

Water Sector Projects Implementation Unit

IRRIGATION SYSTEM ENHANCEMENT PROJECT

Geghardalich Gravity Irrigation Scheme



Environmental and Social Impact Assessment

**Originally approved October 2015
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List of Acronyms

AMD	Armenian Dram
CJSC	Closed Joint Stock Company
EIA	Environmental Impact Assessment
EIAEE	Environmental Impact Assessment and Expert Examination
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HPP	Hydro Power Plant
IREP	Irrigation Rehabilitation Emergency Project
ISEP	Irrigation System Enhancement Project
MNP	Ministry of Nature Protection
NA	National Assembly
NGO	Non-Governmental Organization
OP	Operational Policy
PIU	Projects Implementation Unit
RA	Republic of Armenia
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SCWE	State Committee for Water Economy
SI	State Institution
SNCO	State Non-Commercial Organization
SPNA	Specially Protected Nature Areas
TOR	Terms of Reference
UNECE	United Nations Economic Commission for Europe
USD	United States Dollar
NSS	National Statistical Service
WB	World Bank
WHO	World Health Organization
WUA	Water Users Association

EXECUTIVE SUMMARY

Background on the Amendment of this ESIA Report

This document is the updated version of the ESIA Report of Geghardalich Gravity Irrigation Scheme. The document was updated based on the changes in the project which aimed at meeting the concerns of the inhabitants of Goght community. Members of the Goght community had expressed concerns that construction of the Geghardalich gravity scheme may affect reliability of their irrigation water supply. As a result, a new investment was added to the project – construction of an alternative feeding canal to Geghardalich Reservoir from Gilanlar mudflow channel – to further ensure reliability to Goght water users. The prior version of the ESIA Report for the reconstruction of Geghardalich gravity scheme had passed through all procedures required by the WB and Armenian legislation, and was disclosed publicly in Armenia and on the World Bank website in October 2015. Construction works on Geghardalich scheme have been ongoing since [month, year].

In parallel with the commencement of the construction works of Geghardalich Gravity Irrigation Scheme, concerns emerged among some of the inhabitants of Goght community that the project may affect the availability of water for irrigation in their community. Specifically, they were concerned that the water quantity available in the reservoir will not be sufficient to ensure the irrigation needs of Goght community. Goght community has been the traditional beneficiary of the irrigation water accumulated in Geghardalich Reservoir. The new scheme would expand water supply delivered directly from this Reservoir to 4 additional communities which were previously supplied by the Hatsavan-Geghadir pumping station. Concerned Goght residents have perceived the Geghardalich Gravity Scheme as threatening to redirect and redistribute water away from them towards other communities. Hydrological analysis (analogue method using Azat-Garni post) of 1939-2006 on the water balance demonstrates that the gravity scheme would not affect water availability for Goght residents. As an additional precaution, the project will include the construction of an additional feeder canal to the Geghardalich reservoir.

Between May and November 2016 about 6-7 discussions were held with Goght Community representatives and residents to discuss solutions towards alleviating their concerns. The construction of an additional feeder canal from Gilanlar mudflow stream was found to be the most effective solution to ensure a stable water balance in Geghardalich Reservoir and diminish the risk of water scarcity and conflict among neighboring communities.

The construction of feeder canal from Gilanlar mudflow stream to Geghardalich Reservoir was included in the agenda of Goght Community Council on June 2 2016 and the Council made a decision to apply to the “Water Sector PIU” SI with the request to incorporate the construction of the additional feeder canal from Gilanlar in the Construction of Geghardalich Gravity Irrigation Scheme Project (the Resolution of the Council of Goght Community is presented in Annex L). The PIU responded positively and ordered the Design company to make amendments in the design and include the above proposal of Goght community in the Project. This new version of the ESIA report is prepared to reflect above mentioned design changes associated with Gilanlar canal.

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 was 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.

The State Committee for Water Economy (SCWE) under the Ministry of Agriculture 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.

At present, the Government of Armenia is using World Bank funding for the implementation of Irrigation System Enhancement Project (ISEP) and is preparing a new Irrigation Systems Modernization Project. Physical investments under ISEP are intended for the conversion and reconstruction of several pumping schemes into gravity schemes and the rehabilitation of the priority canals. Geghardalich gravity irrigation scheme is part of the ISEP investments.

National Environmental and Social Regulations and Applicable WB Policies

In the Republic of Armenia, environmental issues are regulated according to several legislative acts, including the law on Environmental Impact Assessment and 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 Geghardalich gravity 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 reconstruction of Kaghtsrsashen 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).

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 Geghardalich dam required for upgrading a reservoir feeding the scheme and, therefore, triggers OP/BP 4.37 Safety of Dams.

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.

ISEP also triggers WB OP/BP 7.50 Projects on International Waterways. However, the reason for that in investments into the Meghri scheme and OP/BP 7.50 is not applicable to works on Geghardalich scheme.

Project Description

In 2010 the Water Sector Projects Implementation Unit SI (Client) ordered the design for “Efficient Use of Excessive Water of Geghardalich Reservoir and of “Seven Springs” Potable Water Captures” to increase the efficiency of water resources of Azat River. These works were implemented by “Hayrnakhagits Institute” CJSC at the level of preliminary design. This assignment is closely related to the current Geghardalich gravity scheme and is useful in substantiation of the project.

Geghardalich irrigation scheme is located within the territory of Kotayk Marz of Armenia. The current irrigation scheme is driven by pumps and includes 3 pumping stations serving about 1,000 ha of irrigated lands of 6 communities. The lands of Voghjaberd, “Jrvezh-Dzoraghbyur” Gardener’s Association and Jrvezh Forest Park under the “Reserve Park Complex” State Non-Commercial Organization (SNCO) are irrigated from Azat Reservoir by four-cascade pumping station of Azat, and the lands of Hatzavan and Geghadir communities are irrigated by Hatzavan and Geghadir pumping stations. These pumping stations are served by “Kotayk” Water Users Association (WUA) and “Garni-Geghard” WUA.

The current pumping irrigation scheme is very unreliable for various reasons. Pumping stations are physically depreciated and obsolete, the pressure pipelines go over unstable terrain, which causes frequent breakage of pipes. Pumping stations do not have appurtenant structures and are in poor technical state.

The Geghardalich Gravity Irrigation Scheme project envisages increasing the storage volume of the Geghardalich reservoir from 2.4 million m³ to 3.4 million m³ to irrigate 1448 ha of agricultural lands. This includes 705 ha of agricultural lands in Gogh community, which are currently irrigated through the existing Geghardalich-Goght pipeline, and 743 ha of agricultural lands in the communities Hatzavan, Geghair, Voghjaberd, “Jrvezh-Dzoraghbyur” Gardener’s Association and Jrvezh Forest Park through construction of 26 km pipeline up to the pressure basin of Azat 4th degree pump station. Currently, these 743 ha of agricultural lands receive water through Geghadir, Hatzavan and Azat 4-degree pump stations. With the proposed project gravity water will be supplied to all 1448 ha of the project areas.

The estimated design/project cost is about \$8.3 million, with the Economic Rate of Return (ERR) 26.3%.

Environmental and Social Baseline

Geghardalich Gravity Irrigation Scheme project will have impact on the communities Goght, Kamaris, Geghadir, Hatzavan and Voghjaberd, as well as Jrvej-Dzoraghbyur Gardeners Association and National Reserve Park. The irrigated area makes up 1448.8 ha served 3 pumping stations. The lands of Voghjaberd, Jrvej-Dzoraghbyur Gardeners Association, Jrvezh Forest Park are irrigated from Azat Reservoir by Azat pumping station, and the lands of Hatzavan and Geghadir communities are irrigated by Hatzavan and Geghadir pumping stations taking water from Azat River.

The unemployment and poverty in rural communities of the Marz is characterized by incomplete utilization of agricultural lands and weak development of infrastructures. 70-80% of the population of affected communities is involved in agriculture. The main agricultural crops are wheat, vegetables, fruits, fodder, etc. The main direction of animal husbandry is dairy products. Due to the poor state of water supply system, the production of agricultural products has declined. Due to low income from farming, lack of employment opportunities there is permanent seasonal emigration in impacted communities.

The climate in the project area is specified by cold and snowy winter. The average annual temperature is -4°C, the average monthly temperature is -14°C in January, -6°C in April, 8°C in July, and -2°C in October. The absolute minimum is -42°C and was observed in January and absolute maximum of 24°C was observed in July.

The relief is moderately intersected. Extensive areas are occupied by small ravines and very steep planes and eroded bare cliffs.

There are no specially protected nature areas (SPNA) in the immediate proximity of the Gegardalich gravity irrigation scheme. The following SNPA are located closest to the Gegardalich scheme, which are, however, outside of the project direct and indirect impact area due to the distance:

Khosrov State Reserve, occupying an area of 23,878 ha, established in 1958 for protection of sparse wood and semi-desert landscapes with corresponding unique flora and fauna coenosis;

Erebuni State Reserve, occupying an area of 89 ha, established in 1981 to protect rare and disappearing species of wild flora and fauna, especially for protection of the gene pool and the habitat of over 100 wild wheat species; and

Irrej Forest Park, occupying an area of 404 ha, established in 1977 within the area of arid mountain steppe and semi-desert zones for growing over 100 bush and tree species, including 21 plant species included in the Red Book.

Expected Environmental and Social Impacts and Their Mitigation

The expected environmental and social risks associated with the construction of the Geghardalich Gravity Irrigation System are moderate and can be effectively mitigated. These potential impacts are introduced in the present Executive Summary and are discussed in a greater detail in Chapter 7 of the ESIA report, along with the respective mitigation measures.

Impacts of 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.

There may be some social impacts during the construction phase, including construction related traffic increase, temporary impacts on the land use and temporary local employment.

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;
- 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:

Environmental impacts at the operation phase include impact on Karmir River flow and overall water resources of the watershed, as well as impact on landscape, flora and fauna, noise, and land use.

(a) Soil erosion, salinization and alkalization

Operation of Geghardalich gravity scheme may have some negative impact on the lands of project affected area, particularly in terms of soils natural balance (increase of salinization, alkalization, toxicity and absorption index)

which may be due to irrigation water pollution and/or richness of salt or other chemical compounds, described in the section on environmental and social baseline situation (section 5.3), as well as erosion, in case improper irrigation techniques are applied.

(b) Increased use of pesticides

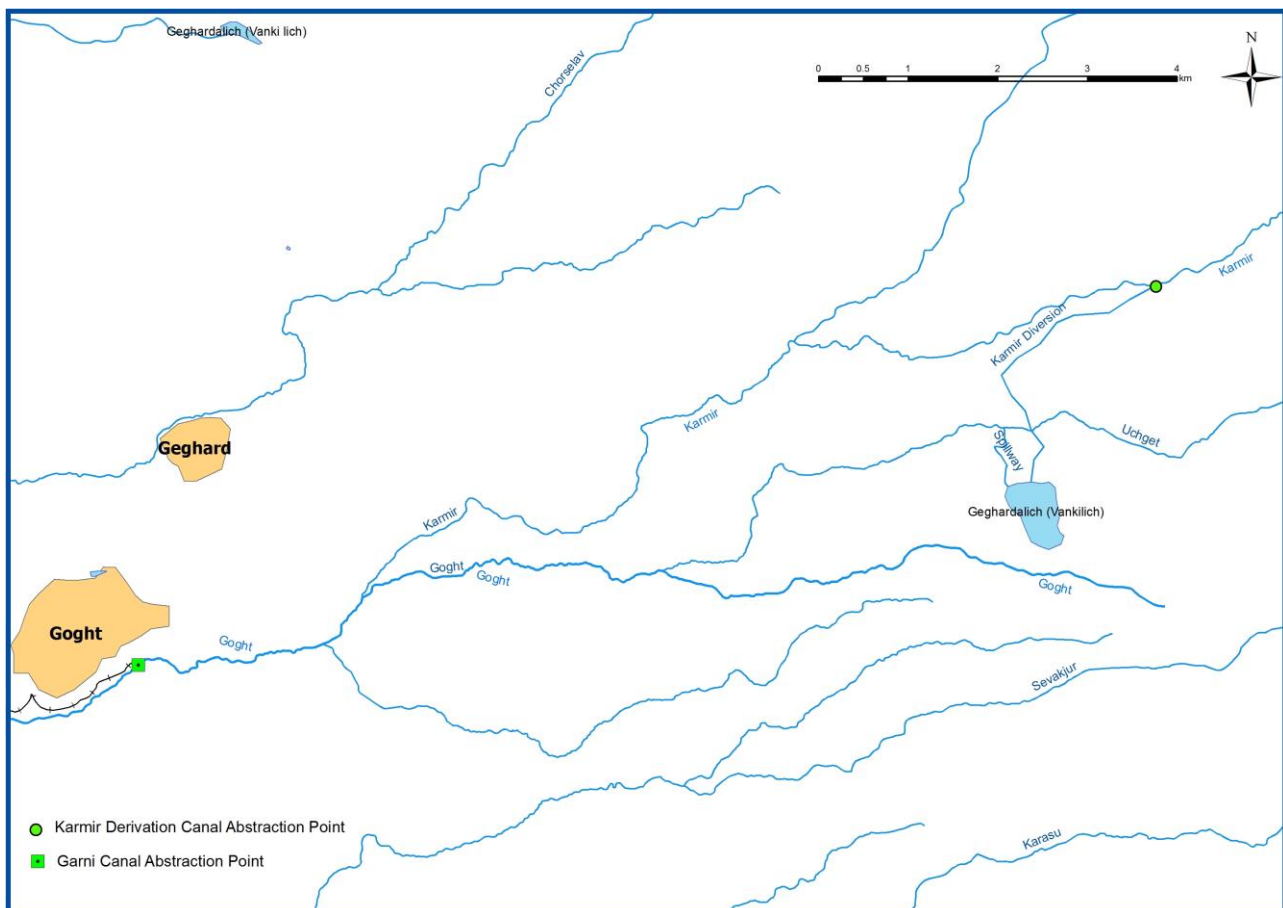
Improved provision of irrigation services and return of some area to irrigation after years of discontinued service are likely to intensify farming in the Meghri scheme command area. This may indirectly influence the pattern of agrochemical's use. Potentially increased and improper use of pesticides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

(c) Impact on the Geghardalich reservoir

The construction of Geghardalich gravity scheme envisages also certain impact on the reservoir. Particularly, increase in the storage volume of the reservoir will pose additional risks related to operation and maintenance. Such risks are carefully studied during the design phase both by the Consultant, and the dam safety panel.

(d) Impact on aquatic ecosystem of the Karmir and Goght Rivers

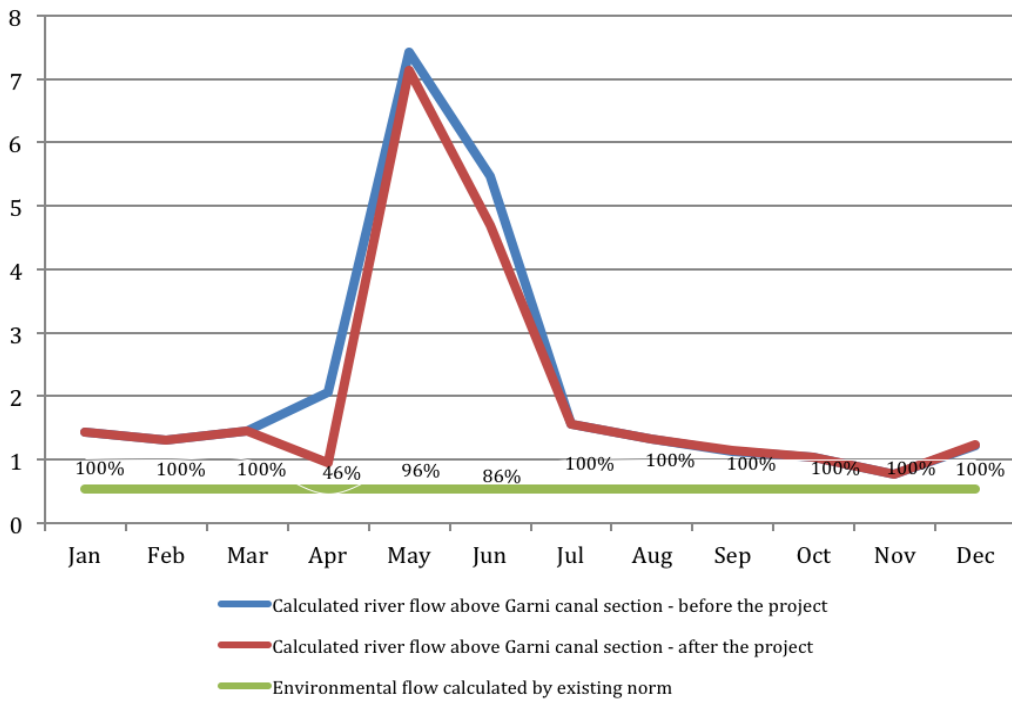
The main expected impact (annually 2.185 mln m³ additional water abstraction during the spring inundation months) is on Karmir River (downstream the derivation canal point) and Goght River, since Karmir River eventually flows into Goght River.



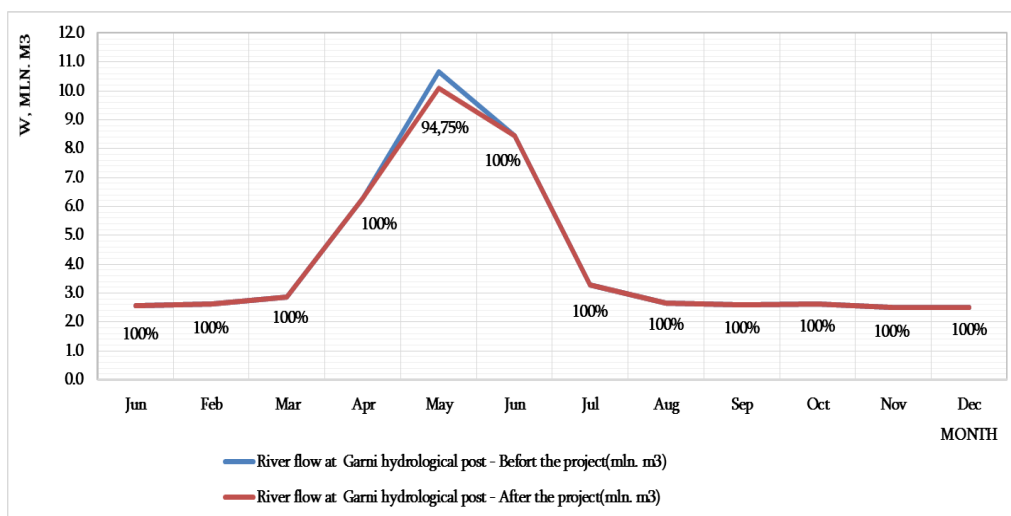
One of the main criteria used for impact assessment on Karmir and Goght Rivers was the environmental flow, which was determined as required by the national legislation and in accordance with the **Decree of the Government of RA no. 927 dated 30.06.2011**. According to this Decree, the environmental flow is defined as the average daily discharge of the 10 successive days with the lowest discharge. It is a fixed amount over time (usually coincides with the period when there is no anthropogenic pressure on the river flow and conditions under which the aquatic life exists in the Armenian rivers) and guaranteed even during drought years. The analysis made in section 7.3.1 shows that downstream the water abstraction point for Geghardalich System the environmental flow (minimal flow to be left in the river bed after abstraction) will be well maintained after the

project. For example, downstream the Karmir Canal derivation point twice more water will be left in Karmir River (which does not have ichtyofauna and rich aquatic biodiversity due to its seasonal nature), than is required by the environmental flow requirement.

For the impact further downstream on Goght River, as the hydrograph below (before and after the project) shows the ecology and hydrology will also not be significantly impacted, given that the extra abstraction will occur during the spring inundation months and such abstraction is small compared to total available. Hence, in the section of Goght River upstream the Garni Canal (the downstream water user) the river flow reduction due to additional abstraction for the Geghardalich project will compose slightly over 6% of the annual rive flow, and thus will not bring significant changes to the environment.



Calculated flow upstream the next water user, before and after the project, mln m3 (Karmir River)



Calculated flow upstream Garni hydrological post, before and after the project, mln m3 (Gilanlar Mudflow)

To summarize, there will be no significant impact on the environment or downstream water users by Geghardalich Gravity Irrigation Scheme.

Potential social impacts at the operation phase include economic gains to communities in the coverage area, as well competition for water use.

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 Geghardalich scheme service area for early detection of undesired trends of its deterioration and for prompt corrective action;
- Obtaining river water quality data from 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 Karmir River, because meeting of the actual water demand is possible without disruption of its seasonal dynamics. This judgment is confirmed by the analysis of the Karmir River flow before and after the project, which is presented in chapter 6 of this ESIA report. Also, as the analysis show, all water users downstream will receive the same quantity of water as at present;
- No significant impact is expected on fauna and flora in the Geghardalich Gravity Irrigation Scheme area, because the ecosystem functionality will not be violated and no ecosystem fragmentation will occur;
- To monitor the compliance with the environmental flow requirement and make sure only permitted quantity of water is abstracted, extra monitoring point will be installed at the Karmir Canal derivation point;
- 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 Geghardalich gravity irrigation scheme;
- In order to reduce the risks associated to the increase of reservoir volume, corresponding design solutions are provided by the specialists. Particularly, in the course of reconstruction of the dam special technology will be applied (bentonite film/mat) will be used, which will later on exclude filtration discharge and risks associated to that.

Environmental and Social Management Plan

The present ESIA report carries an Environmental and Social Management Plan (ESMP), 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 ESMP 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 ESMP during the construction. Supervision of the ESMP 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 Geghardalich gravity irrigation system design included a series of public hearings and discussions on social-economic issues related to irrigation, including 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 H, I, J, K and L. The early draft ESIA report underwent the process of environmental expert examination, which included conduct of a public consultation meeting in accordance with the requirements of RA legislation.

After the approval of Geghardalich Project, in parallel with the commencement of the construction works, the inhabitants of Goght community (the traditional beneficiary community of Geghardalich Reservoir) started periodically to present their grievances and complaints stating that after the project implementation Geghardalich Reservoir will not be able to ensure simultaneously the needs of Goght community and the other communities covered by the Project, as according to the inhabitants there will not be sufficient water in the basin feeding the

reservoir and in Karmir River, particularly in dry years. Although at the design stage it was proved by different calculations that the water for average year is sufficient for the project implementation and for satisfying the needs of all the communities, the entities responsible for the Project decided to meet the concerns of Goght community, and to construct an alternative feeding canal from Gilanlar mudflow channel, which will ensure possible water deficit of Geghardalich reservoir in dry and droughty years.

The present revised ESIA report will be disclosed electronically in Armenian and English languages on the PIU website and hard copies in Armenian will be made available at the Goght municipality as well as at the Kotayk and Ararat (for Dvin and Verin Dvin Communities) marzpetaran (the regional authority) for easy access by the project-affected people.

1 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. 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 3,018,854 de jure (2,871,771 de facto) according to the final results 2011 census, announced in 2013¹. 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.



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"² (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.

The Government of RA, with significant support from international institutions, continues strengthening its macro-economic management. The ISEP, commenced in 2013, will be implemented over the four years, based

¹ National Statistical Service of the Republic of Armenia. Official web-site of the NSS of the RA: <http://www.armstat.am/en/>.

² Social Snapshot and Poverty in Armenia, 2012. National Statistical Service of Armenia.

on the loan agreement between the World Bank and the Republic of Armenia, aiming at improvement of irrigation infrastructure and capacity building of WUAs.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 National Legal and Regulatory Framework

Following the independence in 1991 the legislation of the Republic of Armenia (RA) was reviewed with the aim of developing a more comprehensive state policy towards ecological protection and sustainable use. Taking into account rapidly changing economic situation, the adopted laws have undergone many changes, and in some cases new laws are adopted.

2.1.1 Constitution

According to the Constitution (adopted in 1995 and amended in 2005), the Republic of Armenia is a sovereign, democratic and a social state governed by the rule of law. Article 10 of the **Constitution** of the Republic of Armenia defines the State responsibility for environmental protection, reproduction, and wise use of natural resources.

2.1.2 Codes

Land Code (2001)

The Land Code defines the main directives for management use of the state lands, including those allocated for various purposes, such as agriculture, civil construction, industry and mining, energy production, transmission and communication lines, transport and other purposes. The Code defines the lands under the specially protected areas as well as other reserved lands. It also establishes the measures aimed to the lands protection, as well as the rights of state bodies, local authorities and citizens towards the land. Within the Geghardalich gravity irrigation project, it is planned to acquire some state and community lands for the pipeline, which will be done in accordance with the requirements of the Land Code.

Water Code (2002)

The main purpose of the Water Code is to provide legal basis for protection of national water resources, 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 (2005) and National Water Program (2006), water cadaster and monitoring system, public access to 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.

The RA Labor Code (2004)

This code regulates collective and individual working relations, defines the bases for establishment, modification and termination of these relations and the order for their realizations, rights, obligations and responsibilities of subjects of the labor relations, as well as conditions for the providing of security and maintenance of the health of employees. During the construction works on Geghardalich scheme, all labor relations must comply with the requirements of this law.

Forest Code (2005)

The Code shall regulate relations connected with sustainable forest management – guarding, protection,

rehabilitation, afforestation and rational use of forests and forest lands of the RA as well as with forest stock-taking, monitoring, control and forest lands. With the operation of Geghardalich gravity irrigation system the water supply to Jrvezh Forest Park will improve. Jrvezh is a forest park with a total area of 408 ha. Most of the territory of the park is covered by forest. Within the Geghardalich gravity irrigation scheme project 260 ha of the territory of Jrvezh Forest Park will be irrigated. This area is currently being irrigated through the 4-degree Azat pump station, which is in deteriorated condition, and thus the irrigation water supply is not secure. .

Mining Code (2011)

The RA code dated 28.11.2011, defines principles and rules of mining in the RA, the relations linked to preservation and use of deposits, conditions and requirements of efficient use, complex use and preservation of deposits, security of mining and protecting environment from its negative impacts, as well as protection of rights of the state, citizens and users of deposits. According to the Code, natural deposits areas are under the exclusive ownership of the state. The law also defines preconditions, which are basis for prohibition of mining. As a result of increasing the height of the Geghardalich Reservoir dam it will be necessary to use padding, to do which the design envisages operation of 2 sand-clay mines and 1 pebble-soil mine. These processes are regulated according to the Republic of Armenia Mining Code.

2.1.3 Environmental Legislation

Law on Environmental Impact Assessment and Expertise (2014)

A new law on environmental impact assessment and expertise was adopted recently (July 2014). The Law provides legal basis undertaking state environmental expertise of planned activities and concepts and presents standard steps of Environmental Impact Assessment (EIA) process. The Law establishes general legal, economic, and organizational principles for conducting mandatory State EIA of various types of projects and concepts of sectoral development.

According to this law, activities are classified into 3 categories: A, B, C.

The categories are defined on the basis of the volume of the activity, characteristics and the level of impact on environment. "A" category includes such large-scale processes which have a significant impact on the environment based on practice, particularly they are: the mining industry, chemical industries, hazardous waste transportation, recycling or landfilling, metals', construction materials' and other products' high-output plants, thermal energy production large installations etc. "B" category includes practically the same types of activities, but on a smaller scale or productivity. "C" category includes the types of activities that have a certain, not significant impact on environment and do not require assessment of this impact.

Geghardalich Gravity Irrigation Scheme is classified as category "C" irrigation project.

The state expertise procedure consists of 2 stages. During the first stage lasting 1 month the Ministry of Nature Protection and the public are notified about the project (short summary), and the first round of public consultation is held. The Ministry of Nature Protection undertakes classification of a project and recommends TOR for the EIA, if the EIA is required according to the classification outcome. EIA is not required for "C" category, just a notification and public hearings of initial stage.

According to Article 16 of the Law of the RA on EIA and Expertise, the expert examination process for Category C is ended at the preliminary stage, and an expert opinion is issued at the end of that stage. The opinion is issued as a result of reviewing the preliminary assessment application, and there is no requirement to produce a full-scale EIA report. Therefore, according to the Armenian legislation, although EIA is not required for activities provided under Category C, they are still subject to expert examination.

Law on Flora (1999)

The law defines the RA state policy in the field of maintenance, protection, usage and regeneration of flora. The law defines objectives for flora examination, state monitoring, state inventory, requirements and approaches to the preparation of the Red Book of plant species, conditions, peculiarities, limitations of allocation of flora objects for purposeful use, basis of termination of the right to use, provisions on flora maintenance, and economic encouragement of usage and implementation of supervision. Though in the territory of Geghardalich Gravity Irrigation Scheme, including Jrvezh Forest Park, no red-listed plant species are found, certain damage to vegetative cover is inevitable, so the requirements of this law should be taken into consideration.

