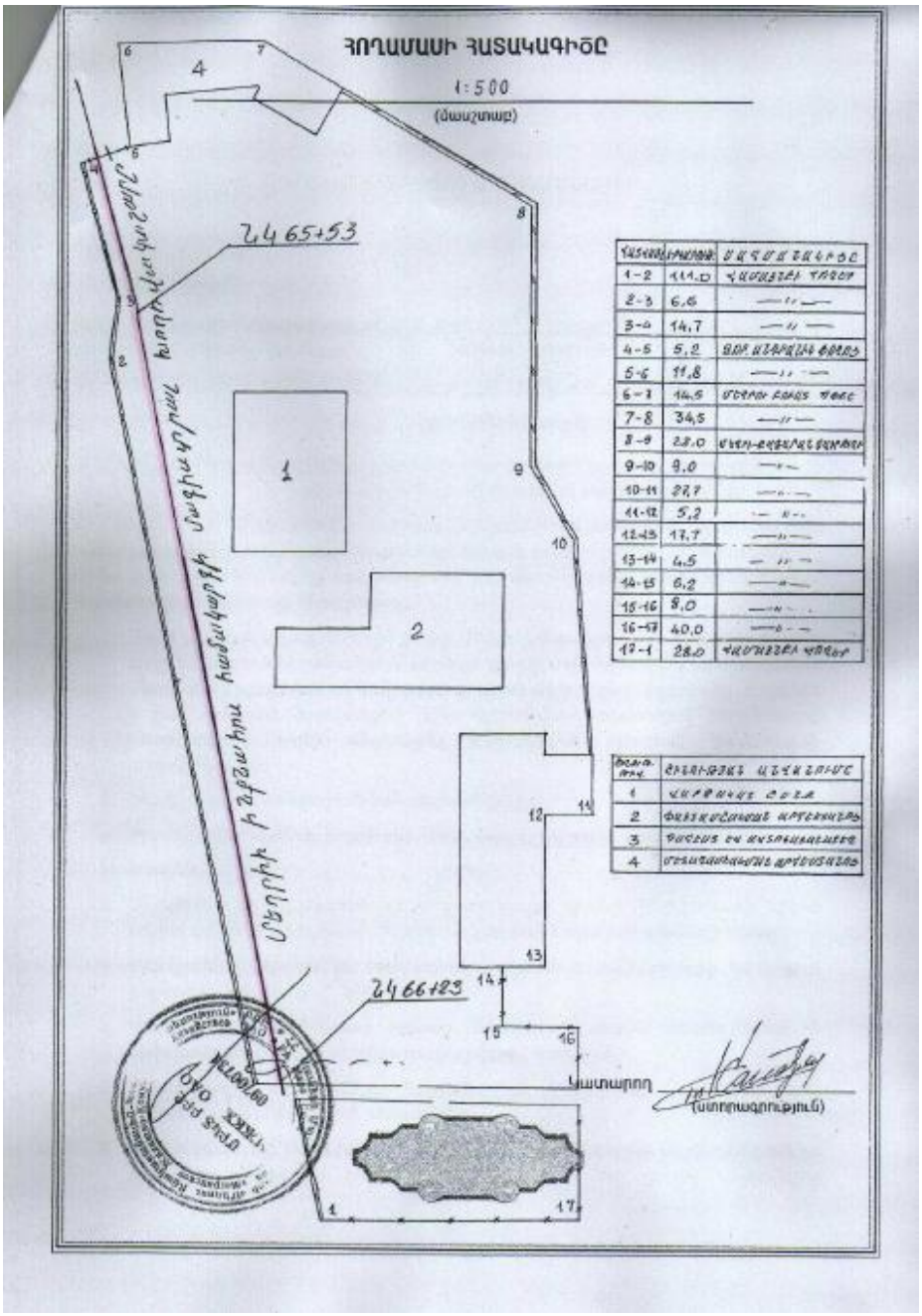
Director of the State Agency
"Water Sector Project Implementation Unit"
of the State Committee of Water System
of the RA Ministry of Territorial Administration