Law on Fauna (2000)

The law defines the RA state policy in the field of maintenance, protection, usage and regeneration of fauna. The law defines the objectives of survey of the fauna, state monitoring, state inventory, requirements and approaches of red book preparation on fauna, conditions, peculiarities, limitations of allocation of fauna objects for purposeful usage, basis of termination of the right to use, provisions on fauna maintenance, and economic encouragement of usage and implementation of supervision. Though in the territory of Geghardalich Gravity Irrigation Scheme no animal species registered in the Red Book are found, the construction works may change the living conditions of some animals, so the requirements of this low should be taken into consideration.

Law on Wastes (2004)

The law regulates legal and economic relations connected to collection, transfer, maintenance, development, reduction of volumes, prevention of negative impact on human health and environment. The law defines objects of waste usage, the main principles and directions of the state policy, the principles of the state standardization, inventory, and introduction of statistical data, the implementation of their requirements and mechanisms, the principles of wastes processing, the requirements for presenting wastes for the state monitoring, activities to decrease the amount of the wastes, including nature utilization payments, as well as the compensation for the damages caused to the human health and environment by the legal entities and individuals, using the wastes, as well as requirements for the state monitoring and legal violations. Since the construction works will create construction waste, its final deployment and storage should be carried out according to the requirements of this law.

Law on Environmental Oversight (2005)

This Law regulates issues of organization and enforcement of oversight over implementation of environmental legislation of the Republic of Armenia, and defines the legal and economic bases underlying the peculiarities of oversight, the relevant procedures, conditions and relations, as well as environmental oversight in the Republic of Armenia. According to this law, the environmental legislation requirements applicable to the Geghardalich Gravity Irrigation Scheme, shall be supervised by the State Environmental Inspectorate.

2.1.4 Water Resources

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. The management of the irrigation system to be built within the Geghardalich Gravity Irrigation Scheme project will be carried out by “Sevan-Hrazdan” water supply agency, given that currently the water use permit for the system is issued to them.

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

The task of this law is to ensure the implementation of water supply and demand formation process, to set up priorities for use of water resources and to draw up water basin management plans. Given the overall objective to supply safe and reliable irrigation water to the target communities, Geghardalich Gravity Irrigation Scheme project is directly related to the scope of this law.

Law on the National Water Program (2006)

The overall goal of the law is development of measures (short-, medium- and long-term) aimed at satisfying the needs of the population and economy, ensuring of ecological sustainability, formation and use of the strategic water reserve, and protection of the national water reserve. Given the overall objective to supply safe and reliable irrigation water to the target communities, Geghardalich Gravity Irrigation Scheme project is directly related to the scope of this law.

2.1.5 Agricultural legislation

Law on Amelioration of Agricultural Lands (2005)

This law regulates relations related to amelioration of agricultural lands for the purpose of maintenance and increase of soil fertility, protection from erosion and salting and inclusion of less fertile soils in the agricultural circulation. Given the objective of the project to improve the irrigation system, it is closely related to preservation of agricultural land quality.

Law on Phytosanitary (2006)

The law regulates the relations between the state authorized agency and the physical and legal entities in the field of phytosanitary. It outlines the main issues in phytosanitary, procedures for the state registration of plant protection means, procedures for providing conclusions on the import of fertilizers, and defines the responsibilities in farming in terms of application of fertilizers. This law directly relates to the project, given the expected increase in the use of pesticide due to improvements envisaged by the project.

2.1.6 Social Legislation

The Law of the RA "On Social Protection of Disabled People" (1993)

This Law establishes the legal, economic and organizational basis of social protection of disabled people in the Republic of Armenia, basic provisions of the state policy in provision to disabled people of optimum conditions and privileges on implementation of their rights and capabilities for the purpose of providing for them peer with other citizens of the republic of possibilities. During the distribution of irrigation water the requirements of this law will be taken into account, in order to make sure to ensure the rights of the disabled.

The Law of the RA "On Equal Rights and Equal Opportunities of Women and Men" (2013)

The law defines the guarantees for ensuring equal rights and equal opportunities of men and women in political, social, economic, cultural and other fields and regulates the relationships arising with the regard thereto. It also prohibits gender-based discrimination. The requirements of this law will be considered while offering temporary employment to local communities during the construction stage and during irrigation water distribution, so as men and women will enjoy equal rights for employment and water use.

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

This Law provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations between protection and use activities. Article 15 of the Law describes procedures for, among 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 the land can be allocated for construction, agricultural and other types of activities in areas containing monuments. Given that there some historical and cultural sites not far from the Geghardalich Gravity Irrigation Scheme project area, the requirements of the law are taken into account during the project design works.

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

This 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. The project implementation requires temporary and permanent land use, and the rational use of these lands should be implemented in accordance with this law.

2.2 National Legal and Regulatory Framework

In addition to the aforementioned legal acts, the Republic of Armenia has signed and ratified a number of environmental conventions and protocols. In the table below the conventions/protocols related to the project that are signed or ratified by the RA are presented.

Table 1: International Conventions and Protocols, to which Armenia is Party

N	Name, Place and Date	Ratified by NA of the RA	In force for RA
1	GLOBAL CONVENTIONS		
2	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971)	Acceded as assignee by the request of MFA RA 1993	1993
3	Convention concerning the protection of the World Cultural and Natural Heritage (Paris 1972)	Acceded as assignee by the request of MFA RA in 1993	1993
4	UN Convention on Biological Diversity (Rio-de-Janeiro, 1992)	31.03.1993	14.05.1993
5	UN Convention to Combat Desertification (Paris, 1994)	23.06.1997	30.09.1997
6	Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)	27.10.2010	01.03.2011
7	Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam)	Acceded as assignee on 10.09.1998	24.02.2004
	REGIONAL (EUROPEN) CONVENTIONS		
8	UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	14.05.1996	10.09. 1997
9	Protocol on Strategic Environmental Assessment (Kiev, 2003)	25.10.2010	24.04.2011

N	Name, Place and Date	Ratified by NA of the RA	In force for RA
10	UNECE Convention on access to information, public participation in decision making and access to justice in environmental matters (Aarhus, 1998)	14.05.2001	01.08.2001
11	UNECE Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)		
12	Protocol on Water and Health (London, 1999)	In the process of ratification	
13	European Landscape Convention (Florence, 2000)	23.03.2004	01.07.2004
14	Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979)	26.02.2008	01.08.2008

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 ESIA 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.

ISEP triggers the following safeguard policies of the World Bank:

Table 2: Project steps in compliance with WB policy guidelines

Title of a safeguard policy	Requirements of the policy in regard to works on Geghardalich gravity irrigation scheme
Environmental Assessment (OP/BP 4.01)	According to the requirements of the WB Geghardalich project has to undergo an environmental impact assessment and develop an appropriate reporting.
Natural Habitats (OP/BP 4.04)	During the design phase of the project affected areas should be examined to determine the endangered natural habitats. A precautionary approach to natural resource management shall be applied to ensure opportunities for environmentally sustainable development.
Pest Management (OP 4.09)	Since 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 Geghardalich scheme 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.
Physical Cultural Resources (OP/BP 4.11)	The policy is triggered by Geghardalich gravity irrigation project, given that it entails the risk of damaging cultural property (e.g. includes large scale

Title of a safeguard policy	Requirements of the policy in regard to works on Geghardalich gravity irrigation scheme
	excavations, movement of earth, surface environmental changes or demolition).
Involuntary Resettlement (OP/BP 4.12)	A Resettlement Policy Framework (RPF) has been prepared for this Project and will regulate all involuntary resettlement and land loss related to project implementation including loss of land, temporary land use, loss of productive assets or access to such assets, and negative livelihood impacts.
Forests (OP/BP 4.36)	Assist the protection of forests, which are located on the other bank of Azat River, through consideration of forest-related impact of all subproject operations, ensuring restrictions for operations affecting critical forest conservation areas.
Dam Safety (OP/BP 4.37)	Heightening of the dam required for upgrading a reservoir feeding the Gegardalich scheme triggers dam safety. Based on the requirements of this policy, the design of the dam passed a specialized professional scrutiny to ensure its quality. A system of regular monitoring of the technical condition of the dam has been worked out to ensure that any faults in its operation are revealed 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.
Projects on International Waterways (OP/BP 7.50)	The Geghardalich gravity irrigation scheme project does not trigger this safeguard policy, since Azat River is not an international waterway.

Comparison of the national legislation of Armenia and the World Bank Operational Policies

After independence, the newly adopted legislative acts were based mostly on the principles and rules inherited from the former Soviet Union. They were predominantly oriented on the human health while ignoring nature conservation needs mostly being declarative in nature. Most of the methodological principles and standards developed during the former USSR were still in place.

Further amendments in legislation were based on international standards. The newly adopted Law on EIA and Expert Examination (EIAEE) in line with the guiding principles of the Aarhus convention applies provisions for the strategic environmental assessment and other elements of international and European regulations. It also requires environmental classification of activities into three categories depending on their risk.

At the same time there are certain discrepancies between the national legislation and the good international practice. In particular, according to the WB classification construction/reconstruction of the irrigation schemes would be classified into environmental Category A or B while according to newly adopted Law on EIAEE, such activities are not classified into any category. If the irrigation canals or pipes pass through the natural protected areas, forests and green zones then these projects are subject to examination as a “B” category both during construction and reconstruction. Water resources supply and water resources projects, envisaging having pipelines with diameter 300mm and more are classified as a “C” category for which EIA is not required and only initial environmental screening is required. For pipelines with a diameter less than 300mm no EIA and no initial environmental screening is required.

As for Geghardalich project, it is planned to construct an irrigation pipe with a diameter exceeding 300 mm, so this project is considered as "C" category, and is **not** subject to environmental impact assessment according to the RA Law on EIAEE. In this respect there is contradiction between the RA and WB requirements of the legislation. According to the RA law on EIAEE, the planned preliminary application package submitted to the MoNP doesn't include extensive research and assessment. Based on the general agreements between the WB and

the RA, under such circumstances the requirements that are more stringent shall be applied. *Hence construction of Geghardalich gravity irrigation scheme is subject to a full-scale ESIA.*

2.3 Institutional Framework

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

Ministry of Agriculture

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

The **State Committee of Water Economy (SCWE)** under the Ministry of Agriculture is the implementing agency for the ISEP. In 2014 the SCWE moved from the Ministry of Territorial Administration to the Ministry of Agriculture, but its functions largely remained unchanged. The Committee has a mandate of improving the management of companies engaged in water activities. Amongst other objectives, the SCWE promotes improvement of water services to the consumers and implementation of further reforms in the water infrastructure and service delivery. SCWE 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 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 Monitoring 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.

The environmental assessment of the project, the issuance of water use permit and the control of the requirements of environmental legislation during the works should be carried out by various units of the RA Ministry of Nature Protection.

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 Agency of Mineral Resource and the Subsoil Concession Agency.

Ministry of Territorial Administration and Emergency Situations

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 Ministry of Territorial Administration and Emergency Situations elaborates and implements the policies of the Republic of Armenia Government in the area of civil defense and protection of population in emergency situations. “Armenian State Hydro-meteorological and Monitoring Service” SNCO (Hydromet) 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.

The coordination and inter-municipal collaboration, as well as the control of possible accidents and emergency situations during the construction works will be carried out by the corresponding units of the Ministry.

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 Labor and Social Affairs

Among other things the Ministry 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

The 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

The 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.

3 METHODOLOGY OF ESIA

3.1. Overall Methodology

The present ESIA was carried out according to the Terms of Reference agreed with the World Bank and covered the entire scope of the Geghardalich Gravity Irrigation System Project, including construction and operation phases of the Project. A specialized team was established for the ESIA, comprising of Nature Protection and Ecological Expert, Socio-Economist and Environmental Expert.

The ESIA process included deskwork to review project documents and scientific literature (see Annex E for List of References), as well as fieldwork aimed at verification of the available data, collection of missing information, and meetings with the Project stakeholders. Intensive field surveys carried out by the members of the environmental and socio-economic team in May-June 2014 formed the basis of investigations. The ESIA team walked over the irrigation scheme corridor and conducted visual observation of the site to verify baseline information available from the literature and to reveal any additional aspects not noted in the publications. 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.

For additional and more detailed investigation and collection of accurate information, questionnaires were distributed among representatives of the impacted communities and the leadership of the relevant WUAs. The comments and opinions of the community members and WUA representatives and the responses to the questionnaire were used for making corresponding revisions in the ESIA. In order to identify possible negative impacts from project implementation and development of mitigation measures, a preliminary assessment was made and environmental checklist was prepared according to stipulated procedures.

Since there are not hydrological observation posts in Karmir River, the method of analogy was used to determine the main characteristics of the flow. As the first option, data of Azat-Garni gauging station as the basis for analogy method is used, in order to determine the main characteristics of Karmir River flow. As an alternative option, a group of independent hydrologists suggested using Gegharot-Aragats hydrological post for the analogy method, taking into consideration similarities in physical-geographic, natural climatic conditions, as well as ground formation, watershed area and other characteristics with Karmir River watershed. Taking into consideration that the calculated annual flow of Kamir River for 75% probability of occurrence is 13.57mln m³ according to one method (analogue method using Azat-Garni post) and 20.5 mln m³ according to the other method (analogue method using Gegharot-Aragats post), in the follow-up calculations “more conservative” value of 13.57 mln m³ is taken as basis, on order to be on a “safe side”.

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*. While Geghardalich gravity irrigation scheme project will divert 2.18 mln m³ more water comparing to what is being diverted currently (taking the excess flow during the spring inundation months of April, May and June), as shown in several places of the present report, the environmental flow, established according to the Decree will

be well-maintained at all times, leaving much more water in the river at all times than the environmental flow

In order to ensure the transparency of presentation and assessment, a summary matrix in tabular format is applied. The intensity and general trends of a specific environmental impact are assessed by scores (positive or negative). The following assessment scale is used: high, moderate, low; no impact, possible impact on local level; and possible impact on regional (marz) level.

For drawing conclusions, the national standards are used together with international such as of the WB, World Health Organization (WHO) and others. Based on these standards, the impact is assessed as follows:

Table 3: Impact assessment based on international and/or national standards

Impact level	Reason
High	International or national standards are exceeded
Moderate	International or national standards are hardly fulfilled
Low	International and national standards are fulfilled

The presented method allows identification of the most important environmental impact and the mitigation measures, which should be applied to reduce negative environmental impact.

3.2. Calculation of Hydrological Flow of Karmir River

a) Analogue method using Azat-Garni Hydrological Post

60-years of observation data of Azat River–Garni gauging station was used as an analogue under this option. In order to determine the average design flow, the flow recorded in Azat-Garni hydrological post was restored taking into account non-recoverable losses: 85% from irrigation, and 30% from municipal water supply. Afterwards, the restored annual flow was analyzed statistically according to the momentum method. The results are presented in the tables below.

Table 4: Restored natural average monthly and annual flows of Azat-Garni hydrological post, m³/s

No	Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ave
1	1939	4.66	4.80	4.76	8.53	17.0	5.50	5.30	4.10	3.73	4.00	4.00	4.10	5.87
2	1940	3.77	3.84	3.84	9.81	9.71	10.6	5.34	4.16	4.18	4.40	4.50	4.46	5.72
3	1941	3.95	4.39	3.62	10.1	14.6	7.22	4.34	5.20	5.30	4.30	4.77	4.21	6.00
4	1942	3.99	4.09	4.09	6.50	15.9	10.3	5.43	4.52	4.65	4.48	4.77	4.97	6.14
5	1945	3.88	3.71	3.76	5.28	8.99	10.33	4.00	3.73	3.53	3.48	3.43	3.41	4.79
6	1946	3.58	3.71	3.86	6.21	17.11	15.03	5.37	4.28	4.34	4.99	4.97	4.82	6.52
7	1947	4.35	5.20	7.82	8.09	10.91	8.97	4.30	3.93	4.32	4.83	4.78	4.24	5.98
8	1948	4.72	5.12	4.80	7.54	13.81	19.63	4.21	3.60	3.75	3.64	3.69	4.10	6.55
9	1949	4.26	4.35	4.32	5.18	10.31	7.67	3.87	4.02	3.74	3.69	3.55	3.50	4.87
10	1950	3.51	3.51	3.77	6.90	12.79	8.03	4.25	3.94	3.93	4.01	3.60	3.69	5.16
11	1951	3.63	3.56	3.76	6.16	9.02	7.67	3.95	3.68	3.70	4.35	3.80	3.66	4.75
12	1952	3.52	3.60	3.83	8.09	11.32	9.90	5.40	4.13	4.23	4.02	3.97	3.90	5.49
13	1953	3.87	3.94	3.94	6.55	9.71	13.44	5.99	4.51	4.28	4.30	4.30	4.25	5.76
14	1954	4.21	4.17	4.50	7.83	14.16	14.08	4.68	5.23	4.64	4.54	4.36	4.29	6.39
15	1955	4.34	4.28	4.16	6.96	13.21	8.67	4.08	3.93	3.90	3.74	3.85	3.76	5.41
16	1956	3.55	3.54	3.76	7.64	9.58	14.08	6.37	4.03	3.78	3.70	3.41	3.58	5.59
17	1957	3.87	3.86	4.34	8.82	11.32	12.55	6.14	4.08	3.58	3.76	3.76	3.49	5.80
18	1958	3.65	3.53	3.23	7.20	23.11	11.74	4.50	4.15	4.18	4.29	3.68	3.52	6.40
19	1959	3.57	3.53	3.73	7.54	10.42	6.69	4.35	3.89	3.75	4.36	4.04	3.68	4.96

No	Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ave
20	1960	3.64	3.77	4.05	9.84	18.94	10.49	4.93	4.49	4.17	4.35	4.11	4.10	6.41
21	1961	3.79	3.84	3.88	5.58	10.07	4.74	3.73	3.70	3.71	3.54	3.63	3.34	4.46
22	1962	3.52	3.46	4.01	6.72	10.06	7.65	3.11	2.74	2.81	2.92	2.97	3.01	4.50
23	1963	3.00	2.84	3.07	11.2	16.55	20.67	8.96	4.87	4.19	4.43	4.30	4.26	7.36
24	1964	4.20	4.33	5.33	7.20	15.05	9.47	4.02	3.76	3.23	3.17	3.16	3.44	5.53
25	1965	3.40	3.27	3.42	5.06	8.18	7.20	3.55	3.20	3.05	3.70	3.09	3.37	4.21
26	1966	3.23	3.17	3.84	7.60	13.33	13.83	3.93	3.19	3.50	4.00	3.25	3.28	5.51
27	1967	3.33	3.19	3.34	5.33	20.29	15.90	5.17	3.70	4.02	4.37	3.87	3.75	6.36
28	1968	3.90	3.88	4.03	11.0	15.30	12.68	5.51	3.94	4.20	3.44	3.97	3.94	6.32
29	1969	3.90	3.84	4.22	9.03	17.12	11.48	4.32	3.64	4.25	4.37	4.05	4.09	6.19
30	1970	3.78	3.67	4.57	12.6	11.26	5.66	3.87	3.43	3.60	3.77	2.96	3.36	5.21
31	1971	3.73	3.72	3.89	4.25	17.50	18.40	3.39	3.15	3.13	2.88	2.66	2.49	5.77
32	1972	2.58	2.57	2.62	2.79	10.35	10.26	3.80	2.78	2.81	2.55	1.65	2.35	4.01
33	1973	2.46	2.59	2.50	3.55	12.06	9.23	2.88	2.43	2.23	2.03	1.54	2.13	3.80
34	1974	2.44	2.57	3.31	4.85	10.29	4.90	2.64	2.26	2.24	2.87	1.99	1.78	3.51
35	1975	2.00	2.56	2.88	13.39	9.42	4.71	2.04	1.97	2.07	1.92	1.45	1.58	3.83
36	1976	1.63	1.63	1.65	5.97	18.37	22.9	3.85	2.40	2.45	2.39	1.88	1.98	5.59
37	1977	2.30	2.30	2.38	4.98	8.47	7.16	2.25	2.05	1.95	1.60	1.18	1.28	3.16
38	1978	1.50	1.50	1.94	5.84	13.66	13.28	7.15	2.25	2.10	2.12	1.46	1.83	4.55
39	1979	2.08	2.42	2.60	5.38	10.32	7.31	2.45	2.16	2.00	1.80	1.72	2.30	3.55
40	1980	2.21	2.10	2.60	7.72	12.99	5.03	2.25	2.0	1.90	1.61	1.84	1.73	3.67
41	1981	2.05	2.20	2.35	6.59	8.27	14.62	2.80	2.10	2.00	2.01	2.01	1.53	4.04
42	1982	2.11	2.20	2.41	12.0	14.82	6.04	2.50	2.20	2.10	1.95	1.82	1.63	4.32
43	1983	1.70	1.88	2.36	4.03	15.87	8.05	2.25	2.02	1.90	1.60	1.25	1.68	3.72
44	1984	2.00	2.02	2.22	9.77	11.55	15.58	3.15	2.60	2.52	2.55	2.24	2.13	4.86
45	1985	2.36	2.46	2.61	10.9	11.65	5.66	2.65	2.45	2.30	1.93	2.05	2.37	4.12
46	1986	2.24	2.28	2.43	3.81	6.20	11.36	3.24	2.53	2.40	2.67	2.32	2.33	3.65
47	1987	2.16	2.39	2.35	7.83	18.37	7.94	2.45	2.20	2.25	2.64	2.31	2.12	4.58
48	1988	2.22	2.12	2.85	9.22	10.98	15.2	6.05	2.95	2.95	3.22	3.31	2.99	5.34
49	1989	3.11	3.25	4.95	10.5	7.89	2.62	2.65	2.50	2.35	2.40	1.94	2.27	3.87
50	1990	2.29	2.49	2.90	6.65	9.51	7.26	2.35	2.15	2.08	1.91	1.62	1.66	3.57
51	1991	1.80	1.76	1.93	3.81	8.89	4.43	2.30	2.10	1.98	1.80	2.38	2.16	2.95
52	1992	2.16	2.24	2.12	5.19	10.50	8.51	4.00	2.60	2.65	3.25	3.75	4.65	4.30
53	1993	1.92	1.96	2.10	5.96	12.42	15.78	2.62	2.25	2.15	2.03	2.33	2.10	4.47
54	2000	1.89	1.83	2.02	5.83	5.90	4.36	2.25	2.08	1.98	1.66	1.57	1.57	2.75
55	2001	2.28	2.32	2.92	4.54	6.80	5.82	2.60	2.02	1.90	1.59	1.35	1.48	2.97
56	2002	1.42	1.60	1.80	5.94	15.10	10.02	3.65	2.35	1.97	1.96	2.14	2.41	4.20
57	2003	2.95	2.95	3.39	16.80	30.5	12.80	3.00	2.47	2.30	2.48	2.87	1.99	7.04
58	2004	2.91	2.82	5.42	3.29	6.69	5.12	2.90	2.51	2.35	2.26	2.04	2.05	3.36
59	2005	2.14	2.18	2.31	14.5	18.75	15.30	3.80	2.92	2.65	2.68	1.85	1.80	5.91
60	2006	4.11	4.13	4.47	12.5	11.65	5.12	2.95	2.75	2.67	3.27	3.00	2.58	4.93
Ave		3.06	3.12	3.43	7.51	12.76	10.11	3.93	3.18	3.11	3.14	2.99	2.98	4.94

Table 5: Average annual discharge at Azat–Garni hydrological post for various probabilities of occurrences

Average annual discharge Q_0 , m^3/s	Variation coefficient, C_v	Non-uniformity coefficient, C_s	Discharge (m^3/s) by probability of occurrence, $P\%$															
			1	3	5	10	20	25	30	40	50	60	70	75	80	90	95	97
4.94	0.23	0.46	7.95	7.31	6.95	6.43	5.78	5.68	5.43	5.14	4.85	4.57	4.28	4.13	3.97	3.56	3.24	3.05

In order to determine the flow characteristics of Karmir River, the flow at Azat–Garni post was transferred to the intake section of Geghardalich Reservoir using surface factor, without taking into consideration the dependence of flow module from the average elevation of catchment area, as the surface runoff within the high volcanic plateaus such as Gegama Ridge and Aragats Massif is discharged in form of springs from the contact between lava flows and older relief at the elevations of 1400-1600 m. Therefore, no increase of modulus is provided for Karmir River which has an average catchment elevation of 3070 m.

The average annual and monthly flows of Karmir River at the intake section of Geghardalich Reservoir for the Q25, Q50, Q75 and Q95 years (probabilities of occurrences) were determined based on the characteristics of probability curve of the Azat–Garni hydrological post.

Table 6: Distribution of annual flow of Karmir River at the intake section of Geghardalich Reservoir for various probability years

Probability of occurrence	Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
		25%	mln m^3	1.12	0.97	1.18	1.94	3.67	2.67	1.42	1.18	1.14	1.12	1.09
	m^3/s	0.42	0.40	0.44	0.75	1.37	1.03	0.53	0.44	0.44	0.42	0.41	0.43	0.59
50%	mln m^3	0.94	0.82	0.99	1.66	3.11	2.25	1.21	0.99	0.96	0.96	0.91	0.99	15.79
	m^3/s	0.35	0.34	0.37	0.64	1.16	0.87	0.45	0.37	0.37	0.36	0.35	0.37	0.50
75%	mln m^3	0.80	0.70	0.86	1.42	2.68	1.94	1.04	0.86	0.83	0.83	0.78	0.83	13.57
	m^3/s	0.30	0.29	0.32	0.55	1.00	0.75	0.39	0.32	0.32	0.31	0.30	0.31	0.43
95%	mln m^3	0.62	0.53	0.64	1.09	2.06	1.48	0.80	0.67	0.65	0.64	0.60	0.64	10.42
	m^3/s	0.23	0.22	0.24	0.42	0.77	0.57	0.30	0.25	0.25	0.24	0.23	0.24	0.33

b) Analogue Method using Gegharor-Aragats Hydrological Post

As an alternative method for calculating the flow in Karmir River analogue catchment with similar watershed area, elevation and ground conditions is taken. It is Gegharot River in its Aragats hydrological observation point, for which there is a series of discharges for the period 1938-2013. The watershed of Gegharot River is similar to Karmir River also with its physical-geographic and natural climatic conditions. Also, the upper reaches of the both watersheds are distinguished with cairns (collection of special types of stones), into which the snowmelt water is infiltrated, and then are discharged in the lower reaches of the watershed in a form of large springs. In Azart River watershed such large springs are discharges in the territory of Garni (then feeding Azat River), and in Gegharot River similar large springs are discharged into Aknalich and then feed Metsamor River.



Location of Gegharot and Karmir River Watersheds in Armenia

The area of Gegharot-Aragats watershed composes $F=39.5 \text{ km}^2$, whereas the watershed area of Karmir River-Diversion Canal section composes $F=38.5 \text{ km}^2$. The transition coefficient of areas is 0.97.

Table 7: Average annual discharges recorded in Gegharot-Aragats post in the period 1938-2013

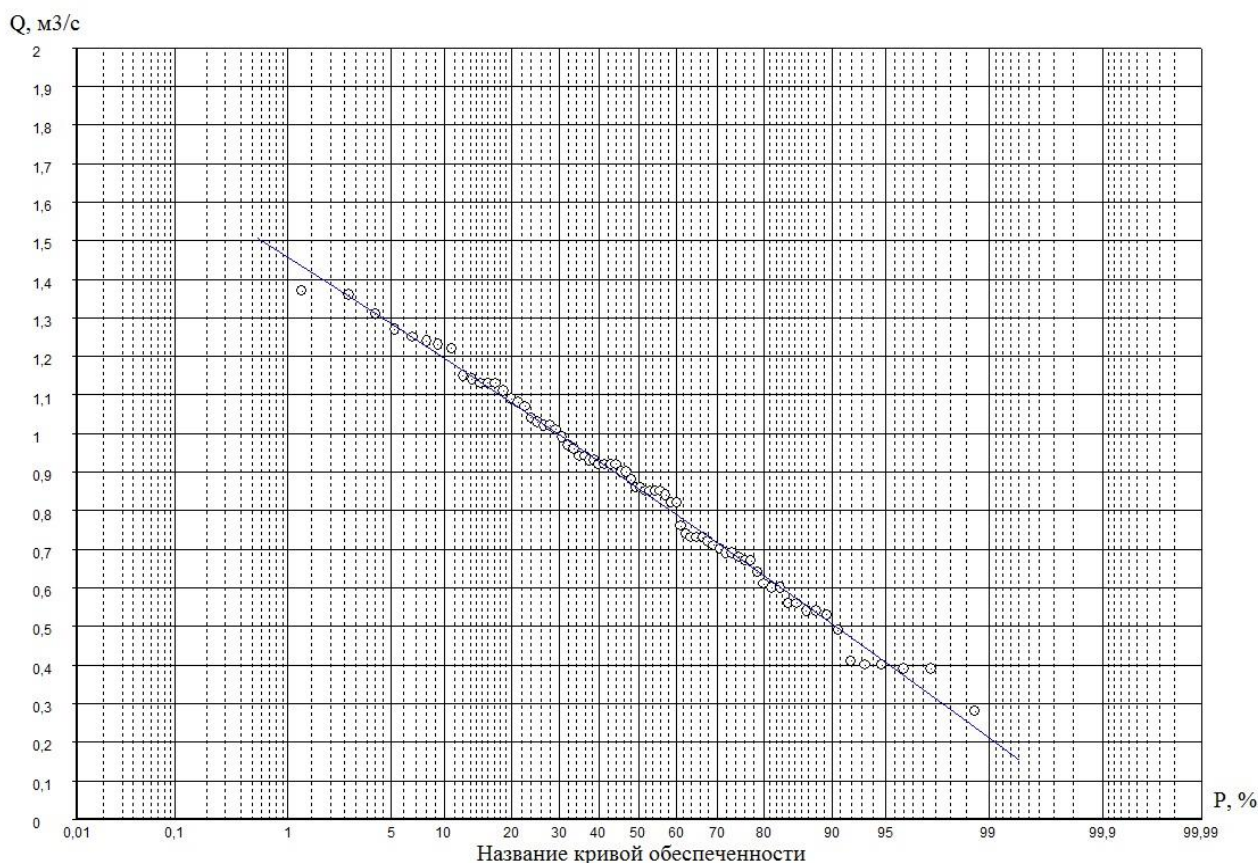
Year	Average discharge, m^3/sec	Year	Average discharge, m^3/sec	Year	Average discharge, m^3/sec	Year	Average discharge, m^3/sec
1938	0,82	1957	0,90	1976	1,27	1995	0.98
1939	0,92	1958	0,69	1977	1,14	1996	1.10

Year	Average discharge, m ³ /sec	Year	Average discharge, m ³ /sec	Year	Average discharge, m ³ /sec	Year	Average discharge, m ³ /sec
1940	1,07	1959	1,13	1978	1,37	1997	0,97
1941	0,85	1960	1,04	1979	1,01	1998	1,02
1942	0,93	1961	0,54	1980	1,15	1999	0,97
1943	0,56	1962	0,56	1981	1,03	2000	0,40
1944	0,60	1963	1,36	1982	0,86	2001	0,28
1945	0,67	1964	0,85	1983	0,88	2002	0,40
1946	0,93	1965	0,68	1984	1,13	2003	0,49
1947	0,53	1966	0,94	1985	0,70	2004	0,73
1948	0,99	1967	1,13	1986	0,69	2005	0,60
1949	0,92	1968	0,92	1987	0,96	2006	0,72
1950	0,76	1969	1,11	1988	1,09	2007	0,54
1951	0,73	1970	0,73	1989	0,39	2008	0,64
1952	0,90	1971	0,82	1990	0,71	2009	0,92
1953	1,23	1972	1,24	1991	0,85	2010	0,85
1954	0,67	1973	1,08	1992	0,86	2011	0,63
1955	0,74	1974	1,31	1993	1,02	2012	0,39
1956	0,84	1975	0,94	1994	1,22	2013	0,41

Table 8: Average perennial discharges and flows recorded in Gegharot-Aragats hydrological post for the entire observation period

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Average discharge, m ³ /sec	0.25	0.24	0.28	0.57	1.60	2.65	2.16	1.01	0.56	0.42	0.33	0.33	0.87
Average, %	2.4	2.3	2.7	5.7	15.3	25.4	20.7	9.7	5.4	4.0	3.2	3.2	100
Flow, mln m ³	0.67	0.58	0.75	1.48	4.29	6.87	5.79	2.70	1.45	1.12	0.86	0.88	27.4

To calculate the flow for Karmir River, the probability of occurrence curve for Gegharot-Aragats was constructed, based on which the natural discharge of Karmir River, was calculated for 75% probability of occurrence, using coefficients $C_v=0.30$, $C_s = 0.087$.



Probability occurrence curve for Gegharot-Aragats, $Cv=0.30$, $Cs = 0.087$

Table 9: Calculated (according to Gegharot-Aragats hydrological post) perennial natural discharges and flows at the section Karmir River-Diversion Canal Section at 75% probability of occurrence

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Ave discharge, m^3/sec	0.19	0.18	0.21	0.44	1.19	1.98	1.61	0.76	0.42	0.31	0.25	0.25	0.65
Average, %	2.4	2.3	2.7	5.7	15.3	25.4	20.7	9.7	5.4	4.0	3.2	3.2	100
Flow, mln m^3	0.51	0.44	0.56	1.14	3.18	5.12	4.30	2.04	1.09	0.82	0.65	0.69	20.5

3.3 Calculation of Ambient Air Pollution

Dust emissions during excavation-loading

Dust emissions mainly appear during operation of construction machinery, the calculation of which is carried out according to the methods in force:

$$Q_d = (P1 \times P2 \times P3 \times P4 \times P5 \times G \times P6 \times B) \times 106/3600 \text{ t/hour,}$$

where P1 – dust part adopted 0.05; P2 – 0-50 particles of mcm in dust aerosol, 0.02; P3 – coefficient, considering wind velocity, 1.0; P4- coefficient, considering moisture of material, 0.8; P5 - coefficient, considering size of material, 0.5; P6 - coefficient, considering site conditions, 1.0; G – excavated soil mass, 56482.2 m^3 during entire

construction period.

During reconstruction of the Geghardalich dam: $22811.2\text{m}^3 \times 2.7\text{t}/\text{m}^3 = 61590.24\text{t}$:

During construction of the Geghardalich pipeline the excavated soil mass will make: $33671\text{m}^3 \times 2.7\text{t}/\text{m}^3 = 90911.7\text{t}$.

The entire soil mass excavated during construction: $61590.24\text{t} + 90911.7\text{t} = 152501.94\text{t}$

Earthworks and landscaping will be implemented during the entire construction period, so the soil quantity per hour will be: $152501.94\text{t} : 4224\text{hour}/\text{construction period} = 36.1\text{t}/\text{hour}$

B – coefficient, taking into consideration the dumping height of material, 0.6

$Q_d = 0.05 \times 0.02 \times 1.0 \times 0.8 \times 0.5 \times 36.1 \times 1.0 \times 0.6 \times 106/3600 = 2.4\text{g}/\text{s}$, or $2.4 \times 3600 \times 4224 : 106 = 36.4\text{t}/\text{construction hour}$.

Diesel fuel emissions

Emissions of diesel fuel are calculated on the basis of corresponding methodological instructions of the Ministry of Nature Protection of RA "Determination of quantity of harmful substances emitted into atmosphere from vehicles".

Sulfuric anhydride

Emissions of sulfuric anhydrides are calculated by the following formula of CORINAIR inventory system:

$$E_{SO_2} = 2k_s \times b$$

where k_s – content of sulphur in fuel - $0.002\text{t}/\text{t}$, b – fuel rate, t

$$SO_2 = 2 \times 244\text{t} \times 0.002 = 0.976\text{t}/\text{hour or } 0.06\text{g}/\text{s}.$$

Dust emissions during operation of construction machinery

During movement of vehicles dust is emitted into atmosphere. Movement of vehicles takes place 5 months or 1000 hours.

The calculation is carried out on the basis of the abovementioned methodology by the formula as follows:

$$Q = (C_1 \times C_2 \times C_3 \times N \times L \times q_1 \times C_6 \times C_7)/3600 + C_4 \times C_5 \times C_6 \times q_2 \times F_0 \times n,$$

where: C_1 – coefficient, considering average capacity of vehicle in site, $C_1 = 0.8$; C_2 - coefficient, considering average velocity of vehicles, $C_2 = 1.0$; C_3 - coefficient, considering conditions of roads, $C_3 = 1$; N – number of runs of vehicle in 1 hour, $N = 2$; L – average length of 1 run, $L = 1\text{km}$; C_4 - coefficient, considering material profile on platform, C_4 varies within $1.3 - 1.6$, $C_4 = 1.3$; F_0 – average area of platform, $F_0 = 12$; C_5 - coefficient, considering velocity of material blowing, $C_5 = 1.2$; C_6 - coefficient, considering moisture of surface layer of material, $C_6 = 0.6$; C_7 - coefficient, considering dust portion emitted into atmosphere, $C_7 = 0.01$; q_1 – dust emissions into atmosphere per 1km run, $q_1 = 1450\text{g}$; q_2 – dust emissions from actual unit area of material, $q_2 = 0.002\text{g}/\text{m}^2\text{s}$; n – number of vehicles $n = 4$

$$Q = (0.8 \times 1 \times 1 \times 2 \times 1 \times 1450 \times 0.6 \times 0.01)/3600 + 1.3 \times 1.2 \times 0.6 \times 0.002 \times 12 \times 4 = 0.094\text{g}/\text{s}$$

$$Q = (0.094 \times 1000 \times 3600)/106 = 0.34\text{t}/\text{construction period}$$

Cement dust is calculated by the following method: $G_{\text{cement}} = V \times d \times k \times n$,

where: V – concrete volume, D – concrete bulk weight, K – averaged number of cement in concrete mix, N – emission coefficient of cement dust, kg/t.

$$4270.99\text{m}^3 \times 2.1 = 8969.079\text{t} \times 1.33 = 11928.87\text{kg}$$

Cement dust - $11928.87 \times 1000 / (3.3 \times 24 \times 8 \times 3600) = 5.2\text{g/s}$ or $12.34\text{t/construction period}$

3.4 Calculation of Drinking-Communal Water Requirements during Construction

The water rate necessary for drinking-domestic purposes of workers implementing the construction is presented below.

Table 10: Calculation of water necessary for drinking and domestic purposes

Parameters	Reference	Measurement unit	Formula	Value
1. Maximum number of employees	N	people	Design data	550
- workers	N1	people		470
- engineering-technical staff	N2	people		80
2. Number of working days at construction stage	D	day	Design data	395
3. Water use rate		l/day	B. C. 2. 04.01-85 Appendix 3, Item 31	
- workers	n1	l/day		25
- engineering-technical staff	n2	l/day		16
4. Necessary water rate for drinking of employees and domestic purposes	W	m ³ /constr . period	$W = (N1 \times n1 + N2 \times n2) \cdot D / 1000$	
		m ³ /day	$W = (N1 \times n1 + N2 \times n2) / 1000$	

Hermetic containers are proposed to be used for collection of domestic wastewaters. After filling-up they are disposed and spilt into the nearest functioning treatment plant.

The quantity of wastewaters is calculated:

$$V_{d.w.} = W - IL, \text{ where } IL - \text{irretrievable losses of } 5\%.$$

$$V_{d.w.} = 4889.45\text{m}^3/\text{constr. hour} \text{ or } V_{d.w.} = 12.38\text{m}^3/\text{day}.$$

3.5 Calculation of Noise Level

Table 11: Calculation of noise level in village area and residential structures

Parameter	Reference	Measurement unit	Formula	Value
1. Characteristic of noise source	LA eq	DBA	B. C. 11-12-77	79
2. Reduction of noise level depending on distance	ΔLA dist	DBA	B. C. 11-12-77	32
3. Reduction of noise level by screens	ΔLA scr.	DBA	B. C. 11-12-77	18
4. Reduction of noise level by green area in site	LA green	DBA	B. C 11-12-77	0
5. Noise level in site close to residential buildings	LA res	DBA	$LA\ res = L\ A\ eq - \Delta LA\ dis - \Delta LA\ scr - \Delta LA\ green$	29
6. Admissible noise level in populated area	L adm	DBA	B. C 11-12-77	55
7. Reduction of noise level by windows	ΔLA w	DBA	B. C. 11-12-77	18

4 PROJECT DESCRIPTION AND JUSTIFICATION

4.1 Objective of the Project

Reconstruction of Geghardalich Reservoir and construction of the Geghardalich gravity irrigation scheme in the Kotayk Marz of Armenia will improve the efficiency of water resources utilization, reduce operation and maintenance costs of the system and improve overall operation of communities' on-farm irrigation systems by ensuring reliable irrigation water delivery to agricultural lands of communities. This will contribute to expansion of irrigated areas, higher productivity, and food safety will increase incomes in agricultural sector reducing the number of poor population and mitigate current population migration in the area. Furthermore, improved water delivery will encourage farmers to expand agricultural production and grow high value crops.

The area of Geghardalich Reservoir and Geghardalich gravity irrigation scheme Project is located mainly within intensively used areas of agricultural importance, where water supply is not ensured or is insufficient. So far, irrigation remains the only and the most commonly used land improvement measure. The priority in irrigation development is given to conversion from pumped schemes to gravity schemes and rehabilitation of water conveyance systems for more prudent use of water resources, reduction of water losses and costs.

4.2 Description of Proposed Project

Geghardalich irrigation scheme is located within the territory of Kotayk Marz of Armenia. The current irrigation scheme is driven by pumps and includes 3 pumping stations serving about 1,000 ha of irrigated lands of 6 communities. The lands of Voghjaberd, "Jrvezh-Dzoraghbyur" Gardener's Association and Jrvezh Forest Park of the "Reserve Park Complex" SNCO are irrigated from Azat Reservoir by four-cascade pumping station of Azat, and the lands of Hatzavan and Geghadir communities are irrigated by Hatzavan and Geghadir pumping

stations. These pumping stations are served by “Kotayk” Water Users Association (WUA) and “Garni-Geghard” WUA.

The current pumping irrigation scheme is very unreliable for various reasons. Pumping stations are physically depreciated and obsolete, the pressure pipelines go over unstable terrain, which causes frequent breakage of pipes. Pumping stations do not have appurtenant structures and are in poor technical state.

The Geghardalich Gravity Irrigation Scheme project envisages increasing the storage volume of the Geghardalich reservoir up to 3.4 million m³ to irrigate 1448 ha of agricultural lands. This includes 705 ha of agricultural lands in Gogh community, which are currently irrigated through the existing Geghardalich-Goght pipeline, and 743 ha of agricultural lands in the communities Hatzavan, Geghair, Voghjaberd, “Jrvezh-Dzoraghbyur” Gardener’s Association and Jrvezh Forest Park through construction of 26 km pipeline up to the pressure basin of Azat 4th degree pump station. Currently, these 743 ha of agricultural lands receive water through Geghadir, Hatzavan and Azat 4-degree pump stations. With the proposed project gravity water will be supplied to all 1448 ha of the project areas.

Table 12: Total irrigated area and irrigation demand in the Geghardalich Gravity Irrigation Scheme Project Area

	Area, ha	Annual irrigation water demand, mln m ³	m ³ /per ha
Goght	705	2.249	3190
Jrvezh-Dzoraghbyur Gardener’s Association	188	0.537	2856
Jrvezh Forest Park under the “Reserve Park Complex” SNCO	260	0.697	2681
Geghadir	120	0.37	3083
Hatzavan	120	0.37	3083
Voghjaberd	55	0.212	3855
Total	1448	4.434	

Currently the reservoir supplies irrigation water only to Goght community, and the average annual supply composes 2.249 mln m³. However, for some years too much water is diverted through the derivation canal, in which case the excess water is discharged through the spillway.



Derivation Canal to Geghardalich



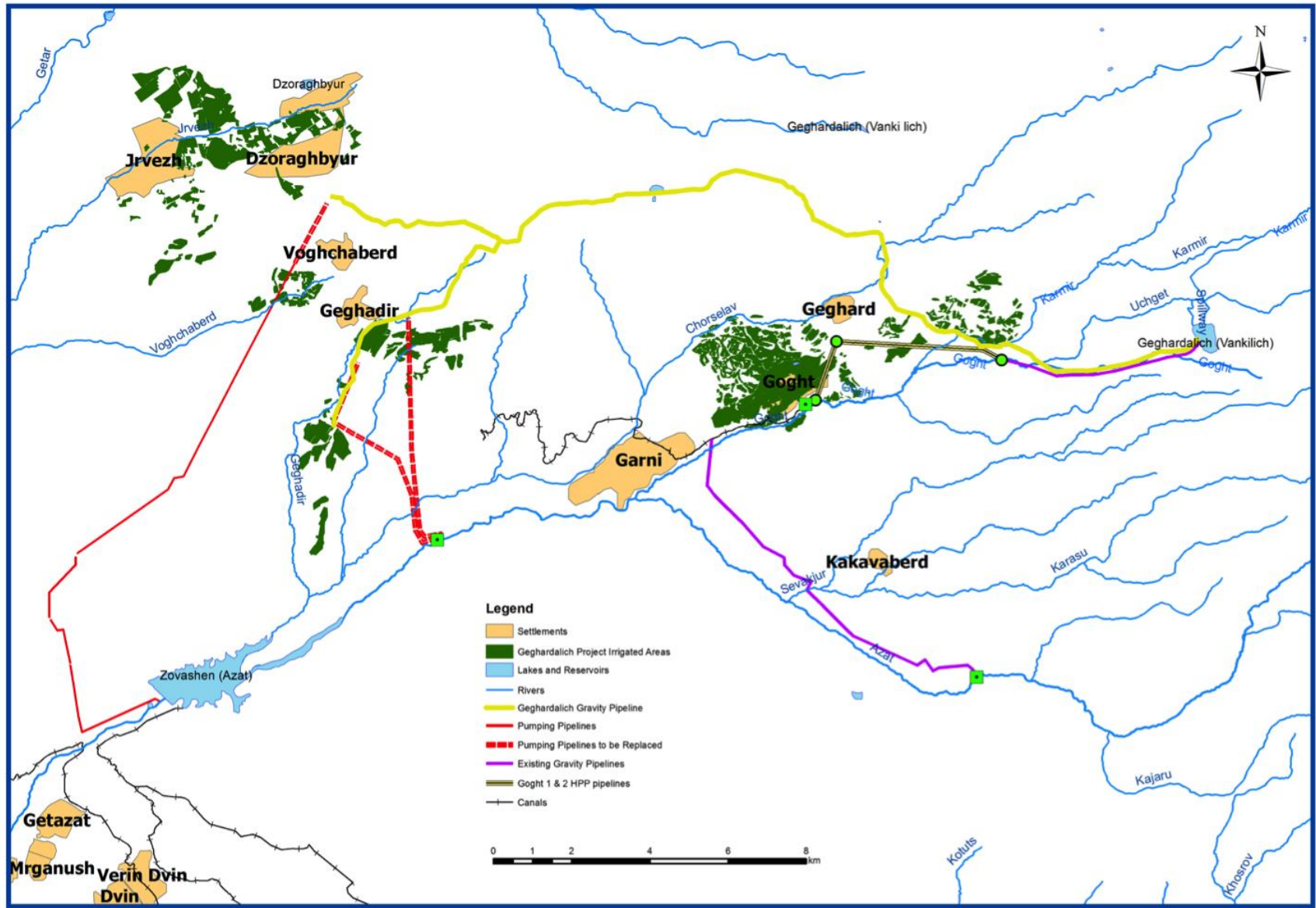
Water discharge through the spillway when the reservoir is overfilled



Spillway of the Reservoir

After construction of the Geghardalich Gravity Irrigation Scheme, the water required for irrigation will be delivered to the discharge basin through buried steel pipelines to be placed in a 1.3-1.8 m deep trench with a width of 1.0-1.3 m at the bottom. The envisaged length of the pipeline is about 26.0 km and the diameter - 500 mm. A 3,544 km long Geghadir-Hatzavan branch made of $Dy=250\text{mm}$ steel pipes will start from DM211+00 of the main pipeline and go until the pressure basin of Geghadir-Hatzavan pumping station. The pipeline will be placed in a covered trench.

During construction, it would be required to arrange a construction site on the area of about 120 m² furnished with 7 movable caravans, water-tight well or bio-toilets, drinking water tanks, capacities for temporary storage of garbage. No private land will be used for this construction site/camp.



Route of the Proposed Geghardalich Gravity Scheme Irrigation Pipeline

The **main pipeline** route of the Geghardalich Gravity Irrigation Scheme passes across the administrative area of Goght, Kamaris and Voghjaberd communities. The total land area under the main pipeline is 4.17 ha. The pipeline passes across 14,000 m of community owned lands in Goght, then across 7,000 m of community owned lands in Kamaris, and across 4,800 m of community-owned lands in Voghjaber communities. No private lands will be used. The use of community lands for the construction of this scheme has been agreed with each community. All agreements on the use of community-owned lands from the respective communities are presented in Annex J.

The Geghadir-Hatzavan pipeline route passes across the administrative area of Geghadir community (3544. m long). The total area under the Geghadir-Hatzavan pipeline makes 0.444 ha. The land belongs to Geghadir community and the community has agreed to the use of land for the project (Annex J). No private lands will be used.

The route of the **Hatzavan pipeline** passes along the administrative area of Geghadir and Hatzavan communities. It occupies 0.4686 ha land. The pipeline passes across 1397 m of community owned lands in Geghadir, and then across 2,226 m of community owned lands in Hatzavan. All agreements on the use of community-owned lands from the respective communities are presented in Annex J. No private lands will be used.

Overall, as shown in table below, the total area to be permanently taken by the Geghardalich scheme (area under the pipes) amounts to 5.08 ha, while the approximate area to which access will be temporarily restricted during construction works makes 21.43 ha.

The planned activities have completely been projected taking into consideration the issues of side effects on the environment and resettlement, and the possible side effects have been minimized.

As described in Table 13, the Geghardalich gravity scheme is not expected to involve any private land use, and all activities are expected to take place on community lands (the use of which has been previously authorized by the relevant community authority). However, if during the construction phase, for some unforeseen reason, a need for any change to the pipeline route arises, it will be reflected in this revised ESIA document, and all relevant agreements with land owners and users will be obtained in compliance with the project Resettlement Policy Framework (RPF), and will be obtained prior to the commencement of the works in question.

Table 13: Land use during construction and operation of the Geghardalich gravity scheme*

St. ³	Length of pipeline, m	Use of area, ha		Characteristic of area
		constant	temporary	
<u>Main pipeline</u>				
0+00÷64+64	6 464	1.07	4.202	Pipeline is of 530mm diameter. Lands along the route belong to Goght community.
64+64÷64+79	15	0.0025	0.0097	Route crosses the river in a concrete casing 10.5m long, pipe diameter is 530mm. Lands along the route belong to Goght community.
64+79÷69+90.5	511.5	0.084	0.33	Pipeline is of 530mm diameter. Lands along the route belong to Goght

St. ³	Length of pipeline, m	Use of area, ha		Characteristic of area
		constant	temporary	
				community.
69+90.5÷70+21	30.5	0.0049	0.0198	Route crosses the Karmir River in a concrete casing 22m long, pipe diameter is 530mm. Lands along the route belong to Goght community.
70+21÷140+00	6 979	1.117	4.54	Pipeline is of 530mm diameter. Lands along the route belong to Goght community.
140+00÷210+00	7 000	1.12	4.55	Pipeline is of 530mm diameter. Lands along the route belong to Kamaris community.
210+00÷216+90	690	0.11	0.45	Pipeline is of 530mm diameter. Lands along the route belong to Voghjaberd community.
216+90÷248+59	3 169	0.51	2.06	Route passes along the road edge, pipe diameter is 400mm. Lands along the route belong to Voghjaberd community.
248+59-258+00	941	0.151	0.612	Pipe diameter is 400mm. Lands along the route belong to Voghjaberd community.
Total	25 800	4.17	16.77	
<u>Geghadir-Hatzavan pipeline</u>				
0+00÷15+00	1500	0.188	0.975	Pipe diameter is 273 mm. Route passes on the left side of the existing field road. Lands along the route belong to Geghadir community.
15+00÷35+44.5	2 044.5	0.256	1.33	Pipe diameter is 219mm. Lands along the route belong to Geghadir community.
Total	3 544.5	0.444	2.305	
<u>Hatzavan pipeline</u>				
0+00÷13+77.7	1 377.7	0.186	0.895	Pipe diameter is 219mm. Lands along the route belong to Geghadir community.
13+77.7÷13+97	19.3	0.0026	0.013	Pipe diameter is 219mm, crosses Garni-Yerevan motor road in a reinforced concrete tube of 1000mm diameter. Lands along the route belong to

St. ³	Length of pipeline, m	Use of area, ha		Characteristic of area
		constant	temporary	
				Geghadir community.
13+97÷24+00	1 003	0.13	0.65	Pipe diameter is 219mm, passes through the road edge. Lands along the route belong to Hatzavan community.
24+00÷36+23	1 223	0.15	0.795	Pipe diameter is 159mm. Lands along the route belong to Hatzavan community.
Total	3 623	0.444	2.305	
<u>Gilanlar Canal</u>				
0+00÷7+00	700	0.65	0.98	The canal starts from the water intake structure built on Gilanlar stream and passes through community pastures for 700 meters. The lands belong to Verin Dvin community.
7+00÷20+00	1,300	1.21	1.56	At point 7+00 the canal crosses a ground road and passes through community pastures for 1,300 meters. The lands belong to Dvin community.
Total	2 000	1.86	2.54	

**At the design phase the communities give their written agreement for community land use (both permanent and temporary use); at the construction phase the communities give permission for construction of the structure; after construction the structure is handed over to the PIU commission headed by a representative of the State Committee of Water System; afterwards the structure is transferred to Garni-Geghard WUA for operation with a Government Decree.*

Monitoring and Emergency Action Plan for Geghardalich Reservoir

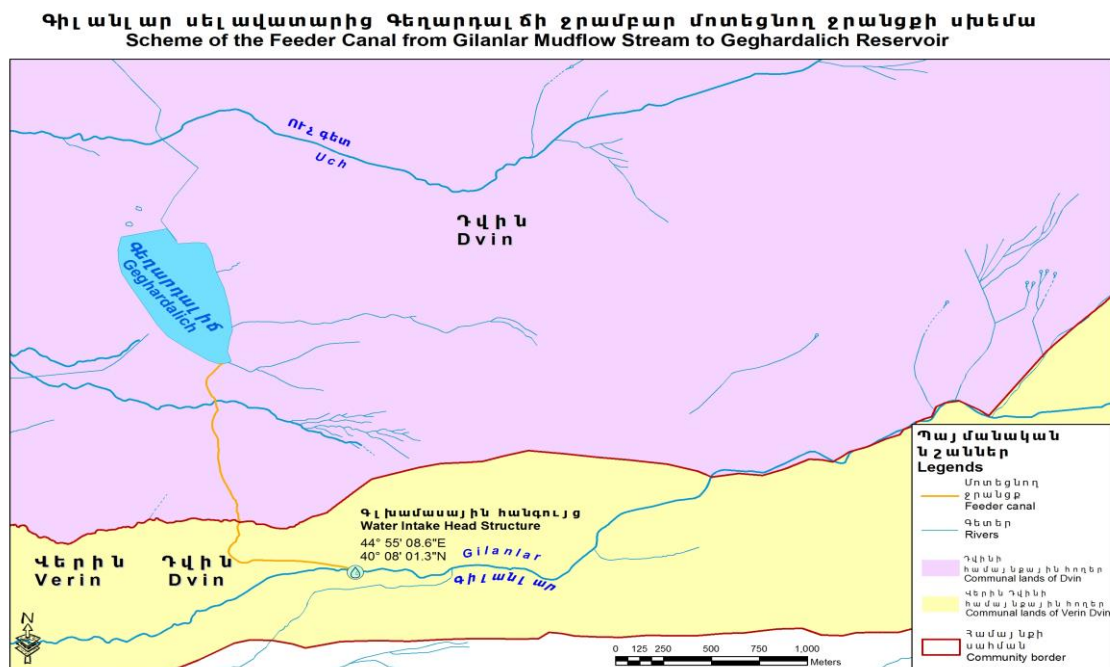
Sevan-Hrazdan water supply agency is the organization in charge of the operation and maintenance of the Geghardalich reservoir. In 2002-2004 dam of the Geghardalich Reservoir was rehabilitated, followed by development and adoption of monitoring and emergency situations plan for the reservoir. This plan is being implemented by Sevan-Hrazdan water supply agency. Particularly, since 2004-2006 the organization started conducting monitoring of water quantity in the reservoir, and the annual data is available. Similar plans and programs are also envisaged within the Geghardalich gravity irrigation scheme project. The design of the project was carefully studied by the Geghardalich dam safety panel, which presented several suggestions for ensuring safe operation of the reservoir. All of these suggestions were incorporated in the revised design documents. It is envisaged, that in future the monitoring and emergency situations plans will be implemented in a more efficient manner, given the plans to install SCADA automated management system in the area, as well as plans to establish a 24-hour duty stations during the irrigation season.

4.3 Additional Feeder Canal Feeding Geghardalich Reservoir from Gilanlar Mudflow Stream

4.3.1 Background

Notwithstanding the fact that this Project has passed all the procedures specified by the WB Operational Policies, as well as Armenian legislation, and that all the necessary positive conclusions have been acquired (all the required consultation meetings have been held, including in Goght community; moreover, the main issues raised by the inhabitants of the community during the consultation meetings have been considered and incorporated in the Final Design), at the commencement of construction works Goght inhabitants expressed their mistrust to the water calculations of the project. Namely, they raised the issue of insufficient water in Geghardalich reservoir to meet the irrigation needs of Goght community. Inhabitants were not sufficiently reassured by hydrological calculations which show that the irrigation supply for Goght will not be affected, and proposed that additional feeding for the reservoir is ensured.