/signature/
/Official Seal/

Owner of the Real Estate
Hayrapetyan

Director of Meghri
Communal Service
Rehabilitation OSC

/signature/



III. Voluntary Easement Contract for Meghri Gravity Scheme - Cheese Factory

VOLUNTARY EASEMENT CONTRACT

Place of signing: **t. Meghri** **Date: 11.04.2014**

Entity/Citizen Meghri Cheese Factory Ltd. (hereinafter the Owner),
(Name, surname)
Registered at the following address: t. Meghri
(Registration address)
Passport: _____-_____
_____
(Passport (Identification Card) data)
on the one hand, and the State Agency "Water Sector Project Implementation Unit" of the State Committee of Water System of the RA Ministry of Territorial Administration (hereinafter "PIU") on the other hand, signed the present Contract on the following:

1. With this Contract the Owner of the Real Estate provides the PIU with the limited right of use for the Real Estate mentioned in this Contract (hereinafter the Easement), particularly gives the right to lay a pipeline for a designed gravity irrigation system through the territory belonging to him/her by the Right of Ownership (arable land, grassland, etc.).

2. **The Real Estate burdened with Easement has the following:**

e) **Type:** (arable land, grassland, spare/unused land, orchard, etc.):
f) **Address:** v. Gudemnis, Syunik Marz, RA

3. The plan of the Real Estate burdened with the Easement, with the mark of Location of the Easement, is attached to the present Contract and makes integral part of it.
4. **Objective of Providing an Easement:** Water delivery system for pump stations (construction of pipeline for gravity irrigation system).
5. **Payment for Easement:** No payment is set for providing an Easement. This Easement is voluntarily provided.
6. **Contract Dates:** The Contract validity is termless /or indicate end date of contract.
7. The PIU shall construct and develop the pipeline and take all possible precautions to avoid damage to adjacent land/structure/other assets and replace all ground cover displaced during construction works.
8. The Owner confirms that he/she has the transferable right of the land/structure/asset described above.
9. The Owner testifies that the land/structure described above is free of squatters or encroachers and not subject to other claims.
10. The Owner confirms that he/she is not dependent on the land described above as an important source of livelihood or residence.
11. Acting Legislation of the Republic of Armenia is applied to the relations not regulated by this Contract.