A range of discussions with the participation of all the responsible entities were held in order to find effective solutions to the new issues raised. Although the hydrological calculations for Geghardalich Gravity Scheme were conducted in due order, the entities responsible for the Project decided to meet the demand of Goght community and ensure additional feeding for Geghardalich Reservoir. As a solution the construction of an additional feeder canal from Gilanlar mudflow stream was considered, which will serve as additional warranty for Goght community to avoid potential problems and conflicts with the neighboring communities in dry and drought years.



In the frames of the consent reached as a result of group discussions, consultation meetings and mutual agreements between the PIU, design consultant, local municipality and community members who had expressed their concerns, a joint visit to Geghardalich Reservoir and Project area of the Gravity scheme was held on June 24, 2016 (the photos are presented in Annex M). Participants in the visit included “Water Sector” PIU representatives, inhabitants of Goght community including the community members who expressed their concerns, representatives of the Design Company and the reservoir management (Sevan-Hrazdan Water Intake State Company), where mutual agreement on further project implementation was reached based on the studies and water calculations of the Gilanlar mudflow stream conducted by the design company beforehand and on-site observations performed during the visit. Approximate study of the potential route of additional feeder canal

from Gilanlar and analysis of its feasibility were carried out, after which each of the Parties agreed to undertake, within their competence, all the steps required for this design change.

4.3.2 The Description and Technical Indicators of the Feeder Canal from Gilanlar

The water intake head structure is located 2 km NE from the main dam of Geghardalich Reservoir on Gilanlar Valley at absolute elevation of 2710-2715m. There is no landslide or any other physical-geographical phenomena within the borders of the water intake head structure. The topsoil of the area is quite favorable in terms of construction. During investigations the flow at the intake section was estimated 1.8-2.0m³/sec. The hydrologic unit of “Design of Feeder canal from Gilanlar Mudflow Stream” consists of the following key structures:

- Water Intake Head Structure
- Feeder canal

Water Intake Head Structure

The water intake head structure is envisaged to be constructed at absolute elevation of 2710-2715m of Gilanlar Mudflow stream. It is a structure of class IV. Hydraulic calculations were carried out for 5% probability flows and were verified for 1% probability. The 5% probability flow makes up 2.17m³/sec and the 1% probability flow – 3.16m³/sec. The intake is designed with a capacity of 2.0m³/sec. There are two inlets at the intake with dimension of 1.0mx1.0m. Gates and trash racks are envisaged at the entry of the intake.

Feeder canal

The canal is made of concrete. Its upstream L=13.2m section from DM DM-(0+06.90) has rectangular section with bottom width of B=2.8 m. This section includes L=11.0 m long and h=0.65 m high overspill weir. After 1 m long transition, from DM0+07.30 to DM19+00 the canal is proposed with trapezoidal section B=1.1m, H=1.1m, m=1.0.

The DM9+35-DM9+60 section of the canal goes through a double-pipe aqueduct d=1020x9:

The canal crosses field road at DM7+00, where construction of a bridge is envisaged. At the construction stage there will not be a problem with blocked roads as there are a number of ground roads in the area. However, if the roads get closed or blocked, an alternative ground road will be laid to bypass the construction site. The bottom of the reservoir will be strengthened by rocks at the outlet of the canal.

4.4 Baseline Information

4.4.1 Natural Environment

Climate

The climate within the design section of the catchment area is specified by cold and snowy winter. As there are no meteorological stations within the investigated catchment areas, the description of climate characteristics is provided based on the “Climatological Atlas of the Armenian SSR” and the data of nearest Yeratumber meteorological station.

The average annual temperature is -4°C, the average monthly temperature is -14°C in January, -6°C in April, 8°C in July, and -2°C in October. The absolute minimum is -42°C and was observed in January and absolute maximum of 24°C was observed in July.

The average daily transition temperatures within specified limits and the number of days with the temperature within these limits are presented in the table below.

Table 14: Summary of Atmospheric Air Temperature in the Geghardalich Scheme Area

Temperature above the limit		Temperature below the limit		Number of days
>T°C	Date	<T°C	Date	>T°C <T°C
0	10/V	0	20/X	190
5	20/VI	5	1/X	100
10	1/VII	10	1/I X	60
15	25/VIII	15	10/VIII	15

The ground surface temperature is -14°C in January, - 6°C in April, 15°C in July, -1°C in October and the average annual is -1°C.

The maximal soil freezing depth is 180 cm.

The absolute air humidity is 1 Mb in January, 2 Mb in April, 8 Mb in July and 3 Mb in October.

The relative humidity within the year is 80%.

Average annual precipitation makes up 850 mm. Maximal precipitations occur in May - 113 mm and minimal in September - 32 mm. The daily precipitation with 1% probability is 75 mm. The number of days with precipitation of 0.1mm and over is 145 days. The number of sunny days is 65.

600 mm precipitation falls in form of snow. A stable snow cover is formed in October 20 which starts to melt in May 20. The average maximal thickness of the snow cover for 10-days period is 175 cm. The density of snow cover is 33 g/cm³.

The north-east winds with average velocity of 4-6 m/s prevail during the year. The velocity of winds with the design probability of 4% and 30% is $V_{4\%} = 29$ m/s and $V_{30\%} = 19$ m/s. The direction and occurrence of winds are presented in Fig. 1.2.

Annual evaporation is 200 mm and evaporability is 514 mm.

In order to show the annual variations of main weather characteristics, we used the data of Yeratmber meteorological station and high-altitude Aragats meteorological station. The data are presented table below.

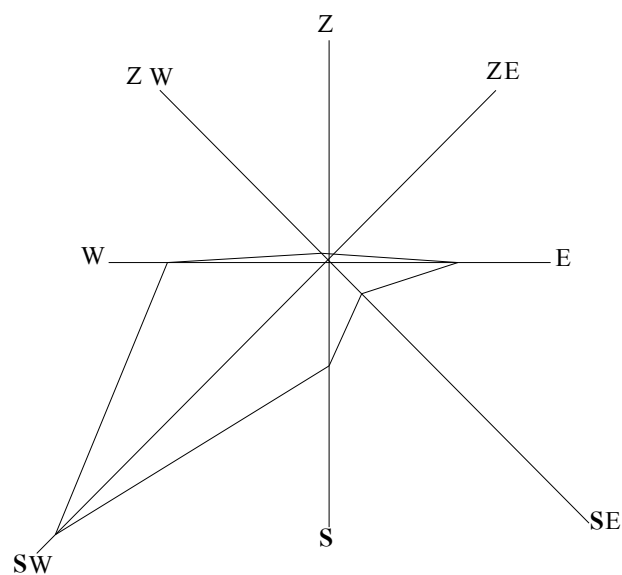
Table 15: Annual distribution of weather characteristics at Yeratmber meteorological observation station

Weather element	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Average annual temperature, °C	-13.6	-13.3	-9.3	-4.4	0.2	4.6	8.7	8.8	5.3	-0.6	-6.3	-9.9	-2.5
Absolute air temperature, °C	2	5	7	11	10	16	21	21	20	15	8	4	21
Minimal air temperature, °C	-39	-32	-29	-24	-17	-9	-5	-2	-13	-19	-28	-34	-39
Average ground temperature, °C	-14	-13	-10	-5	-1	5	12	12	7	-1	-8	-12	-2
Absolute ground temperature, °C	7	13	22	26	33	51	53	55	49	45	27	12	55
Minimal ground	-44	-36	-36	-34	-26	-18	-12	-8	-18	-25	-34	-40	-44

Weather element	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
temperature, °C													
Average wind velocity, m/s	6.7	6.9	6.4	5.6	4.6	4.2	3.4	3.4	3.7	5.1	5.2	5.9	5.1
Number of days with strong wind (>15 m/s)	14	16	11	10	8	8	4	2	7	11	13	21	125
Average air humidity, Mb	1.9	1.9	2.4	3.4	4.7	5.9	7.4	7.0	5.4	4.0	3.0	2.1	4.1
Relative air humidity, %	78	82	82	83	83	78	74	67	64	70	77	75	76
Precipitation, mm	72	76	99	106	113	69	56	39	32	56	72	61	851
Snow cover, cm	39	45	62	87	58	6	-	-	-	8	22	27	
Evaporation from ground surface, mm	-	-	8	16	28	34	32	30	23	19	10	-	200
Evaporation from water surface, mm	-	-	24	50	72	88	90	83	58	33	16	-	514

The investigated catchment area is located with Alpine zone. The soil refers to mountain-meadow turf type.

Calm - 9%, 1 cm = repetition of 5



Wind direction occurrence according to Yeratmber meteorological observation station

Relief

The relief of project implementation area (reconstruction of Geghardalich Reservoir and construction of Geghardalich gravity scheme) usually is moderately intersected. Extensive areas are occupied by small ravines and very steep planes and eroded bare cliffs. The contemporary terrain was developed mainly by flows of andesite-basalt lavas and tuff of Tertiary and Quaternary age. They are covered by alluvial and alluvial-delluvial sediments, represented by rock debris with carbonated sandy clay. The thickness of these sediments usually does not exceed 0.5-1.5 m depending upon the terrain form.

Soils

Mountain brown soils were investigated in detail by R. Edilyan, N.Khtryan, S.Sarkisyn, K.Melkonyan, I.Parsadanyan, J.Melkonyan (Р.А. Эдилян, Н.К. Хтрыан 1963, С.С. Саркисян 1959, К.Г. Мелконян 1968, И.Р. Парсаданян 1970, Дж. Л. Манукян 1970). These investigators identified two sub-types of mountain brown soils: light-colored and dark-colored brown soils. These both sub-types and their varieties are common within the areas proposed for Geghardalich gravity irrigation scheme.

The dark brown soil has dark brown, sometimes grayish tint at the surface. The cultivated brown soils are developed within the pre-mountain plains and are specified by relatively thick humus layer (50-70 cm) and weakly differentiated homogenous structure of the profile. The old irrigated lands usually are eroded and distinguished by higher compaction. These lands are specified by heterogeneous mechanical content, which is stipulated by lithological conditions of the relief, intra-soil erosion processes and impact of irrigation.

The soil with light mechanical content and considerable fluctuation of mineral composition in its profile is developed on sandy clay sediments. The content of minerals in this soil is rather variable. The non-cultivated mountain brown soil is specified by high rock debris content and skeleton texture. The content of rock debris increases with the depth. The cultivated soils usually are specified by lower rock debris content and heavier mechanical composition. Silt accumulations are observed in the upper layer of such soils, which is due to irrigation by silt water. The silt fraction is represented mainly by montmorillonite and chlorite minerals.

Landscape

Geographical position of Armenia, its complex geological structure, location within various altitude zones and boundaries of various flora and fauna provinces contributed to the development of biodiversity and environmental systems. However, intense human activities have adversely impacted the biodiversity and environmental systems and their elements. Representing one of the most extensive economic sectors, agriculture is among the sectors with the strongest impact on the balance of natural components endangering the Armenian biodiversity.

Kotayk Marz with its three districts (Hrazdan, Abovyan and Nairi, total area – 2,089.0 km²) is located in the central part of the Republic of Armenia at the absolute elevations of from 1,040.0 m to 3,597.0 m (3,597.0 m is the summit of Mt. Ajdahak). The landscape morphology of the investigated area is represented by folded-block mountain massifs of volcanic origin. Kotayk Marz encompasses the slopes of Gegama Mountains, Tsaghkunyats Ridge, Mt. Hadis and Mt. Ara with Yegvard Flatland (abs. elevation 1,200.0 m and 1,300.0 m) and Hrazdan Plateau (abs. elevation 1,700.0 m and 1,800.0 m) between them. Two rivers - Hrazdan and Azat flow through the Marz area.

Seismic conditions

Armenia is located with active seismic region expanding from Turkey to Arabian Sea where the Arabic Continent slowly collides with Eurasia. As strong earthquakes with magnitudes over 5.5 occur in Armenia every 30-40 years reaching magnitudes up to 7.1 on the Richter scale, a high-level seismic risk is indicated for the country. Maximum seismic risk is around the city of Yerevan, where active faults exist. The Garni earthquake in 1679 was the most destructive in this region with the magnitude between 5.5 and 7. Another destructive earthquake with a magnitude of 6.9 occurred in Spitak in 1988.² Rather strong earthquake (3.2) occurred recently (27.02.2011) 37 km north from Gyumri.

During the design works micro-seismic research was conducted to study the seismic condition of the Geghardalich dam and its adjacent territories. The research shows that the territory of the dam is within the seismic zone of the magnitude of 9 on the Richter scale. Thus the dam is designed for 9 and more magnitude of aseismic stability.

Specially Protected Nature Areas

There are no specially protected nature areas (SPNA) in the immediate proximity of the Gegardalich gravity irrigation scheme. The following SNPA are located closest to the Gegardalich scheme, which are, however, outside of the project direct and indirect impact area due to the distance:

Khosrov State Reserve was established in 1958. It is located in the southern part of Gegama Shield, north-western slopes of Urts-Yeranis Ridge and basin of Azat and Vedi Rivers at the elevation of from 1,400 m to 2,250.0 m and occupies an area of 23,878.0 ha. The reserve was established for protection of sparse wood and semi-desert landscapes with corresponding unique flora and fauna coenosis.

Erebuni State Reserve was established in 1981. It is located on the slopes Near-Araksian folded mountain ridge, in the south-western part of the city of Yerevan, within administrative area of Voghjaberd, Hatzavan villages and Erebuni community of Yerevan. Currently the reserve occupies 89.0 ha. The reserve was established with the objective to protect rare and disappearing species of wild flora and fauna, especially for protection of the gene pool and the habitat of over 100 wild wheat species.

If implemented, the water from Gegardalich gravity irrigation scheme will be delivered to the lands of Jrvej Forest-Park and used for its irrigation.

Jrvej Forest Park was established in 1977 and occupies an area of 404.0 ha. The park was established within the area of arid mountain steppe and semi-desert zones for growing bush plants. Over 100 bush and tree species were introduced and unique examples of gardening designs were developed in the park since its establishment. 21 plant species included in the Red Book are grown here. The natural flora of the park comprises over 400 flower plants of high quality, and 103 plant species including 67 trees brought from other countries. Jrvej Forest Park is the only green zone still maintained around Yerevan, so establishment of a reliable irrigation system is important for its maintenance.

Flora

The areas of proposed Gegardalich gravity irrigation scheme are located between Yerevan and Geghama floristic regions. The lower parts of the region are specified by semi-desert plants represented by sagebrush, wormwood accompanied by caper bush (*Capparis spinosa*), acantholimons (*Acantholimon*), locoweed (*Astragalus*), Koch thyme (*Thymus kotschyanus*), etc. Considerable areas are occupied by mountain steppe with various plant formations.

The feather grass steppes expand within the altitudes from 1,600 m to 2,100 with prevalence of *Stipa stenophylla*, *Stipa capillata*, *Stipa pulcherrima*, *Stipa pontica*. These plants are accompanied by other cereals *Festuca sulcata*, *Pbleum*, *Agropyron*. Sometimes cereal-herbaceous plants may be seen with prevalence of june grass (*Koeleria cristata*), timothy-grass (*Pbleum*), crested wheatgrass (*Agropyron*), yellow bedstraw (*Galium verum*), Koch thyme (*Thymus kotschyanus*), etc. Some limited areas are represented by grass steppes with prevalence of steppe grass plants: catmint (*Nepeta*) clover (*Trifolium*), alfalfa (*Medicago*), astragal (*Asyragalus*), etc.

The areas at the altitude of 2,100-2,300 m are represented by meadow-steppe plants, where common steppe edifiers join with meadow elements: *Pbleum pretense*, *Helictotrichon*, *L. Hordeum bulbosum*, etc.

The areas from 2,300 m up to Gegardalich Reservoir are occupied by very diverse Sub-Alpine meadows specified by the presence of turf layer and plant cover of various intensity. Depending upon soil and climate, the following species prevail: variable fescue (*Festuca veria*), bluegrass (*Poa longifolia*), Alpine meadow grass (*P. Alpina*), Alpine timothy (*Pbleum alpinum*), etc. They are accompanied by rare curly dock, Alpine curly dock (*Rumex crispus*, *R. alpinum*), mountain primrose (*Ranunculus oreophilus*), dandelion (*Taraxacum*), sometimes thyme (*Thymus*). Occasionally thistle, larkspur, crowfoot, etc. are sharply distinguished over the total plant cover.

The following plants, registered in the Armenian Red Book, are found outside the area proposed for construction of Gegardalich Reservoir and Gegardalich gravity irrigation system, in particular in the state reserves "Khosrov Forest" and "Erebuni": *Chardinia macrocarpa*, *Gundelia tournefortii*, *Saussurea salsa*, *Halotis pilifera*, *Spinacia tetrandra*, *Astragalus persicus*, *Salvia spinosa*, *Malvelia sberardinia*, *Agilops crossa*, *Amblyopyrum muicum*, *Hordeum spontaneum*, *Secale vavilovii*, *Triticum araraticum*, *T. Yrarty*, *T. Boeoticum*.

Plants registered in the Armenian Red Book have not been found in the areas proposed for the project

implementation.

The investigated area of Karmir River represents a zone of active human development and is under agricultural loading (intense grazing of cattle and sheep). This is evidenced by the growth of secondary plant varieties like Anatolian thistle (*Cirsium anatolicum*) and (*Alchemilla oxysepala*). The flora of the surrounding area is represented by Sub-Alpine meadows with prevalence of *Astragalus microcephalus* and altered flora.

The following plant varieties are present in this area according to literature data (see [3], [8], [21], [22], [28] in Annex E – List of References).

Festuca valesiaca – Valensian fescue grass, *Koeleria cristata* – June grass, *Phleum phleoides*, *Phleum alpinum*, *Carex humilis*, *Cephalaria gigantea*, *Veratrum album*, *Heracleum pastinacifolium*, *Rumex alpinus* - շնճիկ, *Rumex crispus*, *Polygonum alpinum*, *Polygonum aviculare*, *Chenopodium album*, *Chenopodium foliosum*, *Thymus kotschyanus*, *Erigeron venustus*, *Hieracium pilosella*, *Prunella vulgaris*, *Scutellaria orientalis*, *Artemisia absinthium* and others:

The Karmir River basin, in the section of which the intake structure of the canal supplying the Geghardalich reservoir is located at elevation 2 752.00m, is located on the upstream watershed hill of the right bank tributary Goght of the Azat River, the outfall of which is Uch. The river is 3.6km long, the outfall elevation is 3 010.00m, the average elevation 2 870.00m.

It should be mentioned that the investigated region is specified by meadows occupying large areas, which are over-used by local population. Intense and continuous grazing of cattle and sheep has caused deterioration of the soil and plant cover. The results of the field surveys and visual observations indicated that there are no plants included in the Armenian Red Book. The flora of the area is represented by species, which are common for the region.

Fauna

The area of gravity irrigation scheme includes four (semi-desert, dry steppe, mountainous steppe and alpine) out of seven altitude landscape zones existing in Armenia having the richest species composition.

Unlike flora coenosis, the fauna species have wide inter-zonal occurrence due to their high mobility and may be seen simultaneously in various landscape zones.

The spectrum of fauna species includes mainly the elements of Mediterranean, Iran-Turanian, Caucasian, East-Paleoarktic fauna.

The mollusks fauna of semi-desert and dry steppe landscape zone is represented by 22 species of 15 genus and 13 families.

Among scorpions met within the territory of Armenia, two species of one genus (*Buttus caucasicus*, *B. eupeus*) may be found in this area, and *Buttus caucasicus* reaches up to abs. elevation of 2,000.0 m and higher.

The entomological fauna (*Insecta*) is specified by high diversity of various ecological groups and is represented by over 750 species. They live in soil cavities, under stones, dung, earth-dung, burrows of rodents, on plants, in plants, in corpses, in water reservoirs at various development stage (dragonflies, amphibiont insects, etc.). The insects of this area are represented by species, which prefer semi-desert and desert fauna coenosis and have accommodated to semi-desert and desert fauna.

Vertebrates. Amphibians are represented by one order, four families and 5 species (*Bufo viridis*, *Hyla savignyi*, *Rana ridibund*, *R. macrocnemis*, *Pelobates syriacus*). Among these 5 species, the Syrian spadefoot (*Pelobates syriacus*) is included into the Armenian Red Book.

The reptiles are represented by *Mauremys caspica*, *Ludakia caucasia*, *Pseudopus apodus*, *Eremias stranchi*, *Lacerta media*, *Ophisops elegans*, *Darevskia nairensis*, *Coluber najadum*, *eirenis punctatolineatus*, etc. There are also snakes - lebetina viper (*Macrovipera lebetina*).

56 species of 40 genus, 22 families and 9 orders of birds (*Aves*) are found in this area. They are represented by *Buteo rufinus*, *Falco naumanni*, *Coturnix coturnix*, *Burhinus oedicnemus*, *Laurus armeniacus*, *Pterocles orientalis*, *Pterocles alchata*, *Columbia livia gaddi*, *Otus scops*, *Athena noctua*, *Caprimulgus europaeus*, *Coracias garullus*, *Merops apiaster*, *Upupa epops*, *Alectoris chukar*, *Calandrella beachydactyla artemisiana*, *C. rufescens pseudobaetica*, *Galerida cristata*, *Alauda arvensis*, *Motocilla*

alba, *Anthus campestris*, *Lanius collurio*, *Lanius senator*, *Cereotrichas galactotes*, *Oenanthe isabellina* *Lanius*, etc.

Birds unlike other vertebrates, represent a dynamic fauna group and their inclusion into this area is arbitrary as there are migrating and non-migrating birds. *P. oenanthe*, gray-necked bunting (*Emberizja buchanani*), *Emb. hortulana* live on the ground, *Merops apiaster*, *Coracias garullus*, *Oenanthe isabellina* live in nests, *Hippolais pallida*, *H. laguida* - in shrub, *Falco naumanni*, *Stumus roseus*, *Petronia petronia* – in rock fissures and in stone piles, etc.

The mammals are less mobile than birds. Wolves and foxes are very common in mountain steppes and may be seen everywhere. In order to find food, they enter into semi-desert areas where there are many rodents, birds and other animals. Dipodid (*Dipodidae*) is another specific inhabitant of the semi-desert and desert areas. The large number of rodent burrows evidences their dense population. The rodents are represented by gerbille, vole, brown hamster and wood mouse.

The mountain steppe and Sub-Alpine landscapes are specified by the presence of mollusks (*Vertigosubstriata*, *Euxina somchetica*), beetles.

Perpetofauna (Reptiles) is rather poor. It is represented mainly by Valentine rock lizard (*Lacerta valentini*), viper (*Vipera darskii*), Armenian steppe copperhead viper (*Vipera erivanensis*).

The birds of mountain steppe and Sub-Alpine zone are represented by rather rare species included in the Armenian Red Book. The most common among birds are perching birds (*Passeriformes*) and falcons (*Falconiformes*).

In addition to hare (*Lepus europaeus*), fox (*Vulpes vulpes*) and wolf (*Canis lupus*), which may be found everywhere, the most common mammals are rodents: murids (*Muridae*) and especially field mouse (*Microtinae*).

The fish fauna of Geghardalich Reservoir is missing due to change of the water level, since stored water is entirely discharged during an irrigation season and there are not sufficient conditions for development of water ecosystem.

The following fauna species, included in the Armenian Red Book, may be found in the adjacent areas of the proposed gravity irrigation system, outside the direct impact zone:

- mammals: *Rhinolopus mehelyi*, *Barbastella leucomelas*, *Miniopterus schreibersi*, *Vormela peregusna*,
- birds: *Aquila chrysaetos fulva*, *Aegypius monachus*, *Merops superciliosus persicus*, *Sylvia nisoria nisoria*, *Sylvia hortensis crassirostris*, *Oenanthe finscii*, *Monticola saxatilis saxatilis*, *Monticola solitaries solitaries*, *Luscinia svecica occidentalis*, *Lania gutturalis*, *Remiz pendulinus menzbieri*, *Sitta tephronota obscura*, *Tichodroma muraria*, *Carposiza brachudactyla*, *Emberiza buchanani*,
- reptiles: *Eumeces schneden*, *Mabuya aurata*, *Elaphe hohenaekeri*, *Telescopus fallax iberus*, *Vipera raddei*.

However, there might be certain indirect impact on the above-mentioned red-list fauna species, which are located outside the project implementation area. Such indirect impact is possible due to the noise from the heavy construction machinery and movement of transportation, which can be expressed during the breeding, movement and search for food processes of the above-mentioned fauna species. In order to mitigate these negative impacts, corresponding mitigation measures are included in Annex A “Environmental and Social Management Plan” of this ESIA report.

The biotopes of the Karmir River area are represented by typical mountain steppe. The area is heavily impacted by people – mainly is used for grazing and haymaking.

According to literature data there are over 80-90 beetle (*Coleoptera*) species in the in the project implementation area (see [1], [7], [13], [14], [15] in Annex E – List of References). The most representative ones, which were also observed during the field trips included ground beetle (*Calathus fuscipes*), (*Harpalus rufipes*), (*Harpalus rubripes*), burrying beetle (*Silpha obscura*), tenebrionid beetle (*Opatrum geminatum*), *Agriotes sp.*, as well as *Harpalus rufipes* Deg., *Harpalus quadratus* Chd., *Amara bifrons* Gyll., *Pristonychus lederi* Rtt., *Calathus longicollis* Motsch., *Microlestes sp.*, *Platambus lunulatus* L., *Pachylister inaequalis* Ol., *Aclypaea undata verrucosa* Men., *Zyras cf. argus* Khnz., *Tachyporus pusillus* Grav., *Xantholinus armeniacus* Coiff., *Creophilus maxillosus* Rossi, *Onthophagus taurus* Schreb., *Aphodius subterraneus* L., *Agriotes infuscatus* Desbr, etc.

There are few species of lizards in the investigated area including Armenian rock lizard (*Darevskia armeniaca* Meh.),

shovel-nose snake (*Coronella austriaca* Laur.):

Avifauna also is poor. Perching birds may be found right at the areas such as carrion crow (*Corvus corone* L.), black-headed bunting (*Emberiza melanocephala* Scop.), common wheatear (*Oenanthe oenanthe* L.), white wagtail (*Motacilla alba* L.), and common bee-eater of coraciiform (*Merops apiarius* L.).

As the reviewed area is not large, it may play some role only during nesting period of the life cycle, however intense utilization of the area makes unlikely that the birds will nest here. Particularly, these territories are intensively used by the livestock as remote pastures, given the absence of houses or related infrastructure in the territory. The only existing infrastructure in these areas are temporary tents, which all have private owners and around 400 heads of livestock, which use the project implementation and adjacent areas as pastures, thus making them highly unlikely areas of sustainable nesting. This assumption was also ascertained during the field observations in spring and autumn, when no nesting areas were observed within the project implementation area and around it.

What regards mammals, there are favorable conditions for field mice such as European snow vole, (*Chionomys nivalis*), common vole (*Microtus arvalis* L.), Major's pine vole (*Microtus majori* Thomas), which establish colonies inside stone piles, under the large and medium rocks buried in soil, holes covered by nettle and thorn weeds.

Unlike the Karmir River, ichthyofauna in the Goght River is not very rich and is mainly restricted to carp fish.

Large mammals of the investigated and adjacent areas may not be considered, as usually the development of small areas does not impact significantly their biological activity as in case of birds. In the project implementation area there are no stenobiont mammals, which have a narrow distribution areal. The above-mentioned mammals have a wide distribution area and implementation of the project works by turns will not deprive the mammals of the possibility to find food. The usual length of the excavated trenches will be 300-500 mm, which the above-mentioned mammals can easily detour. In addition, for domestic livestock special passages are planned, which the wild animals can also use. And finally, during the night hours, which is a favorable time for the above-mentioned mammals to look for a food and move around, no construction works are planned, and thus the impact will be minimum.

Usually such circumstances endanger first of all small sessile animals whose entire life cycle is encompassed by a small area such as most of insects, amphibians, reptiles and small mammals.

4.4.2 Socio-Economic Conditions

Socioeconomic Overview of Kotayk Marz

Kotayk Marz is located in the central part of Armenia. It has three districts (Hrazdan, Kotayk and Nairi) and occupies an area of 2,086 km², which represents 7% of the Armenian territory. The Marz is rich in recreational and water resources. Water resources of the lakes and artificial reservoirs make up 7.7 mln m³. Two large rivers having irrigation importance (Hrazdan and Azat) flow through the Marz area. Kotayk Marz is rich in mineral water, which is evidenced by the production of Arzni, Bjni and Hankavan mineral waters.

Unlike other regions of Armenia, Kotayk Marz has relatively well-developed and multi-sectoral economy. The following table presents the weight of Kotayk Marz in main economy sectors of Armenia in 2012.

Table 16: Main Economic Sectors of Kotayk Marz

Industry	12.9%
Agriculture	6.3%
Construction	9.2%
Retail trade	2.9%
Services	2.9%

The power resources and mineral deposits of the Marz (iron, gold, construction materials) promote development of power and industry sectors. The perspectives of economic development are associated with the growth of processing industry, development of mineral resources, production of metal and non-metal products, cement

production. The Marz is advanced also in the sectors of food production, fruit cannery, production of vegetables, dairy products and beverages.

The Marz has diverse agricultural production. The main direction is poultry (46%). There are three large poultries in the Marz. Nevertheless, the weight of fruit production, viticulture, wheat and vegetable production, beef farming and dairy farming, sheep farming also is high (54%). The main direction in animal husbandry is the dairy farming. Due to high altitude the Marz is not suitable for the growth of thermophilic plants.

The perspectives of agricultural development are associated with animal husbandry and horticulture. The total agricultural production of the Marz in 2012 accounted for 6.3% of the total gross agricultural production of Armenia. The most advanced sectors of agriculture are wheat and vegetable production, horticulture, and to some extent viticulture. Animal husbandry also is an advanced sector. Wheat crops are grown mainly within the mountain black soil (“chernozem”) areas in Hrazdan, Kotayk and Nairi districts. The Marz is considerably advanced in apple, pear and other fruits production.

51.1% of the total area of Marz are represented by agricultural lands including 38,200 ha arable lands, 4,600 ha - perennial plants, 10,600 ha - grasslands and 53,600 ha – pastures.

Irrigation system of the Marz includes Arzni-Shamiram main canal which serves mainly the communities of Nairi district, Kotayk canal and irrigation system constructed on that canal, a four-stage pumping station getting water from Azat Reservoir, Garni irrigation system getting water from Azat River and secondary and tertiary canals constructed on the Sevan-Hrazdan main canal.

Water resources of Kotayk Marz are sufficient for irrigation of over 40,000 ha. However, the poor state of hydraulic structures, canals and irrigation system, technical and other deficiencies and funding difficulties prevent expansion of irrigated areas.

As for population of Kotayk marz, 97.6% of the population makes up Armenians. There are 67 communities in Kotayk Marz including 60 rural communities and 7 cities. The population of Kotayk Marz was 255,300 by the end of 2012.

Table 17: Population Characteristics in Kotayk Marz

Population, including urban	138,200
Rural	117,100
Share of Marz population in total population of Armenia	8.4 %
Share of urban population	54.1%
Agricultural lands	154,987.4 ha

Poverty and unemployment are among the major issues that worry the population of the marz. Unemployment in the Marz is by 0.4% higher than the country average. 5,500 unemployed were registered in the regional employment center as of May 1, 2013, which is by 448 people less compared to the previous period.

Poverty level, compared to the national average, is high.

Table 18: Poverty Level in Kotayk Marz

	Extremely poor	Poor	% in total poor population	% in total population of Armenia
Kotayk	5.7	42.5	13.1	10.0
Yerevan	2.2	25.6	26.8	33.9
Total	2.8	32.4	100.0	100.0

Source: National Statistical Service of Armenia, “Social Situation and Poverty in Armenia”, Yerevan, 2013.

Table 19: Poverty Rates per Gender of Household Heads in Kotayk Marz, %

Gender of the household head	Extremely poor	Poor	% in total	% in total

			poor population	population of Armenia
Men headed households	2.1	32.0	62.8	73.9
Women headed households, including	4.8	33.4	37.2	26.1
Women headed households without a child (under the age of 6)	2.9	29.6	62.8	70.9
Women headed households with a child (under the age of 6)	9.5	42.7	37.2	29.1
Total	2.8	32.4	100.0	100.0

Table 20: Permanent population of Kotayk marz as of January 1, 2013

Marz, district	2011	2012	2013
Hrazdan	21845	21871	21873
Kotayk	58081	58108	58148
Nairi	36990	37002	37108
Kotayk Marz	116916	116981	117129

Population increase in Kotayk Marz partially is due to accommodation of refugees.

Socio-Economic Overview of the Impacted Communities

Geghardalich Gravity Irrigation Scheme project will have an impact on the communities Goght, Kamaris, Geghadir, Hatzavan and Voghjaberd, as well as Jrvej-Dzoraghbyur Gardeners Association and National Reserve Park. The irrigated area makes up 1448.8 ha served 3 pumping stations. The lands of Voghjaberd, Jrvej-Dzoraghbyur Gardeners Association, Jrvezh Forest Park are irrigated from Azat Reservoir by Azat pumping station, and the lands of Hatzavan and Geghadir communities are irrigated by Hatzavan and Geghadir pumping stations taking water from Azat River.

Table 21: Characteristics of irrigation systems based on information provided by impacted communities of Kotayk Marz of Armenia

Community	Irrigated area (ha)	Proposed Irrigated area (ha)	Proposed internal irrigation network (km)
Geghadir	-	120	9
Voghjaberd	55	55	6
Goght	674	650-700	1
Hatzavan	40	120	11.5
Jrvezh Forest Park	240	423.8	12
Kamaris			11.5
Jrvej-Dzoraghbyur Gardeners Association	330	330	44

The areas that will be affected by the Geghardalich scheme are considered low populated zones in terms of population density.

Table 22: Population in the Geghardalich scheme communities as of 2013

Community	Population number
Geghadir	730
Goght	2025
Voghjaberd	1003
Hatzavan	621
Jrvezh-Dzoraghbyur Gardener's Association	2868
Jrvezh Forest Park	–
Kamaris	2513

The unemployment and poverty in rural communities of the Marz is characterized by incomplete utilization of agricultural lands and weak development of infrastructures. 70-80% of the population of affected communities is involved in agriculture. The main agricultural crops are wheat, vegetables, fruits, fodder, etc. The main direction of animal husbandry is dairy products. Due to the poor state of the water supply system, the production of agricultural products has declined. Due to low income from farming and a lack of employment opportunities, there is permanent seasonal emigration in impacted communities.

Table 23: The irrigation systems of affected communities

Community	Irrigated area (ha)	Envisaged irrigated area (ha)	Envisaged pipeline (km)
Geghadir		120	5
Voghjaberd		55	6
Goght		650-700	1
Hatzavan	40	120	11.5
National Reserve Park	240	423.8	12

The investigated affected area is rich in historic and spiritual monuments of various ages, which stimulates tourism development in the region.

Geghadir

Geghadir is located on the 17th km of Yerevan-Garni highway and occupies 5.8 km².

The agricultural lands make up 1,274.4 ha, mainly black soil land, of which 64 ha are occupied by orchards (Simplified Plan of Geghadir Community). There is no internal irrigation network in Geghadir.

It is envisaged that 120 ha will become irrigable in Geghadir after implementation of the proposed activity. Population is 778 people according to 2013 data (Geghadir Plan). Community population is involved mainly in agriculture (production of wheat) and animal husbandry.

The water source for irrigation of community lands is Azat River.

Voghjaberd

Voghjaberd is located 25 km far from Yerevan and occupies 1426.47ha. Most of the population (2,012 as of 2014) are Armenians. The community has housing problems as 24 families live in caravans and 24 families are below poverty level and live on welfare subsidies.

Yerevan-Garni-Geghard highway goes through the village. Population is involved in fruit production and animal husbandry. Currently the entire area of the community is in emergency state due to landslide processes, which has negatively impacted social and economic condition of the population. The community does not elaborate any development plans due to active landslide processes. There are no useful mineral resources within village area.

The community land makes up 1,262.66 ha, of which 605.23 ha are agricultural lands including 25.63 ha orchards. 55 ha will be irrigated as a result of the proposed activity.

Goght

Goght is located on the right side of Gogt River. Population is involved in land farming and fruit growing. Gogt occupies 12.38 km². The population was 2,025 in 2013 and 2,055 in 2014 (an increase by 30 people). 40 people live beyond poverty level and get welfare subsidies. The community has housing problems as 15 families live in caravans. Community land makes up 4,753.33 ha, of which 4,419.9 – agricultural lands, including 97.67 ha orchards. The irrigable areas of Gogt make up 650-700 ha as of 2014, and it has a 15 km long pipeline.

Hatzavan

Hatzavan is located 58 km from the administrative center of Kotayk Marz, 15 km far from the city of Abovyan. It occupies 19.8 km². Most of the population (620 people as of 2014) are Armenians. 11 people live beyond poverty level and get social welfare.

The population is involved in animal husbandry and wheat production. Community land makes up 1,674.19 most of which are pastures 328.91 ha. Only 20 ha out of 120 ha are irrigated.

Jrvej Reserve Park

If the proposed gravity irrigation scheme is implemented, irrigation water will reach also Jrvej Reserve Park (“Jrvej Forest Park” of the “Reserve Park Complex” SNCO). The Park was established in 1977 and occupies an area of 423.8ha. The park was established within the area of arid mountain steppe and semi-desert zones for growing bush plants. Over 100 bush and tree species were introduced and unique examples of gardening designs were developed in the park since its establishment. 21 plant species included in the Red Book are grown here. The natural flora of the park comprises over 400 flower plants of high quality, and 103 plant species including 67 trees brought from other countries. Jrvej Forest Park is the only green zone which is still maintained around Yerevan, so establishment of a reliable irrigation system is important for its maintenance.

Only 188km of the park with 423.8ha is irrigated. The existing irrigation network is in poor state.

Jrvej-Dzoraghbyur Gardeners' Association

Jrvej-Dzoraghbyur Gardeners' Association is an area, managed by the Gardeners' Association where the land owners are the members of the Association. It has 2,868 private plots. The proposed operation will render irrigable 330 ha entirely represented by orchards. There is an irrigation network with overall length of 44 km comprising: 1 km d=300mm; 2 km d=200mm; 6 km d=150mm; 15 km d=125mm; 18 km d=100mm. The network is in poor state; 180 ha are not irrigated.

Kamaris

Kamaris is located 10 km far from the regional center of Kotayk Marz and 22 km far from the capital Yerevan. It occupies 16.49 km². The community land comprises 4,274 ha pastures, 950 ha arable lands and 196 ha homestead plots. It is close to Akunk, Zar, Gegashen, Garni and Gegadir rural communities. Population is 2,513 people mainly involved in animal husbandry and wheat production. There are 535 households. The considerable part of income comes from migrant labors.

Kamaris is among the poor and underdeveloped communities of Kotayk Marz. Socio-economic conditions of the community are unfavorable, it has irrigation problems. Only 30% of pastures are irrigated. Because of lack of irrigation networks most of the lands remained unirrigated, yields are low which impacts population income. The community is not among agricultural producers of the region as most of arable lands were converted into pastures due to lack of irrigation and loss of fertility, and the orchards do not serve their purpose.

No resettlement issues are anticipated in the affected communities during the implementation of works.

According to the design the pipeline will pass through community lands and pastures of Voghjaberd, Goght and Kamaris avoiding any private land use and the waste will be removed from the communities for 2-3km. However, some unforeseen circumstances and obstacles may force the construction contractor to change the route of the pipeline and face the need to use private lands. In such cases the construction works should

immediately be stopped and the PIU should start negotiations with the landowner to sign a voluntary easement agreement for the land use. If the landowner disagrees for his land use on voluntary basis than a Resettlement Action Plan (RAP) will be prepared 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.

Table 24: Assessment of Geghardalich Gravity Irrigation Scheme Project

	High possibility of positive impact	Positive impact is possible	Any impact unlikely	Possible negative impact	High possibility of negative impact	So far no judgments are possible	Comments
Social impact	A	B	C	D	E	F	
1. Incomes and facilities	+						Higher incomes due to expansion of irrigation network
2. Human migration		+					Higher new job opportunities
3. Resettlement/relocation			+				No impact
4. Construction related traffic increase and other nuisance to local communities				+			Shor-term temporary disturbance of local communities is expected from the movement of construction vehicles and operation of machinery that generates noise and dust
5. Temporary impacts on land use				+			Some temporary influence is expected during works
6. Temporary local employment for men		+					Temporary employment opportunity for local non-qualified labor
7. Temporary local employment for women		+					Traditionally Armenian women do not work in construction. So to ensure equal opportunities of temporary employment for local communities the contractor will offer relevant jobs for local women as well (e.g. cooking, cleaning)
8. Role of women		+					Expansion of irrigated areas will promote women employment as hired workforce for cultivation of lands
9. Minorities			+				No impact
10. Sightseeing places			+				No impact
11. Regional impacts			+				No impact
12. Recreation/leisure			+				No impact

Based on assessment of social-economic impact for the activity implementation, construction of the Geghardalich Gravity System and reconstruction of the Geghardalich reservoir is expected to significantly reduce water losses in communities. As a result of the increased irrigation water the communities will be able to irrigate more lands, and to increase the agricultural food yield from irrigated lands. Positive environmental and social impacts are anticipated from the construction of new conduits and rehabilitation of irrigation systems, which in the long-term would be expected to improve social and economic welfare of the population in the affected

communities. Rehabilitation of irrigation canals will improve the general operation of on-farm networks of the communities, providing sustainable irrigation water supply for agricultural lands.

4.4.3 Hydrology

Background

Geghardalich Reservoir, with a total storage volume of 2.4 million m³, was reconstructed in 1986, and, currently serves for gravity irrigation of about 700 ha of agricultural lands of Goght community.



Pipeline delivering water from the reservoir to irrigate agricultural lands of the Goght community

Before 1965 the reservoir was mainly fed with the inflow of small rivers of the watershed of the reservoir. The total inflow to Geghardalich Reservoir from the small rivers of the watershed (75% probability of occurrence) and inter-annual distribution are provided in the table below.

Table 25: Inflow to Geghardalich Reservoir from the small rivers of the watershed

Inflow	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
mln m ³	-	-	0.01	0.08	0.15	0.10	0.09	0.02	0.02	-	-	-	0.47



Gegardalich Reservoir

In 1965 derivation canal was constructed to transfer water from Karmir River to Geghardalich Reservoir. The capacity of the derivation canal, which is usually frozen in winter and early spring months, is 2 m³/sec. The abstraction point of the derivation canal is located on Karmir River at the altitude of 2752 m.

Calculation of Hydrological Flow of Karmir River

There is no hydrological observation post on Karmir River, thus the method of analogy was used to determine the main characteristics of the flow. “HayjNakhagits” CJSC used the 60 years’ observation data of Azat-Garni gauging station as the basis for analogy method, in order to determine the main characteristics of Karmir River flow. As an alternative option, a group of independent hydrologists suggested using Gegharot-Aragats hydrological post for the analogy method, taking into consideration similarities in physical-geographic, natural climatic conditions, as well as ground formation, watershed area and other characteristics with Karmir River watershed.

Details of calculations according to 2 different methods are presented in section 4.2 of this ESIA report.

Taking into consideration that the calculated annual flow of Kamir River for 75% probability of occurrence is 13.57mln m³ according to one method (analogue method using Azat-Garni post) and 20.5 mln m³ according to the other method (analogue method using Gegharot-Aragats post), in the follow-up calculations “more conservative” value of 13.57 mln m³ is taken as basis, on order to be on a “safe side”.

Water Economic Balance

The following baseline information is taken into consideration while developing the water economic balance for Geghardalich Reservoir:

- The annual flow of Karmir River for low-water year (75% probability of occurrence) is 13.57 mln m³. The total water withdrawal upstream the Geghardalich derivation canal (“Seven springs - Garni”) composes annually 4.29 mln m³;
- The annual environmental flow of Karmir River at the Geghardalich abstraction point is 1.80 mln m³ or 0.15 mln m³ per month, which is maintained at the moment and after implementing the Geghardalich irrigation scheme;
- Irrigation water demand for the Geghardalich Gravity Irrigation Scheme is calculated based on the manual “Crop Irrigation Norms and Regimes for Irrigated Areas of the Republic of Armenia” issued by the Institute of Water Problems and Hydraulic Engineering under the Ministry of Agriculture of the Republic of Armenia (<http://www.jhhi.am>);
- The total annual inflow from Karmir River to Geghardalich reservoir through the diversion canal composes 2.249 mln m³ before the project and 4.434 mln m³ after the project;
- The canal is frozen in the months November-February, so there is no inflow into the reservoir in those months;
- The annual inflow to the reservoir from the small rivers and streams of Geghardalich watershed is 0.47 mln m³;
- Inactive storage of Geghardalich Reservoir is 0.06 mln m³.

Thus, taking into consideration the above-mentioned baseline information, the water-economic balance for Geghardalich Reservoir is composed for low-flow years (75% of probability of occurrence), presented in the table below.

Calculation of Hydrological Flow of Gilanlar Mudflow Stream

Gilanlar mudflow stream is the right-branch tributary of Azat River. It is originated from the springs located on Taranist plateau at the elavation of 3115m, on the south-west slopes of Geghama mountains. It flows into Azat river at the elevation of 1350m.

The flow of Gilanlar has not been studied, hence the flow and its annual distribution was calculated through analogue method. Azat river was taken as an analogue and the data of Garni’s hydrological observation station as of 1939-2012 was taken as design baseline data. The catchment area of Gilanlar is $F = 10.2 \text{ km}^2$ at the intake section, and the catchment area of Azat-Garni, which is selected as an analogues, is $F = 326 \text{ km}^2$, hence

transition coefficient is $K = 10.2/326 = 0.03$. Natural average annual discharge of Azat-Garni is $5.76 \text{ m}^3/\text{sec}$, and taking into account the transition coefficient ($K=0.031$) it will be $0.18 \text{ m}^3/\text{sec}$ in Gilanlar.

Average, maximum and minimum discharges for different probability years were calculated for Azat-Garni observation station, afterwards it was transferred to the intake section using surface factor of river basins. The same method is used for distribution of annual flow.

Distribution of average annual flow at the intake section of Gilanlar for various probability years

Year	Probability P, %	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average	
Average high water	25%	Q, m^3/sec	0.14	0.14	0.15	0.26	0.46	0.35	0.18	0.15	0.15	0.14	0.14	0.14	0.20
		W, mil. m^3	0.37	0.34	0.40	0.67	1.23	0.91	0.48	0.40	0.39	0.37	0.36	0.37	6.31
Moderate	50%	Q, m^3/sec	0.13	0.12	0.14	0.23	0.42	0.32	0.16	0.14	0.14	0.13	0.12	0.13	0.18
		W, mil. m^3	0.35	0.29	0.37	0.60	1.12	0.83	0.43	0.37	0.36	0.35	0.31	0.35	5.73
Average moderate	75%	Q, m^3/sec	0.12	0.11	0.12	0.20	0.37	0.28	0.14	0.12	0.12	0.12	0.11	0.12	0.16
		W, mil. m^3	0.32	0.27	0.32	0.52	0.99	0.73	0.37	0.32	0.31	0.32	0.29	0.32	5.07
Low water	95%	Q, m^3/sec	0.09	0.09	0.10	0.16	0.30	0.23	0.12	0.10	0.10	0.10	0.09	0.10	0.13
		W, mil. m^3	0.24	0.22	0.27	0.41	0.80	0.60	0.32	0.27	0.26	0.27	0.23	0.27	4.15

Maximum discharges for various probability years

Intake section	Statistical parameters			Discharge by probability P%							
	Q0	Cv	Cs	0.1%	0.3%	0.5%	1%	3%	5%	10%	20%
Azat-Garni observation station	31.4	0.56	3.5Cv	150	129	122	102	88	70	58	48
Intake section of Gilanlar	31.4	0.56	3.5Cv	4.65	4	3.78	3.16	2.73	2.17	1.8	1.49

Minimum discharges for various probability years

Intake section	Statistical parameters			Discharge by probability P%						
	Q0	Cv	Cs	50%	60%	70%	75%	80%	90%	95%
Azat-Garni observation station	3.47	0.14	2Cv	3.44	3.32	3.2	3.13	3.06	2.87	2.72
Intake section of Gilanlar	3.47	0.14	2Cv	0.107	0.103	0.099	0.097	0.095	0.089	0.084

Thus, it is expected to transfer 1-1.5 mil. m^3 from Gilanlar to Geghardalich Reservoir in May during dry years. It is expected that after Project the flow at Azat-Garni observation station will reduce by 3.50%-5.25% in May and by 0.77%-1.15% annually.

Water economic balance of Geghardalich Reservoir for 75% of probability of occurrence before and after the project, mln m³

Before the project: current situations

Month	Karmir River flow	Water use above the canal		Environmental flow	Calculated flow at the derivation canal point	Inflow from the small rivers of Geghardalich watershed	Flow available for use	Inflow to reservoir	Outflow from the reservoir	Reservoir volume at the end of the month
		Irrigation	Drinking-communal							
January	0.80	0.00	0.158	0.15	0.492	0.00	0.492	0.00	0.00	0.060 ⁴
February	0.70	0.00	0.158	0.15	0.392	0.00	0.392	0.00	0.00	0.060
March	0.86	0.00	0.158	0.15	0.552	0.01	0.562	0.01	0.00	0.070
April	1.42	0.00	0.158	0.15	1.112	0.08	1.192	0.08	0.00	0.150
May	2.68	0.30	0.158	0.15	2.072	0.15	2.222	1.93	0.00	2.079
June	1.94	0.40	0.158	0.15	1.232	0.10	1.332	0.10	0.36	1.820
July	1.04	0.60	0.158	0.15	0.132	0.09	0.222	0.09	0.79	1.125
August	0.86	0.50	0.158	0.15	0.052	0.02	0.072	0.02	0.77	0.380
September	0.83	0.37	0.158	0.15	0.152	0.02	0.172	0.02	0.34	0.060
October	0.83	0.23	0.158	0.15	0.292	0.00	0.292	0.00	0.00	0.060
November	0.78	0.00	0.158	0.15	0.472	0.00	0.472	0.00	0.00	0.060
December	0.83	0.00	0.158	0.15	0.522	0.00	0.522	0.00	0.00	0.060
Annual	13.57	2.40	1.896	1.80	7.474	0.47	7.944	2.249	2.249	

⁴) Inactive or “dead” storage of the reservoir.

After the project

Month	Karmir River flow	Gilanlar River flow	Water use above the canal		Environmental flow	Inflow from the small rivers of Geghardalich watershed	Flow available for use	Irrigation water demand for 1448 ha	Inflow to reservoir	Outflow from the reservoir	Reservoir volume at the end of the month
			Irrigation	Drinking-communal							
January	0.80	0.35	0.00	0.16	0.15	0.00	0.84	0.00	0.00	0.00	0.06
February	0.70	0.29	0.00	0.16	0.15	0.00	0.68	0.00	0.00	0.00	0.06
March	0.86	0.37	0.00	0.16	0.15	0.01	0.94	0.00	0.00	0.00	0.06
April	1.42	0.60	0.00	0.16	0.15	0.08	1.87	0.00	0.08	0.00	0.14
May	2.68	1.12	0.30	0.16	0.15	0.15	3.49	0.12	3.35	0.12	3.37
June	1.94	0.83	0.40	0.16	0.15	0.10	2.26	1.21	1.00	1.21	3.16
July	1.04	0.43	0.60	0.16	0.15	0.09	0.74	1.56	0.00	1.56	1.60
August	0.86	0.37	0.50	0.16	0.15	0.02	0.46	1.19	0.00	1.19	0.41
September	0.83	0.36	0.37	0.16	0.15	0.02	0.55	0.35	0.00	0.35	0.06
October	0.83	0.35	0.23	0.16	0.15	0.00	0.64	0.00	0.00	0.00	0.06
November	0.78	0.31	0.00	0.16	0.15	0.00	0.78	0.00	0.00	0.00	0.06
December	0.83	0.35	0.00	0.16	0.15	0.00	0.87	0.00	0.00	0.00	0.06
Annual	13.57	5.7	2.4	1.90	1.8	0.47	14.144	4.434	4.434	4.434	

5 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 Geghardalich gravity irrigation system. Both perspectives are described below.

5.1 “No Action” Alternative

“No Action” alternative refers to the case with no reconstruction of Geghardalich Reservoir and no construction of Geghardalich gravity irrigation scheme. As it might be anticipated, the “No Action” case would be expected to have a negative socio-economic and environmental impact.

Due to the unreliability of the current irrigation system, the depreciated and obsolete state of pumping stations and intense leakage from the Geghardalich Reservoir, the water supply from the reservoir will further deteriorate in future. The “No Action” case will result in:

- Further deterioration of the existing irrigation system, dam and structures;
- Higher operation and maintenance costs;
- Deterioration of physical-chemical conditions of soil;
- Reduction of irrigated areas and reduction of crop productivity;
- Lower income of rural population;
- Increased migration from rural settlements.

Thus, “No Action” case will adversely affect socio-economic conditions of the project areas and will not support improvement of agricultural production and poverty reduction within the areas covered by the Project.

5.2 Proposed Alternatives

While discussing the alternatives and making final selection the economic efficiency indicators were taken into consideration. No alternatives related to different volumes of reservoir were discussed, given the fact that anything less than proposed volume would result in insufficient water quantity for irrigation, and anything more than the proposed volume would be unrealistic in terms of filling in the reservoir. In terms of environment no other alternatives were studied, given that the territory is less vulnerable in this regards: the water source that is feeding the reservoir is in reality a seasonal gully without any ichthyofauna, and as for the impact on other aspects (biodiversity, lands) the different alternatives of the volume would not result in significant changes in impact.

Two alternative designs for reconstruction of the Dam 1 and Dam 2 and increasing the capacity of the reservoir were developed based on investigations and on-site measurements:

Option 1: It is proposed to construct a 1.6 m high concrete parapet on the both existing dams in order to attain the 3.4 Mm³ volume of the reservoir and take into account the wave impact under the FSL of 2709.3 m. That will allow inclusion of the top 2.0 m low quality fill of the embankment in water accumulation.

Option 2: It is proposed to remove the low quality fill of the embankment to the level of 2706.8 m (1.6 m), make a new fill by loam until the 2710.2 m (2.6 m) level of the dam crest and construct a concrete parapet.

The preference is given to the option 1 based on technical and economic parameters.

In order to reduce seepage losses from the dam body and reservoir floor, it is proposed to cover the upstream slopes of the dams and reservoir floor along the embankment by about 70 m wide sealing bentonite film (mat).

Irrigation outlet

As it was stated above, intense seepage is observed along the irrigation outlet pipe – about 70 l/s. Two options for reconstruction of irrigation outlet and reduction of the seepage were considered under the preliminary design.

Option 1: It is proposed to make a 3 m deep and 10 m wide toe of loam material at the intake structure of the irrigation outlet and construct a new intake. A new valve unit will be installed and two water meters constructed at the downstream end of the irrigation outlet pipe. One will be constructed on the main pipeline and the second – on the existing pipeline of Goght community.

Option 2: It is proposed to dismantle the existing irrigation outlet pipeline over its entire length. To this end, a deep trench will be excavated in the embankment of Dam 1 with a bottom width of 6 m and maximal height of – 15m, slope inclination $m=0.3$. A new $Dy=600$ mm pipeline will be installed with a concrete casing instead of the dismantled one and the trench excavated in the embankment will be backfilled by loam.

The preference is given to the option 1 based on technical and economic parameters.

Spillway

The level of the water intake structure of the existing spillway is at 2706.58 m. In order to have a reservoir with a capacity of 3.4 Mm³, the spillway has to be reconstructed with construction of a weir at the level of 2709.0 m (FSL).

The walls of the spillway intake will be extended to the level of 2709.6 m.

The spillway's diversion canal is made of RC L-20 block. The length of the diversion canal is 106 m. Most of the blocks are inclined. It is proposed to strengthen the displaced blocks using RC spacers after each 2 m (52 items).

Supply canal

The existing supply canal starts from the intake structure constructed on Karmir River. Its length is 3.6 km, and it is designed for diversion of 2.0 m³/s water from Karmir River to Geghardalich Reservoir. The technical state of the canal was investigated and emergency sections identified. The preliminary cost for rehabilitation works was estimated.

Gravity irrigation scheme

The 3.4 Mm³ volume of Geghardalich Reservoir is intended for irrigation of 1,448.8 ha. It is proposed to irrigate the 705.52 ha of Goght community through the existing Geghardalich-Goght pipeline. A main pipeline from Geghardalich Reservoir to the pressure basin of the 4th stage of Azat pumping station will be constructed for gravity irrigation of 743.28 ha.

The length of the main pipeline is about 26.0 km. It is proposed to make it of steel pipes $Dy=600$ mm placed in a closed trench. The design discharge of the main pipeline makes up $Q_{des}=523.6$ l/s. Air and emptying valves will be installed on the pipeline.

Considering that the existing pressure basin is located within a landslide area (Vogjaberd landslide) and currently is deteriorated, it is proposed to construct a new pressure basin and connect it to the existing irrigation network.

3,544 km long Geghadir-Hatzavan branch made of $Dy=250$ mm steel pipes will start from DM211+00 of the main pipeline and go until the pressure basin of Geghadir-Hatzavan pumping station. The pipeline will be placed in a covered trench.