Parties

Person Requiring an Easement
C. Ghazaryan

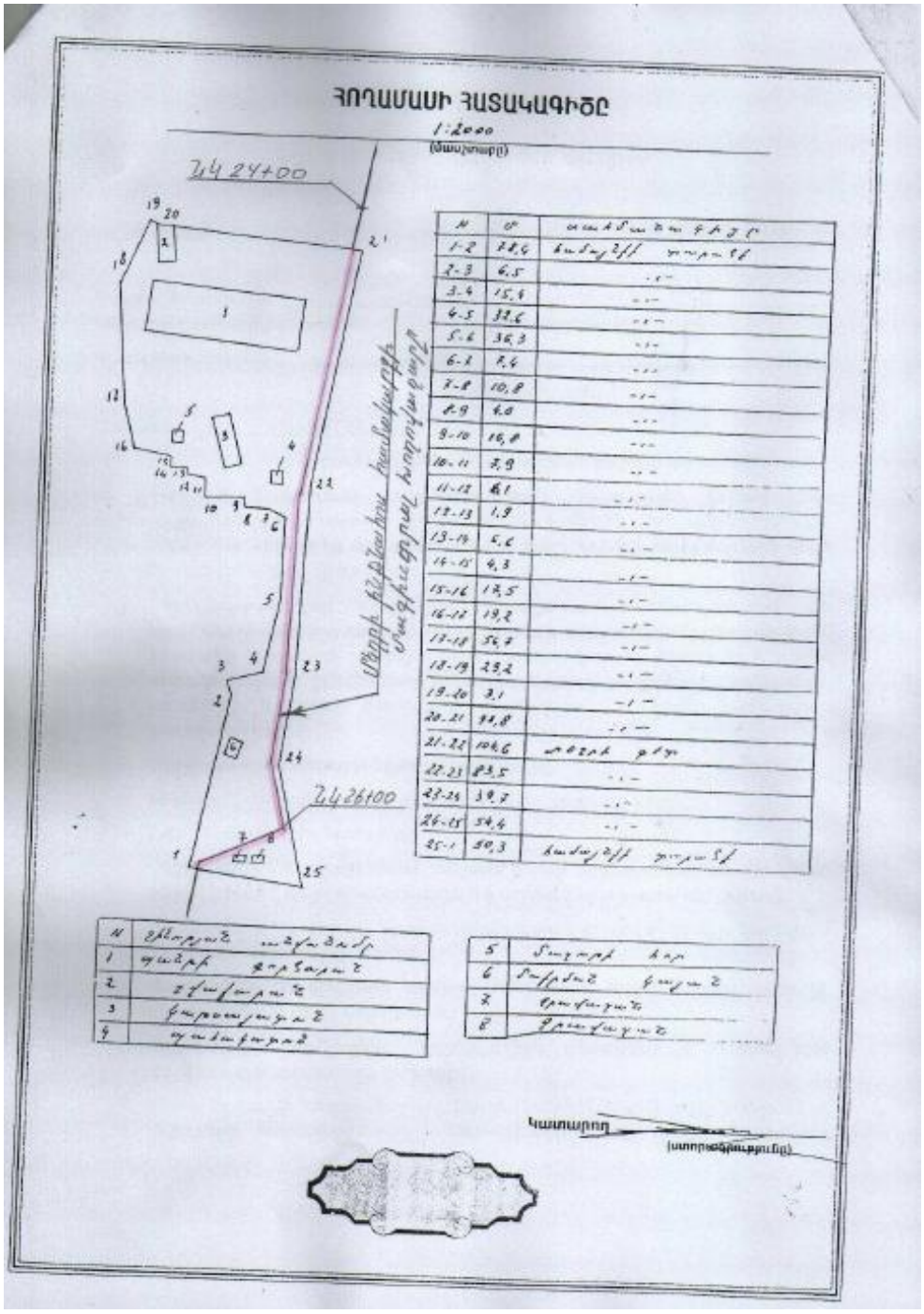
Director of the State Agency
"Water Sector Project Implementation Unit"
of the State Committee of Water System
of the RA Ministry of Territorial Administration

/signature/
/Official Seal/

Owner of the Real Estate
I. Aghabekyan

Director of Meghri
Cheese Factory Ltd.

/signature/



IV. Voluntary Easement Contract for Meghri Gravity Scheme_citizen

VOLUNTARY EASEMENT CONTRACT

Place of signing: **v. Alvank** **Date: 11.04.2014**

Entity/Citizen Haykush Hovsepyan ___ (hereinafter the Tenant),
(Name, surname)
Registered at the following address: 46/36 Nor Nork 7th District, Yerevan, RA
(Registration address)
Passport: 00497529 issued on 21.12.2012 by 045
(Passport (Identification Card) data)
on the one hand, and the State Agency "Water Sector Project Implementation Unit" of the State Committee of Water System of the RA Ministry of Territorial Administration (hereinafter "PIU") on the other hand, signed the present Contract on the following:

1. With this Contract the Tenant of the Real Estate provides the PIU with the limited right of use for the Real Estate mentioned in this Contract (hereinafter the Easement), particularly gives the right to lay a pipeline for a designed gravity irrigation system through the territory leased by him/her by the Right of Ownership (arable land, grassland, orchard, etc.).
2. **The Real Estate burdened with Easement has the following:**

g) **Type:** (arable land, grassland, spare/unused land, orchard, etc.):
h) **Address:** v. Alvank, Syunik Marz, RA

3. The plan of the Real Estate burdened with the Easement, with the mark of Location of the Easement, is attached to the present Contract and makes integral part of it.
4. **Objective of Providing an Easement:** Water delivery system for pump stations (construction of pipeline for gravity irrigation system).
5. **Payment for Easement:** No payment is set for providing an Easement. This Easement is voluntarily provided.
6. **Contract Dates:** The Contract validity is termless /or indicate end date of contract.
7. The PIU shall construct and develop the pipeline and take all possible precautions to avoid damage to adjacent land/structure/other assets and replace all ground cover displaced during construction works.
8. The Tenant confirms that he/she has the transferable right of the land/structure/asset described above.
9. The Tenant testifies that the land/structure described above is free of squatters or encroachers and not subject to other claims.
10. The Tenant confirms that he/she is not dependent on the land described above as an important source of livelihood or residence.
11. Acting Legislation of the Republic of Armenia is applied to the relations not regulated by this Contract.

Parties

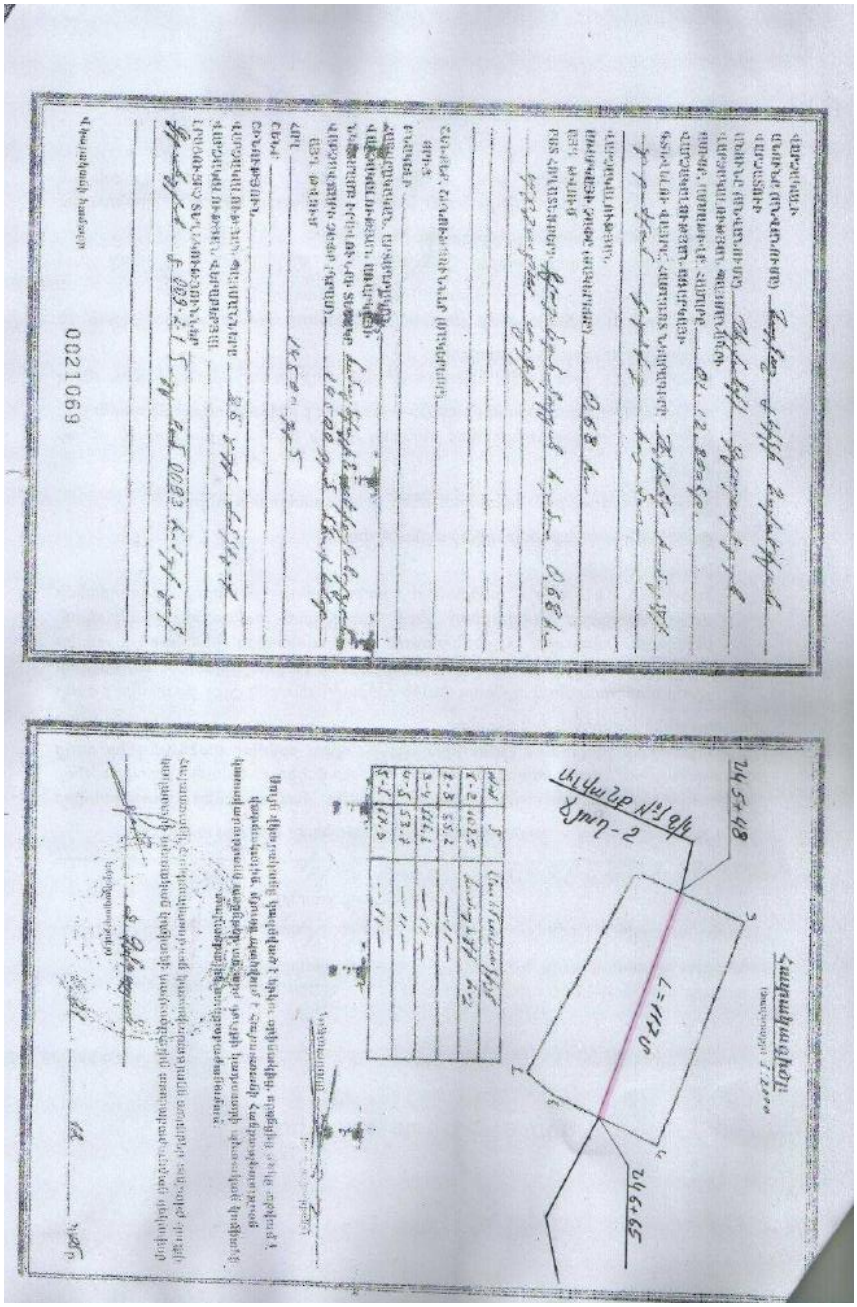
Person Requiring an Easement
D. Ghazaryan