6 BENEFICIAL AND ADVSERSE IMPACTS AND MITIGATION

Replacement of the existing pumping station under the Geghardalich 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 Geghardalich 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 Geghardalich gravity system.

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

6.1 Design phase

Environmental and social mitigation requirements and community feedback 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 negative impacts.

During these periods of time the factor of noise of vehicles, mechanisms and other works of recovery will have direct impact on animals. In order not to violate the migration routes of the animals, crossing paths/bridges must be ensured in the open sections of the system.

During the design of the pipeline route in Geghardalich Gravity Irrigation Scheme 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.

6.2 Construction phase

6.2.1 Environmental and social impacts at the construction phase

Environmental impacts at the construction phase

The construction period is envisaged to be 2 years. For construction and installation works from 6 to 7 bases are envisaged (4 will be located in the reservoir area, and the remaining is proposed to be located in the area of the gravity pipeline to be constructed). Construction works will be implemented by 2 or 3 brigades of 45-60 workers staff.

The main types of works to be performed are:

- Earthworks (excavation, loosening, backfilling, leveling and other);
- Installation and dismantling works;
- Coating of pipes;
- Concrete works;
- Asphalt concrete works.

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

Environmental impact during implementation of construction is mainly stipulated with disposal of soil mass, operation of construction machinery and vehicles and other construction works.

Dust emissions during excavation-loading

Based on the calculations of dust-emissions made according to the existing methodology (Временное методическое пособие по расчету выбросов от неорганизованных источников в промышленности строительных материалов. Новороссийск, 1985г.) and shown in section 4.3, no exceedance of norms due to dust emissions during excavation-loading is expected.

Diesel fuel emissions

The emissions rate of heavy vehicle and machinery according to the methodology in section 4.3 is given below.

Table 26: Emissions rate (g/kg of fuel)

Type of fuel	Material						Conventional unit
	NO _x	CH	COM	CO	N ₂ O	CO ₂	
Diesel fuel	42.3	0.243	8.16	36.4	0.122	3138	4.3

Table 27: Verification coefficients of harmful substances

Category of vehicle	Harmful substance	Impact coefficient	
		Average age	Technical conditions
High capacity vehicles	CO	1.33	1.8
	CH	1.2	2.0
	NO _x	1.0	1.0
	CO ₂	1.0	1.0
	N ₂ O	1.0	1.0

*Classification of vehicles is adopted in the methodology “Core Inventory of Emissions in Europe” (hereafter CORINAIR).

During construction 108 units of vehicles and technical facilities will be totally operated, which use diesel fuel. The rate of diesel fuel per a day will make 531 l, for the entire construction – 292291 l, or 189467 l x 0.835 l/kg = 244063kg or 244 t.

Table 28: Rate of Emissions of Harmful Substances

Category of vehicle	Harmful substance	Emissions rate, g/kg	Emissions	
			t/hour	g/s
High capacity vehicles	CO	87.14	21.26	1.34
	CH	0.58	0.14	0.0084
	NO _x	42.3	10.32	0.65
	N ₂ O	0.122	0.03	0.0019
	COM	8.16	1.99	0.125
	CU	4.3	1.05	0.066

Based on the calculations of diesel fuel emissions made according to the existing methodology (Временное методическое пособие по расчету выбросов от неорганизованных источников в промышленности строительных материалов. Новороссийск, 1985г.) and shown in section 4.3 of this ESIA report, no exceedance of the existing norms is expected.

Emissions during preparation of concrete mix

For preparation of concrete mix, a concrete mixer shall be installed in the Geghardalich reservoir site. It will operate about 1000 hours totally. The quantity of concrete works in the Geghardalich reservoir site will make 3807.62m³ and 463.37m³ in works of the pipeline construction, altogether 4270.99 m³. During preparation of mix cement, aggregates and water are used. Aggregates are hauled in wet state, but cement in dry form by cement carriers.

Based on the calculations of emissions in the course of preparation of cement mix, made according to the existing methodology (Временное методическое пособие по расчету выбросов от неорганизованных источников в промышленности строительных материалов. Новороссийск, 1985г.) and shown in section 4.3 of this ESIA report, no exceedance of the existing norms due to emissions for preparation of concrete mix is expected.

Emissions from welding works

Welding works are envisaged in various construction sites – of bearing structures, reinforcing bars, mounting of steel pipes and in other places. Welding works shall be implemented during 25 days or 200 hours.

Electrodes of AHO type are proposed for welding, during use of which emissions of welding aerosol and manganin oxide appear.

The average daily requirement of up to 10kg of electrodes is envisaged.

Aerosol - 14.4 g/kg x 10 kg/day = 144 g/day, 0.005 g/s, 0.0036 t/constr. period

Manganin oxide - 1.87g/kg x 10 kg/day = 18.7 g/day, 0.00065 g/s, 0.00047 t/ constr. period Construction works will be implemented significantly far from settlements and formed harmful substances practically will not impact on pollution of air basins.

Table 39: Amount of harmful emissions into atmosphere during construction period

Stages of Construction Works	Amount of harmful emissions into atmosphere, g/s (t/constr. period)								
	Inorganic dust	CO	COM	NOx	CU	SO ₂	Welding aerosol	CH	Manganese oxides
1.Excavation-loading works	2.4 (36.4)								
2. Operation of construction machinery	0.094 (0.34)								
3. Emissions connected with diesel fuel	-	1.34 (21.26)	0.125 (1.99)	0.65 (10.32)	0.066 (1.05)	0.06 (0.976)	-	0.0084 (0.14)	-
4. Welding works	-	-	-	-	-	-	0.005 (0.0036)		0.00065 (0.00047)
5. Concrete works	5.2 (12.34)	-	-	-	-	-	-		-

TOTAL		1.34 (21.26)	0.125 (1.99)	0.65 (10.32)	0.066 (1.05)	0.06 (0.976)	0.005 (0.0036)		0.00065 (0.00047)
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(b) Impact on Water Resources

According to the work implementation plan, 6-7 bases will be in the site but a shelter for the construction workers will be provided in settlements located close to the Geghardalich reservoir and gravity irrigation system. It is expected, that contractor or sub-contractors (most likely physical entities from these settlements) will take care of themselves, prepare meal and make agreement for transportation.

The drinking-communal water requirements for the construction workers will be met using the existing drinking water pipelines of the communities of the target area. This has been already agreed with the respective communities. In places, where such pipelines are very far, water necessary for drinking-domestic needs of workers shall be hauled to the construction site by a water carrier and stored in reservoirs.

(c) Earth works

During reconstruction of the Geghardalich reservoir and construction of the gravity irrigation system disturbances of various types on different plots are imminent, which are expressed by both direct and indirect impact on the area. The entire area as a result of reconstruction of the Geghardalich reservoir and implementation of the gravity irrigation system makes 156 000m² (alienation area of the pipeline about 26km long and 6m wide). The main negative impact modes on earthen resources while carrying out preparatory and earth works in the construction zone are segregated:

- Disturbance of arranged natural relief form as a result of carrying out earthworks of various type – filling of embankments, excavation of foundation pits and trenches;
- Worsening of physical-mechanical and chemical-biological properties of fertile soil layer;
- Worsening of agricultural lands quality and economic damage to agriculture concurrently with it;
- Possible pollution of soil surface by construction and domestic waste;
- Technogeneous disturbance of micro-relief as a result of numerous movements of heavy construction machinery.

According to the legislation in force all damages and losses of land users must be entirely compensated.

(d) Noise

Impact of noise on the environment (animals) appears during reconstruction of the Geghardalich reservoir and construction of the gravity irrigation system. Noise appears during operation of construction machinery and compressors. The impact is short term.

The nearest populated village is located 1.5-2.0km far from the Geghardalich reservoir and route of the gravity irrigation system. The calculation of noise level in the village area and in structures is carried out according to СНиП 11-12-77 and is presented in table below. As a result of calculations (shown in section 4.5 of this ESIA report), it may be concluded that during construction of the pipeline the noise level in the populated area of the village is 29DBA, which is well below the norm of 55DBA.

(e) Generation of construction waste

At the preparatory stage of construction during construction of access roads excavation of vegetal and mineral soils takes place. During construction of access roads earthen roads shall be leveled by bulldozers for approach of construction machinery.

According to the design data the quantities of implemented works (provision of road embankment) make 4705.0 m³.

Subsequently, the mineral soil excavated in the process of construction shall be used for backfilling and re-cultivation of a vegetal layer.

As a result of life activity of personnel implementing the construction domestic wastes are formed, which shall be disposed into sites, designated by sanitary-epidemiological stations of regions and agreed with local authorities. Domestic wastes are disposed into the nearest functioning treatment plant (the nearest plant is Yerevan Aeration). Besides domestic wastes, during rehabilitation works of the Geghardalich reservoir construction waste is formed as well – 62m³ and 178.8m³, and during implementation of the pipeline - of 0.5m³ and 277m³ quantity. The total quantity of construction waste to be disposed from the site will make 518.3m³.

The calculations of domestic wastes quantity are presented in the table below. The total number of employees is 470, 45-60 workers in each shift.

Table 30: Calculation of domestic wastes during construction

Parameter	Reference	Measurement unit	Name	Value
1. Quantity of domestic waste per 1 person	Q ₁	m ³ /year	Norm	0.31
2. Number of employees	Ч	people	Design data	470
3. Construction period	T	year	Design data	2.0
4. Density of domestic waste	P	t/m ³		0.3
5. Domestic waste during construction period	M	m ³ /constr. period	M= Q ₁ ×Ч×T	157.356
	M	t/constr. period	M= Q ₁ ×Ч×T× p	47.2

Table 31: The quantitative and qualitative content of wastes formed during construction

No	Waste	Grade and code of danger	Processes, when wastes are formed	Amount, t or m ³	Composition and properties of waste	Method of disposal and use
1	Domestic rubbish	091200400004	Activity of construction brigades	47.2t	Nontoxic, solid. Composition – mixed, paper, polyethylene bottles, food waste	Collected in dustbins. Disposed into spoil area for solid domestic wastes
2	Construction rubbish	3990120001004	During construction works	518.3m ³	Nontoxic, solid. Composition – stones, demolished asphalt concrete	Disposed into designated site located about 2km away

(f) Biodiversity

Excavation works of trenches envisaged for the Geghardalich Gravity System will have direct harmful impact on the trenches area and natural plant cover of its environment.

The project implementation territories are mainly pastures, which are subject to over-grazing. Also, the pipeline route mostly passes next to earthen roads or through the routes of previously existing pipelines (currently dismantled), which have already been subject to anthropogenic impact. The vegetation of the immediate vicinity of the project impact territory is represented with species, widely distributed in the region. This will not be subject to significant impact during the construction works. The vegetation is mainly represented with semi-desert wormwood plants. In the area one can observe the following species: Capparis spinosa, Astragalus, Thyumus kotschyanus, Koeleria cristata, Phleum, Agroyron and others.

Earthworks will leave direct harmful impact on fauna, endangering their burrow and nestling sites, and the temporary nature of auto-mechanization noise may disturb their migration and drinking ways. In order to find food, they enter into semi-desert areas where there are many rodents, birds and other animals. Dipodid (*Dipodidae*) is another specific inhabitant of the semi-desert and desert areas. The large number of rodent burrows evidences their dense population. The rodents are represented by gerbille, vole, brown hamster and wood mouse), because mammals are less mobile than birds.

As already mentioned before, there are no protected areas located close to the Geghardalich Gravity System, and the closest ones are located far enough, not to have any direct or indirect impact on fauna or flora due to the works to be implemented in frames of the project.

Works for Geghardalich scheme will not have impact on any known physical culture heritage. Earth works will carry common likelihood of chance finds.

Social impacts at the construction phase

There might be some social impacts during the construction phase:

(a) Increased traffic, noise and dust related to construction

A short-term increase in traffic is expected in the communities related to the movement of construction vehicles and operation of machinery. This could disturb the peaceful life of the local communities and sometimes block the roads.

The operation of machinery will generate noise and dust, which might cause health problems in the communities.

(b) Temporary impacts on land use

The design of the gravity scheme avoids private lands, and there are no land alienation or resettlement impacts anticipated. However, some temporary use of community lands is expected during works.

(c) Temporary local employment

The positive social impact of the construction phase is the temporary employment opportunity of local non-qualified labor. These will mostly be workers and drivers. However, there is a risk that women will not have the same opportunity of temporal work, as traditionally women do not work in construction in Armenia.

6.2.2 Mitigation and enhancement measures at the construction phase

Environmental Impact Mitigation

(a) Clearing of Vegetation

The layer of the soil, containing vegetation, which has been removed during the construction works, will be properly stored and after the back filling the layer will be put back. Topsoil reinstatement will be sufficient for natural regeneration of grass vegetation along the piping.

(b) Excavation Works

During the excavation works, the layer of the soil, containing vegetation, as well as the humus layer, will be properly maintained and stored. In order to avoid wind and erosion impacts, the humus black-soil layer will be covered with vegetative soil layer, and the back filling will be conducted in the same order.

(c) Operation of Vehicles and Machinery

In order to mitigate the impact from oil spill, atmospheric emissions and noise, corresponding duty regime of

works is defined. In addition, it is envisaged to implement the construction works in different districts consecutively, phase by phase.

(d) 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 the Ministry of Nature Protection must be informed.

(e) Operation of Construction Camps

According to the design it is planned to have 6-7 temporary bases/construction camps, which will be mainly located next to the existing temporary shelters in the highlands (made by shepherds, etc.). Construction camps will be established on community lands. Each construction camp should be created after the consultation with the environment specialists of the supervision consultant. Proper sanitation must be provided and household waste shall be regularly removed.

(f) On-site Storage and Disposal of Waste

In the construction camps corresponding districts will be designated for storing the waste. Respective communities have provided their agreement on that. The waste stored will be periodically transported to the nearest urban landfills.

In the construction stage the contractor must take appropriate measures in order to prevent the deterioration of landscape, the erosion of lands, and the pollution of surface and ground water resources and soil and/or to minimize it. These must include but not be limited by the following: the use of already existing mines and waste disposal sites (according to the terms under the appropriate permits and agreements acquired at the projection stage), precise demarcation of temporary storage sites of the waste (so that these sites do not cause any serious damage to vegetation and to other components of the environment and which must be ensured by the construction contractor), the strengthening of surfaces of pipelines with approximately 5% slope, and the strengthening of high slopes with vegetation, grass and other plants, concrete layer or with gabions, the recovery of all the vegetation and bringing to the initial condition to prevent erosion (before starting the work the fertile layer of the soil must be properly removed and kept in the relevant site in accordance with the requirements of RA Government decision N1396 of September 9, 2011), furnishing the storage sites of fuel lubricants and chemicals with relevant supplies to minimize the pollution of water and soil, the reduction of noise and dust in the construction site especially in the case when the construction work is carried out close to public places, educational establishments. In this case it is needed to use closed or covered trucks for the disposal of the construction materials and waste. Soil works are planned to be performed with technical means and devices equipped with vacuum cleaner. Vehicles and techniques should be regularly checked, regulated and ensured with the effective damping of sound. Construction squares and approaching roads must be regularly watered, and gravel, stored and transported soil masses must be moistened to minimize dust (except the months of winter). Bulk materials should be stored in the area under cover and protected with a special membrane.

At the construction stage household and other waste should be stored in a septic pit built with waterproof materials, which will regularly be emptied in accordance with the applicable rules. Wastewater will be transported to the existing sewer system with specific trucks in accordance with the terms of signed contract.

Construction squares must be projected in the areas devoid of vegetation, temporary buildings must be placed parallel to the outline in the areas devoid of vegetation, above the surface of the ground: on crutches. Construction waste must be regularly removed.

If during the construction works it will be necessary to temporarily use land areas with vegetation, then the following re-cultivation works must be ensured to exclude or mitigate adverse impacts on the natural vegetation:

- Cutting the edaphic vegetated layer of the areas covered with vegetation in advance and storing in the area devoid of vegetation or within the alienation zone or in the specific area agreed with local self-government bodies;
- Drilling the fertile layer of the soil of the areas beaten and devoid of vegetation with excavator in advance and storing in the nearby area devoid of vegetation.

If during the construction work arise unforeseen environmental and/or social problems (for example: disagreements with beneficiaries/officials related to final works, existence of legal or illegal use of alienated zone which prevents the proper implementation of construction works, use of public and/or privately owned land or other property, etc.), work must be stopped and they shall immediately notify the Engineer and Water Sector Projects Implementation Unit in writing. Work can be continued only after giving solution to the problem agreed with the relevant agencies.

(g) Minimizing impact on flora and fauna

To prevent or mitigate negative impact on fauna species of the project area, which are described in detail in section 5.3.1 of this ESIA report, an optimal schedule must be drawn up for excavation of trenches, for implementation of earthworks to install pipelines, which allows to minimize negative impacts on animals, in particular, in the period of their breeding and seasonal migration. In the mentioned periods the factor of noise of vehicles, mechanisms and other construction works will have direct negative impact on animals. From this viewpoint, the best period to implement construction works is late autumn and winter. Thus, the construction works within the Lot 1 (reconstruction of the dam and rehabilitation of supporting infrastructure) can be implemented only in the period of September-November, taking into consideration the need to avoid the irrigation season and weather conditions (2710 m above the sea level). Construction works within the Lot 2 (first section of the main pipeline) can be implemented in a larger time-interval, given that in the lower sections the weather conditions are milder (2000-2710 m above the sea level). And finally, the construction works within the Lot 3 (second section of the main pipeline) will be conducted only during winter months, given that the weather conditions in this section are much milder (1420-2000 m above the sea level).

For not disturbing migration ways of wild and/or domestic animals (from temporary settlements near the reservoir and other project areas), which are described in detail in section 5.3.1 of this ESIA report, suitable passage ways/bridges must be provided in open sections of the system.

These features must be taken into consideration when drawing up and organizing Construction Works Schedule.

To mitigate or possibly exclude the harmful impact of envisaged works on natural plant cover (*in the high altitude areas of the project there are no trees or bushes, whereas in the lower altitude areas it is not envisaged to cut trees or bushes*) excavation works of trenches are necessary to be carried out in the beginning or end period of plants vegetation, avoiding from cutting of trees and bushes and concurrently providing the following re-cultivation works:

- Top soil of areas, covered with plants, will be cut by a scraper in advance and earthed up in sites free of plant cover, then returned into the former place after provision of backfilling and leveling of trenches;
- Fertile soil layer of trampled down areas and areas free of plant cover will be removed by an excavator in advance and earthed up in the nearest area free of plant cover and returned into the former place after provision of backfilling and leveling of trenches;
- To protect and rational use top soil in the case of installing a pipeline over ground surface, fertile soil layer will be removed from the pipeline routes in advance and earthed up in a site free of plant cover, and will be used as much as possible for planting of greenery for that community, if necessary, or for other necessary sites.

(h) Handling Chance Finds

In case of encountering chance finds during earth works, construction contractor will be obligated to immediately take all activity on hold and promptly notify PIU. Management of PIU must communicate information to the State Agency for Historical and Cultural Monuments Protection in written and seek further guidance. Sufficient time and space must be allowed to undertake actions required for extraction and

transportation of finds and conservation of the site. PIU shall issue notice to works contractor and the resumption of works after receiving written notice on the completion of archaeological works from the State Agency for Historical and Cultural Monuments Protection.

Social Impact Mitigation

(a) Temporary Land Use

Agreements from communities allowing temporary land use during construction are included in Annex J. Construction camps will only be established on unused communal lands. Should any use of private lands be required at any stage of the construction or operation of the scheme, the construction contractor must immediately stop all works, inform the PIU, and prepare a Resettlement Action Plan (RAP), if required, in compliance with the Resettlement Policy Framework.

(b) Public awareness

The construction contractor will properly inform the affected communities about the beginning of construction works in the result of which the levels of dust and noise may be added, the roads may temporarily be closed and overcoming routes may be created. The contractor will also create gender-sensitive temporary employment opportunities for women, such as cooks and cleaners. The affected communities will be informed about complaint procedures and the project grievance redress mechanisms through which the public can raise questions, concerns, grievances and 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. The contractor and PIU will coordinate the process.

(c) Noise and Dust

In sequence of other actions 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:

- Install construction camps as far as possible from the inhabited areas;
- Carry out noisy works during day hours;
- Reduce the usage of heavy technique near the inhabited areas as possible;
- Install noise absorber plants on machine equipment.

(d) Safety measures

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

In order to avoid or reduce safety risks associated with the construction works, the following mitigation measures are proposed:

- Raise awareness of negative impacts during construction works;
- Ensure that workers and any visitors are provided and use personal protective gear;
- Insure that workers receive worksite safety training,
- Insure that workers operating large equipment are properly trained and licensed
- Ensure that construction equipment is inspected and licensed
- Ensure that construction equipment is used strictly following its operation instructions;
- Keep first aid medical kits and fire-fighting equipment on site
- Disallow on-site activities beyond the working hours.

- Ensure that active work sites are fenced so that children/people cannot access and become injured.

Table 32: Impacts in the course of construction and proposed measures to mitigate them

Impact	Signs	Degree of tangible results	Duration of the impact	Direct/ Indirect	Notes
Layer of soil and erosion	In the section of the river Karmir ●●●	In the section of the river Karmir ●●●	Long term	Direct	Soil work should be implemented in the area of head-water intake and the pipeline route. There will be necessity of creation a construction site for the head part in the course of construction work and in case of digging the trench for the pipeline – in case of necessity as far as work will be implemented along the existing dirt roads by using sections of already broken ground areas. After the completion of the construction work the excavated soil will be used for backfilling purposes, in case of necessity the vegetation layer will be restored.
	In the section of Geghardalich reservoir rehabilitation ●●	In the section of Geghardalich reservoir rehabilitation ●●			
	In the rest section of the program implementation ●	In the rest section of the program implementation ●			
Landscape and visible aspects	●	●	Short term In the course of construction	Direct	There are temporal structures in the territory of the construction work implementation designed for cattle breeding, for sheep grazing in the summer - “yaylaghs”. Damage caused to these areas in the course of construction works is limited.
Noise	●	●	Short term	Direct	To mitigate the impact of and to reduce the level of noise and dust during the construction phase, the following measures are defined:

Impact	Signs	Degree of tangible results	Duration of the impact	Direct/ Indirect	Notes
			In the course of construction		<ul style="list-style-type: none"> • Installation of construction camps as far as possible from the inhabited areas; • Noise 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.
Air quality	•	•	Short term In the course of construction	Direct	Taking into consideration the limited duration of construction work impact of the vehicles exhaust gases emission into atmosphere will be low. Construction equipment and vehicles will be regularly checked to minimally reduce the negative impact of the environment.
Groundwater resources	•••	0	Short term	Direct	During construction work the proper functioning of the safety and health management program will be in force. There isn't danger of groundwater contamination (e.g. lubricant/fuel of equipment and trucks) because according to the data of the area geological exploration, the possible aquifer layer is from 30 to 120m and more depth and contamination may be prevented by proper maintenance. In addition, in the course of construction work lubricants/fuel may adversely affect the surface waters in the result of the activities carried out essentially in the shallow waters near the Geghardilch reservoir when the bowl is empty and when laying the pipeline, they will partially cross only small streams.
Surface waters	•••	•	In the course of construction		
Flora and Fauna	••	•	Short term In the course of construction	Direct	Greatest part of the cut soils is of agricultural designation, they belong to communities and they aren't of special importance to provide a habitat of endangered or critically endangered species. However, in the vicinity of the projected area can be found some important Habitat for birds, reptiles and

Impact	Signs	Degree of tangible results	Duration of the impact	Direct/ Indirect	Notes
					mammals. This pipeline will not pass through the forested areas of the State reserves "Khosrov" and "Erebuni", as well as lands of the "Jrvezsh Park Complex". It is planned to construct crossings for the relevant parts of the livestock and animals (wood or metal passes).
Protected areas	●●	●	Short term In the course of construction	Indirect	The proposed program will be carried out far from the specially protected, "Khosrov" and "Erebouni" state reserves or from the Jrvezsh Forest Park. This fact gives possibility to considerably mitigate, reduce or exclude impact of construction activities, thus making it the most intangible.
Access roads	●●	●	Short term In the course of construction		From the point of view of flora, fauna and historical sites protection, negative effects would be tangible when there would be necessity to construct access roads. However, the route of the pipeline was primarily chosen along the road as well as in the areas already disturbed in the result of human activities to minimize the negative impact on the environment. Within the limits of possibility, they use the existing roads of the community organizing their works so as not to hinder community traffic and to inform the community of alternative roads if possible, not to disturb community life and to provide access to private lands.
Construction camps	●●	●	In the course of construction	Direct	Construction camps will be based only on unused community lands.
Solid wastes (Originated in the result of implementation of construction works and	●●	●	Short term In the course of construction	Indirect	Some sections of the design will pass in the remote areas where there are no proper waste dump places. During the design phase the Consultant reached a written agreement with the communities on temporary waste disposal sites. From these temporary waste disposal sites the waste will be periodically transported to regular centralized urban landfills, and thus in the course of project implementation there will be no regular collection of waste, thus

Impact	Signs	Degree of tangible results	Duration of the impact	Direct/ Indirect	Notes
activity of workers)					eliminating the need for a permanent solid waste landfill.
Health and safety	●●	●	Short term In the course of construction	Direct	The Contractor shall develop the corresponding system of work safety, hygiene and proper environmental management and carry it out in the course of the construction phase.
Historical and cultural sites	●●●	●	Short term in the course of construction and Long term impacts in the result of physical impact of the program	Direct and indirect due to the pipeline (visible aspect)	Historic Places were either bypassed or they are absent in the zone of the program implementation. There is the Vishapakar memorial obelisk on the top of the hill near the Geghardalich reservoir, 150 meters from the reservoir. In the case of an accidental discovery during construction work they shall stop working immediately and agree the further steps in order to be informed about their historical and cultural monuments protection agency (according to the legislation).
Use of land and alienation	●	●		Direct and indirect	During the construction phase temporary use of community lands is expected (the design avoids private land use). Construction camps will also be established on unused community lands. After the construction activities and the pipeline installation, the used land will be rehabilitated and at the operation phase can be used for agricultural purposes as grasslands and pastures.
Substructures	●●	●	Long term	Direct	
Gender problems	●●	●	Short term	Indirect	Pipeline installation may aggravate the existing gender differences, mainly because of the fact that mainly men will be involved in the construction work, consequently money is likely to be mostly received by men (but not women) who control the financial situation, and that leads to growth of the number of families which are less likely to benefit from the situation. There is basically a

Impact	Signs	Degree of tangible results	Duration of the impact	Direct/ Indirect	Notes
					large percentage of women-headed households in the area and women are the most vulnerable part of population. The construction contractor will offer gender-sensitive temporary employment opportunities for women.
Local labor power	●●●	+	Short term Is limited by the frames of construction	Direct	Local communities will have temporary employment opportunities during the construction phase.

Degree of impact

●●● = high

●● = average

● = low

0 = zero

+ = positive in the local conditions

++ = positive in the region conditions

Degree of tangible results

●●● = high

●● = average

● = low

6.3 Operation phase

6.3.1 Environmental and social impacts at the operation phase

Environmental impacts at the operation phase

Impact on aquatic ecosystems - Impact on Karmir River Flow

With the Geghardalich Gravity Irrigation scheme project no impact is envisaged on the water users downstream the reservoir (Goght community, Goght 1 and Goght 2 HPPs), since they will continue receiving the same quantity of water as currently.

The main expected impact (2.185 mln m³ less water flow) is on Karmir River (downstream the derivation canal point) and Goght River, since Karmir River eventually flows into Goght River. Thus, the impact of less flow is studied between the sections highlighted in red line in the map below.



Karmir River before the Derivation Canal



Intake Structure for the Derivation Canal

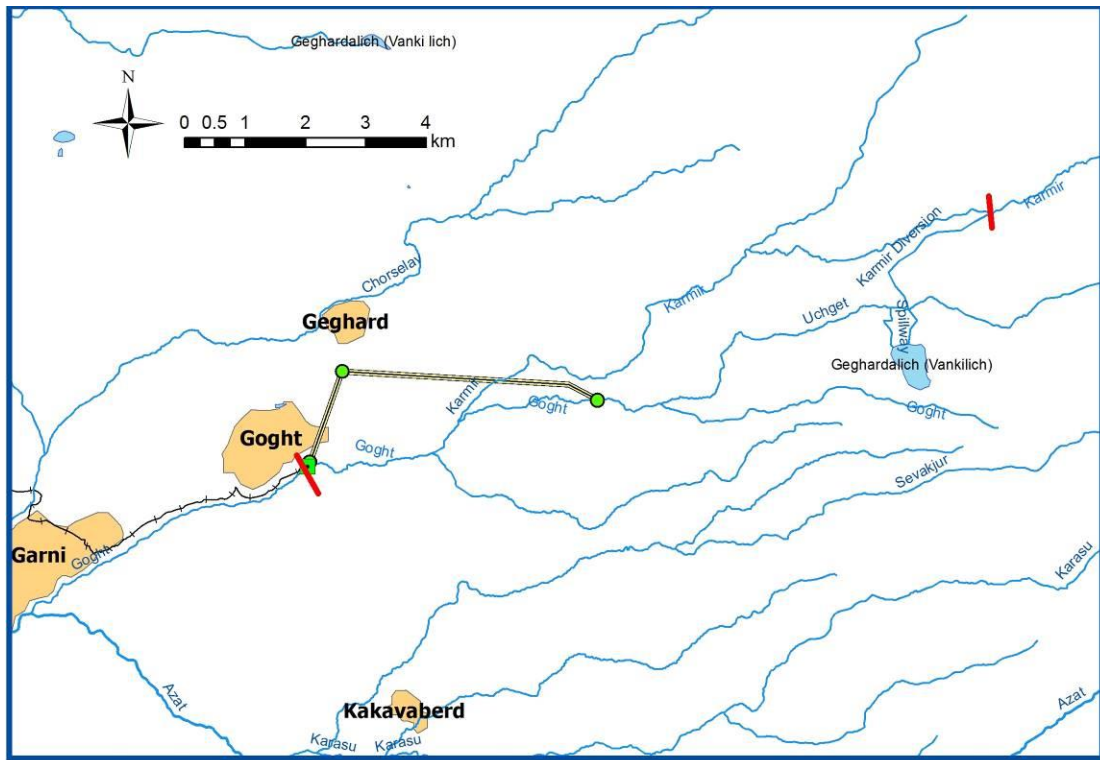


Water Transfer to Reservoir through Geghardalich Derivation Canal



Measurement of Karmir River Flow after Water Abstraction through the Derivation Canal

Karmir River, which does not have ichthyofauna and rich aquatic biodiversity due to its seasonal nature, will still have twice more water after the project, than the environmental flow requires.

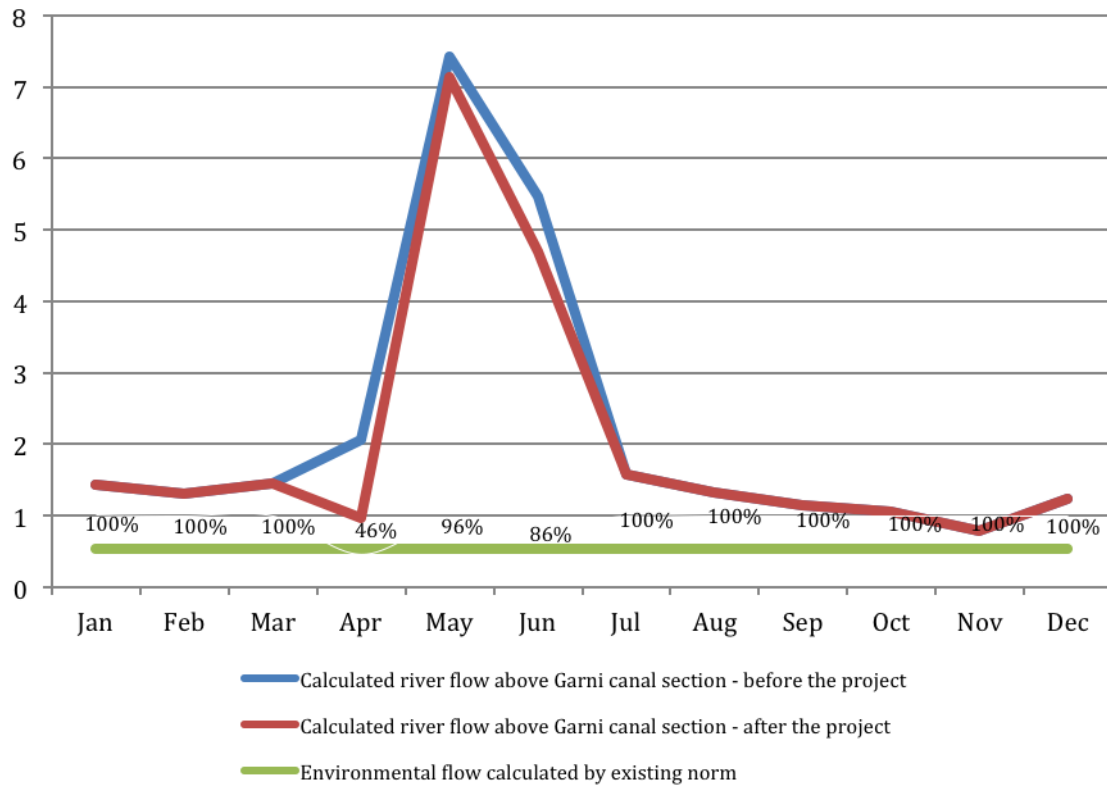


Downstream the Karmir Diversion canal there is only 1 water user (Garni Canal around the territory of Goght). The table and figure below summarizes the impact of the less river flow in that section.

Table 33: Summary of the impact of Geghardalich Gravity Irrigation Scheme Project on Goght River at the section of Garni Canal abstraction point, mln m³

Month	Calculated flow at Garni canal abstraction point	Calculated environmental flow	Abstraction by Garni Canal	Remaining flow – current situation	Remaining flow – after the project
January	1.97	0.54	0.00	1.43	1.43
February	1.86	0.54	0.00	1.31	1.31
March	2.00	0.54	0.00	1.45	1.45
April	2.61	0.54	0.00	2.07	0.96
May	8.33	0.54	0.35	7.43	7.14
June	6.28	0.54	0.26	5.48	4.70
July	2.36	0.54	0.24	1.57	1.57
August	2.06	0.54	0.19	1.33	1.33
September	1.84	0.54	0.16	1.14	1.14
October	1.73	0.54	0.13	1.05	1.05
November	1.33	0.54	0.00	0.78	0.78
December	1.77	0.54	0.00	1.23	1.23

Month	Calculated flow at Garni canal abstraction point	Calculated environmental flow	Abstraction by Garni Canal	Remaining flow – current situation	Remaining flow – after the project
Annual	34.15	6.53	1.33	26.29	24.11



Calculated flow upstream the next water user, before and after the project, mln m³

(the same for Gilanlar mudflow presented on page 6)

As seen from the table above, the impact of project is observed only in 3 months: April, May and June. In April there is no abstraction by Garni Canal, and in May and June there is sufficient flow both for Garni Canal abstraction and Geghardalich project. At all times the environmental flow is well maintained. As for the impact on aquatic environment, the project will not significantly affect given that the additional abstraction will reduce the river flow only by about 6%.

To summarize, there will be no significant impact on the environment or downstream water users by Geghardalich Gravity Irrigation Scheme project.

Soil erosion, salinization and alkalization

Operation of Geghardalich gravity scheme may have some negative impact on the lands of project affected area, particularly in terms of soils natural balance (increase of salinization, 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.

Deterioration of irrigation water quality

During the design phase no water quality analysis are conducted. Unfortunately, no such data exists in the archives of organization in charge of operation of the reservoir. However, before the exploitation of the

gravity system it is planned to conduct a water quality sampling and analysis, which will show if there is a further need to do water quality analysis on a more periodic basis.

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 Geghardalich 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.

Operation of Geghardalich Reservoir

After reconstruction Sevan-Hrazdan water supply agency will continue the operation of Geghardalich Reservoir. In order to increase the efficiency of operation, it is planned to install SCADA automated management system in the derivation canal to the reservoir and also in outflow point from the reservoir. Taking into consideration the fact, that the Geghardalich scheme will provide water to 2 WUAs ("Garni-Geghard" and "Jrvezh-Dozraghbyur" WUAs), it is planned to have persons on duty from both WUAs in the territory of the scheme during the irrigation seasons.

Table 34: Impacts at Operation Phase

Impact	Signs	Degree of tangible impact	Duration of the impact	Direct/ Indirect	Notes
Use of land	●	●	Long term	Direct	During the construction phase temporary use of community lands is expected (the design avoids private land use). Construction camps will also be established on unused community lands. After the construction activities and pipeline installation, the used land will be rehabilitated so that the operation phase can be used for agricultural purposes as grasslands and pastures.
Social and economic	●	+	Long term	Direct	During the operation phase irrigation it is expected that irrigation water problems in communities will significantly be reduced, and the increased irrigation will enable the farmers to use their lands more efficiently and cultivate more profitable crops.

Degree of impact

- = high
- = average
- = low
- o = zero
- + = positive in the local conditions
- ++ = positive in the region conditions

Degree of tangible results

- = high
- = average
- = low

Social impacts at the operation phase

(a) Economic gains of communities in the coverage area

The gravity scheme providing the communities with irrigation water through the pipeline eliminates water loss and enables farmers to irrigate more lands with permanent supply of water. This is expected to have a direct positive impact on family incomes.

(b) Water leakage

It is also important to properly monitoring the operation of the pipeline to avoid water leakage, which might affect livelihoods of vulnerable people, including female-headed households. To exclude these phenomena, it is necessary to undertake the corresponding mitigation measures.

6.3.2 Mitigation and enhancement measures at the operation phase

Environmental impacts mitigation at the 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

Although flood irrigation is the main technology applied in the service area of the Geghardalich scheme, the risk of waterlogging is present, however likelihood of salinization or alkalization of soil is low because ground water horizons are in the depth of 30-120 m, so it will not have significant impact on the balance of (soil-plant-water) ecological system. However, control of waterlogging will be encouraged among water users anyway in order to prevent damage of crops and cut excessive water use. To prevent erosion in the command area of the Geghardalich 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.

Maintaining the quality of irrigation water

In an unlikely case of tangible deterioration of irrigation water quality, the relevant WUA (“Jrvejh-Dzoraghbyur”) 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

“Jrvejh-Dzoraghbyur” 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 Geghardalich scheme design, the “Jrvejh-Dzoraghbyur” WUA must provide the local environmental inspection the approved Management Plan, and the local inspection will supervise adherence to the Management Plan thereafter, 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 “Jrvejh-Dzoraghbyur” WUA offices. Brochures and leaflets will also be available at the “Jrvejh-Dzoraghbyur” 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.

6.4 Decommissioning phase

6.4.1. Impacts at decommissioning phase

Useful life of Geghardalich gravity system is estimated at 50 years. At the decommissioning phase of the Geghardalich 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 Geghardalich 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.

6.4.2. Mitigation measures at decommissioning phase

Waste generated during the dismantling of Geghardalich 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.

Prior to and throughout the decommissioning phase, information-sharing and consultation with affected communities will be maintained, and Project feedback and grievance mechanisms will remain available to affected people.

6.5 The Expected Potential Environmental and Social Impacts of the Construction of Feeder Canal from Gilanlar Mudflow Stream

The construction of the feeder canal from Gilanlar will lead to positive changes in irrigation water supply of Goght community, as well as of the communities under the command of Geghardalich Gravity Scheme

by increasing water availability even in dry and drought years. The overall positive environmental and social impacts expected from the construction of Gilanlar branch will be long-term contributing to social-economic sustainability of beneficiary communities.

Adverse environmental and social impacts are also possible, however they will be temporary and will mostly occur at the construction stage and partially during operation and dismantling phase. The following impacts will be more considerable:

The Impact on Water Resources

The catchment area of Gilanlar is located at altitude of 2715-3320 m above the sea level and flood season mudflows go to Azat river through its bed. Gilanlar is a seasonal mudflow stream and its bed is dry from June on. A part of the Gilanlar mudflow stream is expected to be directed to the Geghardalich reservoir for approximately 20-30 days per year through a feeder canal to be constructed. This canal is envisaged to take 1-15 mln m³ of water in flood season, when there are abundant water resources in the given basin and its downstream sections, and the expected impact will be very small. Moreover, due to the geographic position of Gilanlar, snow melting in the basin starts 7-10 days earlier than in the basin of Karmir river, which is currently feeding Geghardalich.

Given that it does not have permanent flow, the water biodiversity is not developed in this river and the construction of additional water conduit and seasonal intake will not have any impact on the flora and fauna of the given mudflow stream and adjacent areas.

The Impact on Flora and Fauna

The flora and fauna of the area of Gilanlar feeder canal do not substantially differ from the description of the studies performed for Geghardalich Gravity Scheme. It could have been assumed, as those areas are basically located at the same geographical zone and characteristic species are almost the same. Nevertheless, the species identified during the 1 day field visits done by the relevant specialists are not endangered or rare and are not included in the Red Books of Plants and Animals of the RA and in the International Red Lists as well. No material impacts are expected from the envisaged design change, and the expected impacts and mitigation measures are the same in nature as for the gravity scheme and they are described in the relevant sections of Geghardalich ESIA report.

The Impact on Soil Resources

These design changes will result in distortion part of lands, hence causing adverse impacts on soil resources. Particularly, at the preparation stage and during construction works drilling of trenches along the water conduit, distortion of natural relief and other earth works will have adverse impact on soil resources, as well as on the species using those areas as a habitat. The chemical composition and physical-mechanical characterization of fertile layer soil, land category will change, pastures will be somehow affected, furthermore construction and household wastes will emerge in the construction site of the Feeder canal and traffic will increase in those areas due to the intensive works of construction machinery. Besides the above mentioned, some negative environmental impacts of general nature (such as surface water and groundwater pollution, soil and landscape degradation, soil erosion, waste accumulation, fuel and lubricant spillage, noise, vibration and etc.) are also expected from this design change, which (including mitigation measures) are detailed in previous sub-sections of this report.

Description of the Social Statues of the Area Envisaged for the Feeder Canal from Gilanlar Mudflow Stream

The canal will go exclusively through Dvin and Verin Dvin communal lands from Gilanlar mudflow stream to the reservoir. In these highlands the communal land is used by shepherds as a summer pasture. In summer they move to highlands with their families and live in tents or temporary shelters.

Potential Social Impacts

At the construction and operation stage there may be some adverse impacts on the shepherds in regard with free movement of sheep. For this reason, at the construction stage activities will be organized section by section, so that sheep herd can move freely, and at the operation stage the sheep will cross the canal over a bridge to be built as a part of the project. There will be no impact on temporary shelters of the shepherds who have informal agreement with local municipalities for the use of community pastures. Their tents and shelters are located in separate areas; hence the Design Consultant will be able to avoid them.

7 INSTITUTIONAL RESPONSIBILITIES

7.1 Agencies

Executing agencies

Executing agencies are responsible for carrying out mitigation measures prescribed through the ESIA report and ESMP. 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 ESMP 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).

Supervising agencies

Acting in the capacity of the Project implementing entity, SCWE of the Ministry of Agriculture 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 licensed 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 of the Ministry of Nature Protection of RA, which also has a corresponding territorial department in Kotayk Marz. 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 Geghardalich gravity irrigation scheme are the following:

- State Environmental Inspectorate tracks water intake from natural water bodies and river pollution, and
- Sanitary service of the Ministry of Health of Armenia 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.

7.2 Reporting Responsibilities and Schedule

The author of the scheme design and the construction supervision consultant will report to the PIU on the progress of construction works. Environmental and social monitoring of works will be included in the assignment of the supervision consultant. The consultant will report to the PIU on project progress on monthly basis. Monthly progress reports will include, inter alia, a chapter on the environmental and social performance of works contractor. The textual part of the report will describe general status of safeguards compliance, flesh out main issues, and describe 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. 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 will provide the World Bank with bi-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. The 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 or by communities themselves.

7.3 Budget

The Environmental and Social Management Plan (ESMP) attached to the present ESIA report (Annex A) 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.

8 GRIEVANCE AND COMPLAINTS REDRESS

The grievance redress mechanism (GRM) is a mechanism through which people will be able to communicate their questions and concerns regarding the project and be assured of a timely response. The WSPIU has established a Grievance Redress committee (GRC) to address affected people's concerns and complaints proactively and promptly, using an understandable, communicated, and transparent process that is gender responsive, culturally appropriate, and accessible to all segments of the affected people and beneficiary community at no costs. The mechanism will not impede access to the Country's judicial or administrative remedies.

The GRC includes WSPIU staff: the environmental and social specialist, the engineer coordinating gravity irrigation schemes designs and the lawyer.

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures. The grievance mechanism will be implemented so that people can get their problems solved and grievances redressed in a timely and effective manner without directly

addressing the court.

The information on the GRM, as well as the hotline will be communicated to the communities and households who will be affected by the Geghardalich scheme, including local authorities and NGOs, by the PIU during the final disclosure of the ESIA report. Posters about the construction works will be posted at the construction sites and the Municipalities, so that the affected persons can submit their complaints during construction and operation phases.

The construction contractor will be obliged to have posters at all construction sites including Gilanlar canal area. The poster will include GRM contact information so the shepherds as well as other members of the communities will be able to submit their complaints, feedback and concerns.

9 PUBLIC CONSULTATION

In the design phase the consultant organized informal public consultations and surveys in the affected communities of the project in order to obtain baseline data and to estimate the existing social problems, as well as expected social impacts of the gravity system, and to understand the opinions and concerns of the community in order to take those into account while finalizing the ESIA report and design documents. Discussions were carried out with the village mayors of Goght, Geghadir, Hatzavan, Voghjaberd, local WUA, as well as the Marzpetaran (regional authority) and community authorities during the social and economic studies and public hearings on November 19, 2014 in Goght and February 25, 2015 in Yerevan. Detailed information about disclosure and consultation on the ESIA report, as well as list of participants and protocols presented in the annexes G, H, I, J, K and L. The following issues have been discussed:

- Choice of the shortest route to minimize the construction works;
- Avoidance of resettlement;
- 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;
- Handling issues of temporary land use during construction;
- Informing communities of the grievance redress mechanism and how to express their concerns and complaints;
- Presenting the results of social and environmental impact assessment and measures to mitigate negative impacts.

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

The ESIA Report of Geghardalich (without the changes associated with Gilanlar canal) has passed through all the procedures of the WB and Armenian legislation. After receiving WB's final approval in October 2015, the ESIA Report was disclosed at national level (in the official website of the PIU) and in the WB database.

As it was already stated in the previous sections, due to the concerns of Goght community it is also envisaged to construct Gilanlar canal for dry years.

The inhabitants of Goght community have been quite active at the main design stage and during planning of the envisaged changes. They participated in the field visits on 24 June 2016 (pictures provided in Annex M), discussions held in Goght community on 07 and 17 June 2016 and in the WSPIU on May 18, 2016 and their active participation is also expected during further stages of the implementation of design changes.

The proactivity of Goght community residents is evidenced by the regular site visits they conduct in order to monitor current construction works of the Geghardalich scheme.

An additional public consultation meetings were organized in Dvin and Verin Dvin communities on whose area the new Gilanlar canal will be constructed (Minutes are presented in the Annexes K, L). and the information was shared with Goght Community. Additionally, the Leader and the Council of the Goght community were officially informed about the commencement of the design and construction works of Gilanlar canal.

The amended ESIA, approved by the World Bank was disclosed in Armenian and English languages on the PIU website. The hard copies in Armenian was provided to the Goght municipality as well as to the Kotayk and Ararat (for Dvin and Verin Dvin Communities) marzpetarans for easy access by the project affected people.

Annexes

Annex A: Environmental and Social Management Plan

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
<i>Design phase</i>					
Pollution of water and soil, degradation of landscapes and soil erosion as a result of improper disposal of excavated materials and construction wastes	Obtain appropriate permits and/or agreements for disposal of excavated materials and construction wastes, use of water resource and water systems, etc.	Designer	Client, ESAS Consultant	Is included in the Contractual cost	In the course of design
	Develop a list and specifications for construction temporary sites such as access roads, construction camps, transport and machinery maintenance sites, storage facilities, etc.	Designer	Client, ESAS Consultant	Is included in the Contractual cost	In the course of design
Temporary alienation of property or productive assets, including peoples' access to such assets that appear within the alienation zone that hinder construction works	Develop such technical approaches and solutions to the construction of the Gegendalich reservoir system, which, to the extent possible, allow implementation of construction works without demolition and dislocation of private and community properties. Any alienation of property, permanent or temporary, will be in compliance with WB OP4.12, the RPF and a RAP. No private land use will be allowed for temporary construction camps.	Designer	Client, ESAS Consultant	Part of the Contract cost	In the course of design
Excessive damage to soil, disruption of traffic, and safety hazards related to the transportation of construction materials and truck traffic (dust)	Limit movement of construction vehicles and machinery along the canal service roads of the Gegendalich reservoir to limit damage to soil, and to ensure smooth traffic flow and safety both for workers, local traffic and population	Client	Client, ESAS Consultant	Is included in the Contractual cost	In the course of design

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
Landscape degradation and soil erosion	Develop measures to strengthen the steep slopes with vegetation, grass and plants or gabions. Use of plant species characteristic for the landscape in the course of restoration of the vegetation cover.	Designer	PIU	Is included in the contract cost	In the course of design
	Develop efficient methods for disposal or backfilling of extracted soils. Sites without vegetative cover and within the alienation zone or specifically designated by local areas shall be used for temporal storing of the excavated soils.	Designer	PIU	Is included in the contract cost	In the course of design
Impact on biodiversity	Prepare work schedule and plan so the impact on animals and birds will be minimal	Designer	PIU	Is included in the contract cost	In the course of design
Impact on biodiversity	Propose crossing/bridges in the final designs of tertiary canals in order not to alter migration paths of animals.	Designer	PIU	Is included in the contract cost	In the course of design
<i>Construction Phase</i>					
Pollution of water and soil, degradation of landscapes and soil erosion as a result of improper disposal of excavated materials and construction wastes	Maintain operational rules for construction camps, parking sites of vehicles, warehouses of fuel and lubricants, construction materials and chemicals	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Maintain zones of preliminary accumulation of wastes (vegetation free areas) that will cause no damage to the vegetation cover and other components of the environment.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Arrange transport and disposal of wastes according to the established traffic management plan, procedure and in the approved dump sites designated for the specific purpose.	Contractor	PIU	Is included in the contract cost	After acquisition of permission, in the course of construction works.

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
	Maintain appropriate operating rules for the Construction sites in identified suitable sites, including safe handling of control of access, adequate drainage, etc.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Prevent the migration of contaminants from sediment and waste disposal sites to water bodies discharging to international waters.	Contractor	PIU	Is included in the contract cost	In the course of construction work
Water and soil pollution with fuel and lubricants waste from the construction site	The wastewater will be collected in septic 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 provide 7 day work. 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.	Contractor	PIU	Is included in the contract cost	In the course of construction work
Temporary community land use for establishment of construction camps	Acquire community agreement on temporary use of community lands for construction camps; Installation of construction camps as far as possible from the inhabited areas.	Construction company	PIU	Is included in the contract cost	During construction activities
Temporary air pollution (dust) related to the transportation of construction materials and truck traffic, noise and vibration disturbances	Ensure smooth traffic flow and safety both for workers, local traffic and population.	Contractor	PIU	Is included in the contract cost	In the course of construction work

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
	Use closed/covered trucks for transportation of excavated materials and waste. Depending on season, wash truck tires as appropriate at the specially designed car washing sites to control tracking mud and dust onto paved roads.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Check regularly vehicles and machinery, which must be supplied with exhaust mufflers.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Clean the surrounding area from dust by water sprinkling (except in Winter), remove excess materials and clean the sites upon completion of activities.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Provide workers that deal with hazardous materials or are exposed to dust with necessary protection gear and follow applicable regulations and procedures as established by the Government authorities.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Terminate the works at the established time (e.g. work in daylight time) and avoid increase of noise and number of peak hours. Consult with local authorities	Contractor	PIU	N/A	In the course of rehabilitation work
Impacts on safety of personnel	Workers shall be equipped and use safety equipment during implementation of civil works.	Contractor	PIU	Is included in the contract cost	In the course of construction work
Impacts on physical cultural heritage	In case of chance finds, take all activities on hold and immediately notify PIU	Contractor	PIU	Cost of staling to be incorporated in contract cost as a risk contingency	In the course of earth works

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
	Resume works only upon receipt of clearance from the State Agency for Historical and Cultural Monuments Protection and PIU	Contractor	PIU, State Agency for Historical and Cultural Monuments Protection		In the course of earth works
Landscape degradation and soil erosion	Arable land shall not be used as earth borrowing. If unavoidable the topsoil (about 30 cm) shall be removed, kept at specifically designated sites and refilled. Dump excavated soils and substances only within the areas designated for that purpose.	Contractor	PIU	Is included in the contract cost	In the course of construction work
	Restore landscape to quasi-original vegetation cover after completion of rehabilitation works.	Contractor	PIU	Is included in the contract cost	In the course of construction work
Preservation of biodiversity	In the project areas, where there are endangered plant and animal species (as described in this ESIA report), no machinery shall go beyond the defined alienation zone. There shall be no waste accumulations and waste disposal sites in the same areas. There shall be no use and storage of explosives and toxic and chemical substances beyond the specified sites.	Contractor	PIU	Is included in the contract cost	In the course of construction work

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
Temporary alienation of private property or productive assets, including peoples' access to such assets, that appear within the alienation zone that hinder construction works	If any temporary alienation of land or productive assets, including people's access to such assets that appear within the alienation zone and hinder civil works is required, the contractor must immediately inform the PIU and cease the works in this area. The PIU will also provide an immediate written notification to the Engineer. The works can only be continued after the issue is resolved in compliance with the Project RPF, such as through the preparation and implementation of a RAP.	Contractor	PIU	Minimal	In the course of construction work
Blocking community roads, closing access to pastures for men and sheep during construction works	Alternative roads and bridges should be built for movement of vehicles and access to pastures for men and sheep	Contractor	PIU	Minimal	In the course of construction work
Possible negative impact of the project on red-list fauna species occurring outside of the project implementation area	Movement of machinery during the night hours will be prohibited. Heavy machinery equipment will be operating by turns, in order to avoid excessive noise and exceedance of allowed norms of emissions into the atmosphere.	Contractor	PIU	Is included in the contract cost	In the course of construction work
<i>Operation Phase</i>					
Hydrological issues of flooding, low flow and water stagnation	Maintenance of the water conduit and hydro-technical structures to minimize the risk for water stagnation and accidents.	WUA	SCWE	Cost of current operation and maintenance	In the course of operation

Possible negative impact	ENVIRONMENTAL AND SOCIAL MITIGATION MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST (To be quantified according if possible)	TIMING
	Operate the water intakes in such a way that the water withdrawal is properly controlled to avoid withdrawing more water than allowed.	WUA	SCWE	Cost of current operation and maintenance	In the course of operation
Land degradation	Monitor the quality of the water of the drainage system and soils of the command area to timely prevent and mitigate soil salinization, alkalization and pollution by controlling the source of pollution. Implementation of land reclamation/melioration, and anti-erosion measures.	Ministry of Agriculture	SCWE, Ministry of Nature Protection, Ministry of Agriculture	State budget	In the course of operation

Annex B: Monitoring Plan

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

<i>Mitigation measures</i>	<i>Monitoring indicators</i>	<i>Monitoring time/frequency</i>	<i>Monitoring methods</i>	<i>Supervising organization</i>
Construction Stage				
Soil excavated from trenches is arranged in areas relatively flat and free of vegetation and is used for backfilling after installation of pipes	Visual identification of earthwork sites	During earthworks	Visual checking	Supervisor of PIU, Kotayk Marz Administration
Construction machines move through existing local roads or temporary access roads, not passing on irregular earthen surfaces	Visual identification of earthen surfaces on construction site and around it	During construction	Visual checking	Supervisor of PIU, Kotayk Marz Administration
No quarry will be operated without availability of functioning license of Contractor (if materials are not purchased from seller), but quarry sections will be reinstated after works	Availability of licenses, checking of quarries	During excavations	Checking of licenses, checking of compliance with license conditions, visual checking of quarry sites	Supervisor of PIU, State Environmental Inspectorate of Ministry of Nature Protection of RA
Surplus soil is used for leveling of existing earthen road and/or is disposed to other site, which is agreed with local authority	Visual identification of spoil area for soil, agreement documents	During earthworks and after their completion	Visual checking	Supervisor of PIU, Kotayk Marz Administration
Management of construction materials and waste in-situ	Construction materials and waste are stored inside special specified sites of working area, surplus amount of construction waste is not accumulated in-situ	During construction works	Visual checking	Supervisor of PIU

<i>Mitigation measures</i>	<i>Monitoring indicators</i>	<i>Monitoring time/frequency</i>	<i>Monitoring methods</i>	<i>Supervising organization</i>
Protection of water flows against solid waste	Construction waste and garbage, which are not seen in river channel and construction sites; construction materials and waste piles are stored far from water ways	During construction works to be carried out near water ways	Visual checking	Supervisor of PIU
Covered trucks are used for disposal of construction materials and waste	Conditions of trucks	During entire construction	Visual checking along transport route	Supervisor of PIU, Traffic Police
De-dusting of construction sites by water spraying	Conditions of construction sites	In dry weather when implementing construction	Visual checking	Supervisor of PIU
Vehicles are in relevant technical state and have noise suppressors	Technical conditions of vehicles	Daily	Measurers of noise level	Supervisor of PIU, Ministry of Nature Protection, Ministry of Healthcare
Lubricants and other oil products are suitably stored in specially treated restricted places. Used fuel is delivered to representatives of special services for recycling	Conditions for service areas of vehicles Delivery documents	Once a month	Visual checking	Supervisor of PIU, Ministry of Nature Protection, Ministry of Healthcare
Signing of servitude agreements with communities/local governments for temporary use of lands during construction	Availability of servitude agreements at “Jrvezh-Dzoraghbyur” WUA	Prior to mobilization of Contractor to construction site	Checking of documents	Supervisor of PIU, “Jrvezh-Dzoraghbyur” WUA, State Committee on Water Economy