Tenant of the Real Estate
Haykush Hovsepyan

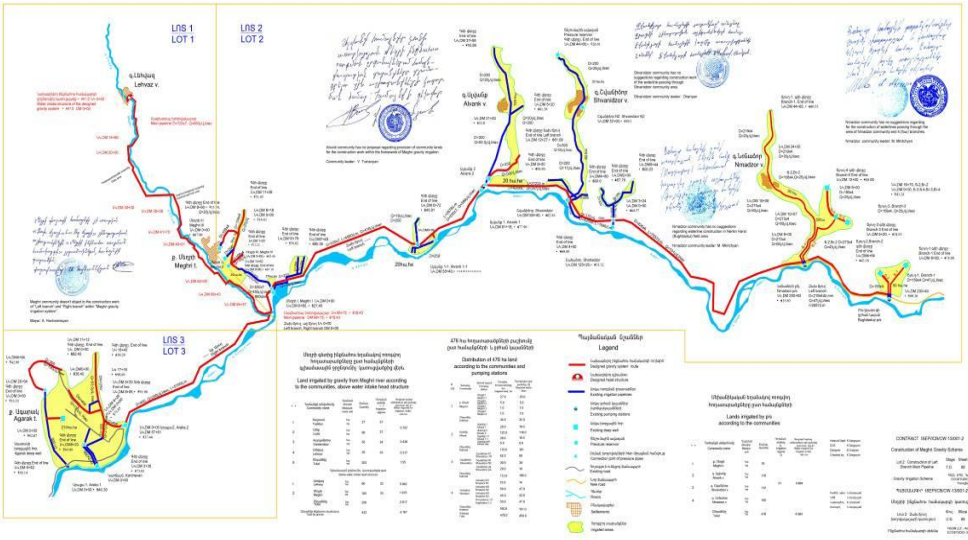
Director of the State Agency
"Water Sector Project Implementation Unit"
of the State Committee of Water System
of the RA Ministry of Territorial Administration

/signature/
/Official Seal/

/signature/



V. Agreements on temporary land use with community heads and their approvals on a cadastral map



VI. Agreements obtained from *(Translations)*

1. *N01/14.2/9101, The Ministry of Transport and Communication of RA, G. Beglaryan, dated 26.07.2013*

Minister of Transport and Communication

N01/14.2/9101

26.07.2013

Mr. V.Hakobyan

Governor of Syunik, RA

Copy: Mr. V.Hovasapyan

Director of HGSN LLC

Director of "Water sector project implementation unit" S/I Mr. A.Ghazaryan

Director of "Meghri RCOE" LLC

Mr. A.Gasparyan

Dear Mr. Hakobyan

In response to your letter N01/453913 dated 22.07.2013 it is necessary to keep the demands of RA CN IV-XI. 05.02-99 construction norms in order to lay the pipeline through the areas of M-2 Yerevan-

Yeraskh-Goris-Meghri-Iran border and M-17, M-2 Kapan-Tsav-Shvanidzor M2 interstate motor road intersections and adjacent areas presented by the design of the route of Meghri gravity irrigation system funded by "Water sector project implementation unit" S/I and the World Bank, particularly:

1. It shall be installed far from the road side ditch not less than at 1.0m distance in the sections out of the settlements.
2. In the territory of settlements – by the external border of the road side or pavement.
3. Intersections shall be carried out in 3 sections of the road according to BC 2.05.03.84 construction norms. The conduit shall be laid through the metal cover the depth of which shall make 0.8m from the surface of asphalt concrete cover, diameter of the protective pipe included.
4. In the sections of bridges and routers keeping the role and importance of the transport.
5. The Client shall rehabilitate the road bed and the asphalt concrete cover by his own means. Prior to the construction works the Client shall sign a contract beforehand with the company carrying out the works (in case of possible road damages during the construction works) about the rehabilitation of the previous condition of the road.
6. The scheme with road signs shall be coordinated with RA Police "Traffic Police" service.
7. During the implementation of construction works, the constructor is responsible for the traffic safety in that section of the road.
8. The Client must have three years' service guarantee contract with the company implementing the construction works concerning the works carried out.

At the same time we inform that according to N1025 decision of RA government dated 11.09.2008, the design documents experimented and developed based on the technical conditions and conclusions provided by the Ministry of Transport and Communication, RA shall be coordinated with the Ministry of Transport and Communication, RA.

After the selection of the Contractor company for the implementation of the above mentioned works, an information is required to present to the Ministry of Transport and Communication concerning the date and the selected construction company prior to the construction works to carry out the required supervision by the Contractor company and laying of the pipeline through the intersections of roads and its adjacent areas.

Taking into account the great number of intersections of interstate motor roads the Ministry of Transport and Communication, RA proposes (Meghri RCOE) LLC to get involved in the works of intersection of roads and their rehabilitation.

Best regards G.Beglaryan

2. **No. 01/14.2/1953-13, Deputy of the Minister of Culture, RA, dated 12.06.2013**

Deputy of the Minister of Culture, RA

N 01/14.2/1952.13 12.06.2013

Director of HGSN LLC

Mr. Hovasapyan

Dear Mr. Hovasapyan

In response to your letter N VH-89 dated May 15, 2013 we inform you that the lands of Meghri, Agarak towns and Shvanidzor, Alvank, Nrnadzor, Karchevan, Bughdaduz villages allotted for irrigation were studied by the Ministry specialists.

We inform that there are no historical-cultural monuments; so the Ministry has no objections concerning the route design of Meghri gravity irrigation.

Best regards: A.Samuelyan

3. **No. E-27, RA Ministry of Justice, "Support to the convict" Fund, dated 31.05.2013**

RA Ministry of Justice
Fund "Support to the Convict"

No. E-27
31.05.2013

Director of "HGSN" LLC
Mr. V. Hovasapyan

I don't have any objections concerning placing water pipeline through the area of Nrnadzor "Nerkin hand" (Bughdaduz) with the purpose of constructing "Meghri gravity irrigation system".

Executive director G.Manukyan

4. **Letter from the Director M. V. Hovasapyan to community leaders for permission to construct and install "Meghri gravity irrigation system" pipeline through their communities**

Urban Design

VH-92
15.05.2013

Mayor of Meghri town
A. Hovhannisyan

HGSN LLC implements the design of Meghri gravity irrigation system within the World Bank project in order to carry out the gravity irrigation of the lands of Meghri, Agarak towns and Shvanidzor, Alvank, Karchevan, Nrnadzor, Bughdaduz villages. The designed gravity irrigation system will serve the areas which are irrigated by 8 pumping stations, by gravity.

The pipeline route passes through the area belonging to the town.

We request your approval regarding the route section passing through the land area of the town according to the presented scheme. The pipeline will be installed underground; the earth cover will be fully restored parallel to the construction with its former cover and former structure. The width of the pit for installation of the pipeline is 2m, and the depth is 1.70m.

We request you to confirm, that the issues concerning the temporary and permanent land acquisition occurred during the construction will be solved by you according to the presented scheme.

We request you to present the location where the excess soil occurred in the area of your community during the construction will be transported.

The route scheme and junctions are attached.

V. Hovasapyan

5. **Mayor of Meghri town A. Hovhannisyan, dated 24.05.2013**

24.05.2013

"HGSN" LLC Director
Mr. V. Hovasapyan

I have no objection regarding the construction of "Left branch", "Right branch", "Main pipeline", "D-1, D-1-1 and D-1-2" branches in the irrigation system of "Meghi gravity system" in the areas of the community.

Mayor of Meghri A. Hovhannisyan

6. **Head of Alvank community, V. Tumanayn, dated 21.05.2013 and 24.05.2013**

24.05.2013

Director of "HGSN" LLC

V. Hovasapyan

I reviewed the project; the community of Alvank doesn't have any objections.

The leader of Alvank community

V. Tumanyan

21.05.2013

Director of "HGSN" LLC

Mr.V. Hovasapyan

According to the design of "Meghri gravity irrigation system", the route of which is presented by WGS coordination system, the section of DM 0+00 to DM 12+27 of "Alvank 1 right branch" passes through the area belonging to Alvank community.

The community leader gives his approval on the provision of the construction lands for the implementation of construction works along the whole section of the pipeline with the width 7m for the purpose of installing a pipeline.

The village community will carry out the following:

- It will provide permanent approaches to the pipeline route during the operation of the pipeline.
- it will not implement any civil works or other measures, which may interrupt the pipeline operation and repair works.

The leader of Alvank community V. Tumanyan

7. **Head of Shvanidzor community, H. Ohanyan, dated 20.05.2013**

24.05.2013 Director of "HGSN"

V. Hovasapyan

I reviewed the project, Shvanidzor community has no objections.

Head of Shvanidzor community H. Ohanyan

8. **Head of Nrnadzor community, M. Mkrtchyan, dated 20.05.2013**

Director of "HGSN" LLC

Mr.V. Hovasapyan

According to the design of "Meghri gravity irrigation system", the route of which is presented by WGS coordination system, the section of DM 133+63 to DM 230+40 of "Left branch" passes through the area belonging to Nrnadzor community.

The community leader gives his approval on the provision of the construction lands for the implementation of construction works along the whole section of the pipeline with the width 7m for the purpose of installing a pipeline.

The village community will carry out the following:

- it will provide permanent approaches to the pipeline route during the operation of the pipeline.
- it will not implement any civil works or other measures, which may interrupt the pipeline operation and repair works.

Leader of Nrnadzor community M. Mkrtchyan

20.05.2013

9. **Head of Gudemnis community, A.Grigoryan, dated 22.05.2013**

Director of "HGSN" LLC

Mr. V. Hovasapyan

According to the design of "Meghri gravity irrigation system", the route of which is presented by WGS coordination system; the section of the "Main pipline" from DM24+18 to DM 30+38 passes through the area of Gudemnis community.

The community leader gives his approval on the provision of the community lands for the implementation of construction works along the whole section of the pipeline with the width of 7m for the purpose of pipeline installation.

The village community will carry out the following

- It will provide permanent approaches to the pipeline route during the operation of the pipeline.
- It will not implement any civil works or other measures, which may interrupt the pipeline operation and repair works.

Leader of Gudemnis community A. Grigoryan

22.05.2013

10. No. 48, Head of Nrndazor village community, M. Mkrtchyan, dated 21.12.2012

Syunik Region, RA
Leader of Nrnadzor village community

Director of "HGSN" LLC
Mr. V. Hovasapyan

In reply to your letter N VH – 206-a dated 21.12.2012, I would like to inform you, that the construction waste and surplus soil can be replaced from Nrnadzor village to the spoil area at the distance of 1-1.5km.

Community leader M. Mkrtchyan

Originals of the mentioned documents are available at HGSN.