<i>Mitigation measures</i>	<i>Monitoring indicators</i>	<i>Monitoring time/frequency</i>	<i>Monitoring methods</i>	<i>Supervising organization</i>
Verification of the availability of gender-sensitive employment opportunities by the contractor	Availability of temporary employment opportunities for both female and male community members	During construction time	Checking the contractor's monthly/quarterly reports	PIU and supervisor of the PIU
Provision of health and safety standards for employees	Employees are provided and use individual safety appliances. Staff, working with complicated mechanisms, has passed relevant training. Job places are provided with necessary medical facilities for first aid and fire prevention devices. Serious accidents have not taken place connected with job	During construction	Visual checking Checking of documents for staff training and licenses for operation of machines	Supervisor of PIU
Provision of information on complaint mechanisms and timely responses to questions and complaints of affected population	Availability of posters at construction sites by contact data of Contractor. Verification of local communities' awareness of available feedback/complain mechanisms Provision of timely responses to community concerns and maintenance of a register of community concerns by contractor	During construction	Visual checking Surveys with local communities Checking of contractor feedback register	Supervisor of PIU Directly PIU
Reinstatement of construction sites disposing waste, carrying out backfilling of top soil, leveling and landscaping of greenery	Reinstatement of construction passage Absence of construction materials,	At last stage of construction activity	Visual checking	Supervisor of PIU

<i>Mitigation measures</i>	<i>Monitoring indicators</i>	<i>Monitoring time/frequency</i>	<i>Monitoring methods</i>	<i>Supervising organization</i>
	waste and garbage			Directly PIU
Operation Stage				
Constant technical servicing of hydraulic structures and pipes/canals of the system	Hydraulic structures and pipelines/canals of the system are in good working state There is no disorder of the system and inundation of areas under command	During operation of the system	Visual checking	State Committee on Water Economy
Application of positive agricultural experience and use of suitable irrigation methods	Irrigated fields are protected against erosion	During operation of the system	Visual checking	Ministry of Agriculture, “Melioration” LLC
Identification of worsening signs for water quality and interruption of water supply until confirmation that water is safe for irrigation	Absence of pollution cases of agricultural lands and production as a result of casual pollution	During operation of the system	Visual checking	Water User Association, Ministry of Nature Protection
Control of environmental water flow in rivers during irrigation season	Aquifer layers of rivers are not endangered due to taking much water for irrigation	During operation of the system	Registers with data of off-take Results of ecosystem monitoring	Ministry of Nature Protection
Implementation of public awareness campaigns and provision of current consultancy services to safely use pesticides and to apply IPM system	Improved irrigation services do not damage soil and health of people due to application of too much or other dangerous pesticides	During operation of the system	Data regarding soil quality and agricultural production	Ministry of Agriculture, “Melioration” LLC, Ministry of Nature Protection

Annex C: Incident Report Form

CONSTRUCTION OF GEGHARDALICH GRAVITY IRRIGATION SCHEME

1	Date:	
2	Gravity System Section:	
3	Location:	
4	Construction Contractor:	
5	Marz (Region):	
6	Water Supply Agency/WUA	
7	Incident Type:	
8	Severity:	<input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> 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:	<i>The photos with appropriate descriptions should be presented as an Attachment to the Incident Report</i>

For PIU use only

<i>Date</i>	
<i>Received by:</i>	
<i>Decision/ Action made:</i>	

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 firefighting kits					
Workers wear uniforms and protective gear adequate for technological processes (gloves, helmets, respirators, eye-glasses, etc.)					
Servicing and fueling 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: List of references

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Annex F: Water Use Permit for the Geghardalich Gravity Irrigation Scheme

Հավելված N 1
ՀՀ Կառավարության 2003 թվականի
մարտի 7-ի N 218-Ն որոշման



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«ՍԵՎԱՆ-ՀՐԱԶԴԱՆՅԱՆ-ԶՐԱՊ» ՓԲԸ

(Զրոգտագործողի անվանումը)

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(Ջրային ռեսուրսների կառավարման և

ԿԱՆԱՐԱՐ Ա. ԳՐՈՒԹՅՈՒՆՅԱՆ

և մատչելիության մարմնի ղեկավար)



Տրված է 18 03 2014թ.

«ՍԵՎԱՆ-ՀՐԱԶԴԱՆՅԱՆ-ԶՐԱՊ» ՓԲԸ

(Ջրօգտագործման քույրաշարժում առաջողի

ՏԵՏՐԵՆ Ս.ՀՈՎՀԱՆՆԻՅԱՆ

և մատչելիության մարմնի ղեկավար)



Որով մեզ է ստացն 18 03 2014թ.

Գործունեության ժամկետը երկարաձգված է մինչև

20 թ.

(Ջրային ռեսուրսների կառավարման և

մատչելիության մարմնի ղեկավար)

(Ջրօգտագործման քույրաշարժում առաջողի

և մատչելիության մարմնի ղեկավար)

Permission for Water Use

Project Manager *Armen Y. Saparyan*



N 000029 18.03.2014p

ՋՐՕԳՏԱԳՈՐԾՄԱՆ ԹՈՒՅԼՏՎՈՒԹՅԱՆ ԱՆԲԱԺԱՆԵԼԻ ՄԱՍ
ՀԱՆԴԻՍԱՑՈՂ ԼՐԱՑՈՒԹՅՈՒՆՆԵՐ

ՀՀ ջրային օրենսգրքի հոդված 32-ի պահանջների համաձայն մշակված սույն պայմանները ենթակա են պարտադիր կատարման:

1. «Անան-Հրազդանյան-ջրաղ» ՓԲԸ-ն (Գեղարդա լճի ջրամբար) պարտավոր է՝
ա/ ապահովել N 000029 ջրօգտագործման թույլտվության ստացմամբ և ջրօգտագործման իրականացմամբ պայմանավորված ՀՀ օրենսդրության պահանջների կատարումը:

բ/ արտակարգ իրավիճակներում և սակավաջրության ու երաշտի պայմաններում ապահովել ՀՀ բնապահպանության նախարարության աշխատակազմի ջրային ռեսուրսների կառավարման գործակալության պահանջները, որոնք ուղղված են հասարակական շահին և շրջակա միջավայրի պահպանմանը:

գ/ իր գործունեությամբ չնվազեցնել մինչև N 000029 ջրօգտագործման թույլտվության ստացումը գոյություն ունեցող ավանդակայն ջրօգտագործողների ջրօգտագործման իրավունքները:

դ/ ապահովել պայմաններ ՀՀ բնապահպանության նախարարության աշխատակազմի ջրային ռեսուրսների կառավարման գործակալության աշխատակցի կողմից ջրօգտագործման թույլտվության պայմանների կատարումը հսկելու համար:

2. Սույն ՁԹ-ի պայմանները ՁՈԿԳ-ի պահանջով ենթակա են վերանայման տվյալ ջրավազանային կառավարման պլանի մշակման ժամանակ:

3. Ջրառի կորոզիոնատական կետն է:

X = 44°35'57.5"

Y = 40°15'11.7"

ՀՀ բնապահպանության նախարար

«Անան-Հրազդանյան-Ջրաղ» ՓԲԸ-ի տնօրեն



Ա. Դարությունյան

Թովհաննիսյան

« 18 » 03 2014p.

« 18 » 03 2014p.



12. Հատուկ միջոցառումներ, որոնք կիրառվելու են արդյունավետ ջրօգտագործումը խթանելու և ջրի որակը բարելավելու, գերխոնավ և առնփնյա կարևոր բնական միջավայրերը և առնչվող կենսաբազմազանությունը պահպանելու համար _____

Մշակել և իրականացնել ջրակորուստների կրճատման
և նորմատիվային ջրաքանակի արդյունավետ օգտագործման
միջոցառումների ծրագիր:

13. Համապատասխան պահանջներ՝ ջրօգտագործման հաշվառման, մոնիտորինգի, գրանցման և ճշգրտման համար _____

1. Ջրառի կետն ապահովել ջրաչափական դիտակետով
և սահմանված կարգով այն կապարակնքել:

2. Կատարել ջրօգտագործման հաշվառման աշխատանքներ և
սահմանված կարգով ՀՀ բնապահպանության նախարարություն
ներկայացնել 2-տա(ջրտնտ) տարեկան հաշվետվությունը:

14. Համապատասխան երաշխիքներ՝ ջրային ռեսուրսներին վնասներ հասցվելու
դեպքում _____

ՀՀ ջրային օրենսգրքի պահանջների խախտման դեպքում փոխհատու-
ցել հասցված վնասը ՀՀ օրենսդրությամբ սահմանված կարգով:

15. Ջրօգտագործման թույլտվությանն առնչվող վճարներն ու վճարման
ժամանակացույցը _____

1. Պետական տուրքի անդորրագիր N 0000048

2. Սույն ՁԹ-ում նշված ջրօգտագործման չափաքանակների

նկատմամբ կիրառել ՀՀ օրենսդրությամբ սահմանված դրույքաչափը,
իրականացնել բնօգտագործման վճարների մուծում:

16. Ջրօգտագործման թույլտվությունը ենթակա է գրանցման պետական ջրային
կադաստրում՝ _____ օրվա ընթացքում:

Սույն ջրօգտագործման թույլտվությունը գրանցված է ջրային պետական
կադաստրում: Գրանցամատյան N 6

Սույն ջրօգտագործման թույլտվությունը կազմված է երեք կողմից:



Հ Ա Յ Տ Ա Ր Ա Ր ՈՒ Թ Յ ՈՒ Ն

2014թվականի նոյեմբերի 19-ին, ժամը 14⁰⁰ -ին ՀՀ ոտայքի մարզի Գողթ համայնքի գյուղապետարանում տեղի կունենա Գեղարդալճի ինքնահոս ոռոգման համակարգի նախագծի նախնական գնահատման փուլի հասարակական ծանուցման և քննարկման լսումները: Նյութերի հետ կարելի է ծանոթանալ գյուղապետարանում, <<Զրային տնտեսության ԾԻԳ>>-ում՝ ՊՀ Բաղրամյան 75/44 հասցեում, <<Հայջրնախագիծ ինստիտուտ>> ՓԲԸ-ում՝ Վ. Վաղարշյան 12 հասցեում:

Համայնքի ղեկավար՝

Ն. Մելքոնյան



Announcement for Hearings



Project Manager

[Signature] V. Sahakyan

ՀԱՅՏԱՐԱՐՈՒԹՅՈՒՆ

Announcement for Hearings

Project Manager [Signature] V. Sahakyan



2014 թվականի նոյեմբերի 19-ին (հունիսի 14⁰⁹)-ին Կոտայքի մարզի Գողթ համայնքի գյուղապետարանում տեղի կունենա Գեղարդալճի ինքնահոս ոռոգման համակարգի նախագծի նախնական գնահատման փուլի հասարակական ծանուցման և քննարկման լսումները: Նյութերի հետ կարելի է ծանոթանալ գյուղապետարանում, <<Ջրային տնտեսության ԾԻԳ>>-ում՝ ՊՀ Բաղրամյան 75/44 հասցեում, <<Հայջրնախագիծ ինստիտուտ>> ՓԲԸ-ում՝ Վ. Վաղարշյան 12 հասցեում:

[Signature] Վահագն Մանուկյան ղեկավար *[Signature]* *Զ. Լևոնյան*




Announcement for Hearings
Project Manager *V. Sahakyan*

2014թ նոյեմբերի 19-ին, ժամը 14:00-ին ՀՀ
Կոտայքի մարզի Գողթի գյուղապետարանում
տեղի կունենա Գեղարդալճի ինքնահոս ոռոգման
համակարգի նախնական գնահատման փուլի
հասարակական ծանուցման և քննարկման
լուծումները: Նյութերի հետ կարելի է ծանոթանալ
գյուղապետարանում, «Ջրային տնտեսության
ԾԻԳ»-ում՝ ՊՀ Բաղրամյան 75/44 հասցեում,
«Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ում՝
Վ. Վաղարշյան 12 հասցեում:


Գ. Կ. Կոտայքի մարզի Գողթի գյուղապետարան *Վ. Վաղարշյան* *Վ. Կոտայքի մարզի Գողթի գյուղապետարան*

ՀԱՅՏԱՐԱՐՈՒԹՅՈՒՆ

Announcement for Hearings
Project Manager  V. Sahakyan

2014թվականի նոյեմբերի 19-ին ժամը 14.00-ին ՀՀ
Կոտայքի մարզի Գողթ համայնքի գյուղապետարանում
տեղի կունենա Գեղարդալձի ինքնահոս ոռոգման
համակարգի նախագծի նախնական գնահատման փուլի
հասարակական ծանուցման և քննարկման լսումները:
նյութերի հետ կարելի է ծանոթանալ գյուղապետարանում,
-Ջրային տնտեսության ԾԻԳ-ում՝ ՊՀ Բաղրամյան 75/44
հասցեում,

-«Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ում՝
Վ. Վաղարշյան 12 հասցեում:

Գեղարդի համայնքի ղեկավար  Հ. Սարգսյան

Annex H: LOP and Minutes of the November 19, 2014 Public Consultation in Goght

Minutes of public consultations held at the preliminary assessment phase of the design for Geghardalich Gravity Irrigation Scheme presented by “Hayjrnakhagits Institute” CJSC in Goght community on the 19th of November, 2014

Agenda

- Presentation of the design for Geghardalich Gravity Irrigation scheme by V. Sahakyan, Chief Engineer of the “Hayjrnakhagits Institute” CJSC for preliminary assessment.
- Questions and answers
- Exchange of views
- Decision

The Chief Engineer of “Hayjrnakhagits Institute” CJSC V. Sahakyan briefly presented the project, which is aimed at converting pumped irrigation of lands under command of Gegardalich Reservoir into gravity, more efficient use of water resources of Karmir River and ensuring more reliable operation of the hydraulic system. To this, end the capacity of the reservoir will be increased from 2.4 Mm³ to 3.4 Mm³ using the opportunities provided by the reservoir area at the same time maintaining the stability requirements to Dam 1 and Dam 2, hydraulic structures of the reservoir which currently are in insufficient state will be rehabilitated, and a 26 km long pipeline will be constructed to deliver water to irrigated areas. The project will ensure irrigation water for 4 communities of Kotayk Province with total area of 1448.8 ha (Gegadir, Hatsavan, Vokchaberd, Goght, Jrvej-Dzorakhbyur Gardeners Association and National Park).

The public hearings were attended by the leaders of the above communities and population of Goght. They asked the speaker many questions, especially about construction of the 29 km long pipeline. They were interested in the technical state of the reservoir and availability of water resources, the use of mudflows, water quotas during irrigation season and how the volume of 3.4 Mm³ will be distributed among communities, the continuity of the project and many other issues which may interest the population.

The speaker answered all the questions, then people exchanged views. In particular, it was noted that the present volume of Geghardalich (2.4 Mm³) was insufficient for Goght, as the areas occupied by newly planted orchard were increasing by 20-30 ha annually in the past 10-12 years amounting up to 650-700 ha, and continue to increase. As a result, the reservoir dries up in 70-90-days (from mid-June to September). Meanwhile, they use the mudflow for irrigation purposes from April to June before the water is released from Gegardalich.

They [population] disagree with the pipeline option proposed under the design, and the community leaders offered and demanded an alternative option for the pipeline alignment passing close to community areas giving the population an opportunity to use the mudflows. In addition to shortening the alignment, this option allows using the existing 4.5 km long 700 mm pipeline, which will further reduce the cost.

Should the alternative option with the pipeline close to community areas be adopted, all the interested communities are ready to arrange quickly all the servitude and other land issues without causing additional financial burden for the design.

Community leaders

Goght Community Leader	[SEAL, SIGNATURE]	A.Hakobyan
Garni Community Leader	[SEAL, SIGNATURE]	A.Vardanyan
Gegadir Community Leader	[SEAL, SIGNATURE]	H.Sargsyan

Մասնակիցների ցանկ գյուղ Գողթ 19.11.2014թ.

1	2	3	4	5
NN	Անուն, ազգանուն	Գործնետարում	Հեռախոսահամար	Ստորագրություն
1	Ներսիսյան Զուլա	Գողթ	054 240414	(2)
2	Պարգևյան Եսայի	Գողթ	094 51 90 30	
3	Գրիգորյան Լիլյան	Գողթ	099 33 27 09	
4	Ջալալյան Սարգիս	Գողթ	094 47 74 30	
5	Կարամյան Լիլյան	Գողթ	093 09 90 39	
6	Մոսիսյան Աստ	Գողթ	094 42 41 30	
7	Խաչատրյան Ռուստե	Գողթ	093 72 73 71	
8	Խոսրոսյան Սրբյան	Գողթ	093 55 65 03	
9	Լիլյան Կարգիսյան	Գողթ	093 42 51 22	
10	Խոսրոսյան Գրիգոր	Գողթ	094 87 20 37	
11	Պարգևյան Սրբյան	Գողթ	093 65 11 81	
12	Կարամյան Լիլյան	Գողթ	094 15 82 62	
13	Խաչատրյան Կարգիսյան	Գողթ	094 67 11 42	
14	Լիլյան Գրիգոր	Գողթ	094 25 40 75	
15	Գրիգոր Զուլա	Գողթ	091 53 82 15	
16	Կարգիսյան Սրբյան	Գողթ	094 54 60 81	
17	Կարգիսյան	Գողթ	091 24 03	
18	Կարգիսյան Գրիգոր	Գողթ	094 58 88 30	
19	Կարգիսյան Գրիգոր	Գողթ	098 13 14 71	
20				
21				
22				
23				
24				

List of Participants in Goght Village
 November 19, 2014
 Project Manager *V. Sahakyan*



ԱՐՉԱՆԱԳՐՈՒԹՅՈՒՆ

19 նոյեմբերի 2014թ

գ. Գողթ

2014թ նոյեմբերի 19-ին ժամը 14:00-ին Գողթի համայնքապետարանում տեղի ունեցավ «Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ի կողմից ներկայացված Գեղարդալճի ինքնահամակարգի նախագծի նախնական գեահատման փուլի արձեղծության ծանուցման քննարկումների վերաբերյալ:

Օրակարգ

- 5. Գեղարդալճի ինքնահամակարգի նախագծի նախնական գեահատման զործընթացի ներկայացում՝ շեկուցող նախագծի «Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ի գլխ. Հարտարագետ Վ. Սահակյան :
- 6. Հարց ու պատասխաններ:
- 7. Կարծիքների փոխանակում:
- 8. Որոշում

Ելույթ ունեցավ «Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ի գլխ. Հարտարագետ Վ. Սահակյան Համառոտ ներկայացվող իրականացվող ծրագիրը, համաձայն որի 22 Գոտայք մարզում Գեղարդալճի ջրամբարի իջնաման տակ գտնվող, մեխանիկական եղանակով ոռոգվող գյուղատնտեսական հողատեսքերի ոռոգումը ինքնահոս եղանակով փոխարինելու, Գարմիր գետի ջրային ռեսուրսները արդյունավետ օգտագործելու, Գեղարդալճի ջրամբարի հիդրոտեխնիկական կառուցվածքների շահագործման հուսալիությունը ապահովելու նպատակով, նախատեսվում է վերակառուցել ջրամբարի տեխնիկապես անբավարար վիճակում գտնվող հիդրոտեխնիկական կառուցվածքները, էլեկտր. №1 և №2 պատվարների կայունության պայմանից ջրամբարի թասի ծավալային հնարավորություններից մեծացնել ջրամբարի ծավալ մինչև 3.4մլնմ³ և կառուցել 26կմ երկարությամբ ջրատար, ապահովել Գոտայքի մարզ 4 համայնքների՝ Գեղաղիր, Հացավան, Ողջաբերդ, Գողթ և «Ջրվեժ-Չորաղբյուր այգեգործական» ընկերության ու «Արգելոցապարկային համալիրի» զուամարայի 1448.8հա գյուղատնտեսական հողատեսքերի ինքնահոս ոռոգումը:

Լսումներին մասնակցում էին վերը նշված համայնքների ղեկավարները և Գողթ համայնքի բնակիչները, որոնց կողմից հարցեր ուղղվեցին շեկուցողին՝ մասնավորապես 29 կմ ջրագծի կառուցման, ջրամբարի ռեսուրսների, տեխնիկական վիճակի, ծրագրի շարունակականության և ազգաբնակչությանը հուզող այլ խնդիրների՝ ոռոգման սեզոնի ընթացքում ստացվելիք ոռոգման ջրի ծավալների, սելավաջրերը օգտագործելու և ամառաբնակիչ 3.4 մլն մ³ ջուրը վերը նշված համայնքներին շաշխմելիք չափաբաժինների վերաբերյալ:

Այնուհետև շեկուցողը պատասխանեց ամառաբնակիչներին, որից հետո տեղի ունեցավ նաև կարծիքների փոխանակում:

Մասնավորապես հնչեցին կարծիքներ այն կողմից, որ Գեղարդալճի ջրամբարի ներկայիս ծավալը /2,4մլ մ³/ չի բավարարում Գողթ համայնքի 10-12 տարիների ընթացքում Գողթ համայնքում ավելացել և շահագործվելու անհրաժեշտ տարեկան 20-30 հա

Minute of Discussions
November 19, 2014
Goght village



ևորատունկ այգիներ, որոնց թիվը հասնում է /650-700/ ոռոգելի տարածքների, որի արդյունքում ջրամբարը դատարկվում է 70-90 օրվա ժամանակահատվածում, հունիսի կէ մինչև սեպտեմբեր:

Շուր որում մինչև Գեղարդալճից ջուր բացթողնելու ժամանակահատվածը ապրիլից մինչև հունիսի կեսերը ոռոգման նպատակով օգտագործվում են սելամաջրերը: Համաձայն չենք խողովակաշարի նախագծով առաջարկվող տարբերակին, նշված համայնքների ղեկավարների կողմից առաջարկվում և պահանջվում է այլընտրանքային տարբերակ, որպեսզի խողովակաշարը անցնի համայնքի բնակավայրերին հարակից տարածքով, որը հեռավորությունն կտա նշված համայնքներին օգտվելու սելամաջրերից:

Առաջարկված խողովակաշարի անցկացումը հեռավորությունն կտա էսպես կրճատել խողովակաշարի երկարությունը, քանի որ առաջարկվող տարբերակից բացի անկա է 4,5 կ 700մ խողովակաշար, որը ևս էօգտագործվի՝ կրճատելով ծրագրի ծախսային մասը:

Առաջարկվող այլընտրանքային տարբերակը, որի դեպքում խողովակաշարը կանցնի համայնքների հարակից տարածքներով, կա բոլոր շահագրգիռ համայնքների կողմից արականակերպելու հողային սերվիտուտի և այլ հողային հարցերի լուծումը առանց ֆինանսական լրացուցիչ բեռի առաջացմանը նախագծին:

Համայնքի ղեկավարներ՝

Գոռո համայնքի ղեկավար՝



Գառնի համայնքի ղեկավար՝

Մ. Գարդանյան

Գեղարդի համայնքի ղեկավար՝

Հ. Սարգսյան

Հաջավան համայնքի ղեկավար՝

Ծ. Արմաշյան



Annex I: Public Consultation in Yerevan

ԱՐՁԱՆԱԳՐՈՒԹՅՈՒՆ

25 փետրվարի 2015թ.

ք. Երևան

2015թ. փետրվարի 25-ին տեղի ունեցավ «Հայջրնախագիծ ինստիտուտ» ՓԲԸ-ի կողմից ներկայացված «Գեղարդալիճ ինքնահոս համակարգի» նախագծի վերջնական փուլի հանրության ծանուցման և քննարկումների վերաբերյալ լսումներ:

Օրակարգ

- 1: «Գեղարդալիճ ինքնահոս համակարգի» նախագծի վերջնական փուլի վերաբերյալ զեկուցեց նախագծի գլխավոր ճարտարագետ Վ. Սահակյանը;
- 2: Տրվեցին հարցեր, տեղի ունեցան կարծիքների փոխանակում;
- 3: Ընդունվեց որոշում

Որոշում ընդունվեց հավանություն տալ վերջնական նախագծային լուծումներին և եղան առաջարկություններ համայնքների ներքին ցանցերի վերաբերյալ: Ջեկուցող Վ. Սահակյանը պարզաբանեց, որ համայնքների ներտնտեսային ցանցերի վերականգնումը առաջիկայում կընդգրկվի «Ռոտզման արդիականացման ծրագրերում»:

- Ընկերության գլխ. ճարտարագետ
- Նախագծի գլխ. ճարտարագետ
- Գողթ համայնքի ղեկավար
- Գառնի համայնքի ղեկավար
- Գեղարդի համայնքի ղեկավար
- Հացավան համայնքի ղեկավար



- Վ. Սահակյան
- Սահակյան
- Սահակյան
- Սարգսյան
- Սարգսյան

Yerevan

February 25, 2015

Minutes

of

Public consultation on the final phase of the Design for “Geghardalich Gravity Irrigation Scheme” presented by the “Hayrnakhagits Institute” CJSC

Agenda

- Report on the final phase of the design for Geghardalich Gravity Irrigation scheme by V. Sahakyan, Chief Engineer of the “Hayrnakhagits Institute” CJSC
- Questions and answers
- Exchange of views
- Decision

It was decided to approve the Final Design solutions. Some proposals were made on the on-farm irrigation networks of the communities. V. Sahakyan clarified that in future the rehabilitation of secondary networks of the communities will be incorporated in "Irrigation System Modernization Project".

Chief Engineer of the Company

Chief Engineer of the Design

Community leader of Goght

Community leader of Garni

Community leader of Geghadir

Community leader of Hatsavan

Annex J. Public Consultations in Hatsavan

MINUTES of Public Consultation on Draft ESIA Report of Geghardalich Gravity Irrigation Scheme Reconstruction

Hatsavan community, Kotayk Marz

September 9, 2015

(advertisement on the time and venue of the consultation meeting was published in the daily newspaper “Hayastani Hanrapetutyun” [Republic of Armenia] on August 28, 2015)

Participants

Artavazd Hakobyan	Goght community leader
Shavarsh Sargsyan	Hatsavan community leader
Norayr Melqonyan	Voghjaberd community leader
Vanush Muradyan	Farmer
Vachik Sahakyan	Armhydroproject, head of unit
Gagik Ghazaryan	Armhydroproject, chief engineer
Susanna Sahakyan	Hatsavan school principal
Vahagn Hovhannisyan	Teacher of history
Anushavan Khachatryan	Member of Hatsavan council
Alvard Khachatryan	Secretary
Mher Gharibyan	Member of Hatsavan council
Ani Karapetyan	Leading specialist
Vardan Petrosyan	Farmer/pensioner
Norair Melkonyan	Farmer
Marine Vardanyan	Social specialist, PIU
Martiros Nalbandyan	Environmental specialist, PIU

Representatives of Geghadir community were unable to participate in the meeting and delivered this message through the Hatsavan community leader attending the meeting

Presentations

Martiros Nalbandyan greeted the participants and noted that the main objective of the public consultation is to discuss draft Environmental and Social Impact Assessment (ESIA) report of Geghardalich gravity irrigation scheme. M. Nalbandyan briefly presented the main sections of the ESIA report, the results of studies and assessment, the description of areas related to the project and the envisioned possible impacts on the areas during and after the project implementation. He also added that all those impacts, mitigation measures and entities responsible for implementation of those mitigation measures are laid out in the Environmental and Social Management Plan (ESMP) which is an Annex to the ESIA report. Then he asked the Social Specialist of the PIU to present the social issues and the details of social assessment.

Marine Vardanyan presented the methods applied for assessment of social impacts on the affected communities. She highlighted the fact that the reconstruction of Geghardalich gravity irrigation scheme will mainly have positive social impact at the operation phase contributing to reduction in migration rate, development of agriculture, mitigation of poverty rate. She also indicated the possible inconveniences at the construction phase and their mitigation measures including temporal employment opportunity in construction (even for women who can be hired as cooks and cleaners unless they are willing to do other work) and presented the temporal and permanent land use issues and the details of the grievance redress mechanism.

Martiros Nalbandyan asked the participants to express their concerns on environmental and social issues related to the upcoming works on Geghardalich scheme.

Afterwards, there were questions and answers, an exchange of opinions.

Question

Vahagn Hovhannisyan: As the waters of the river Karmir finally flow into the river Azat, won't the water intake from the river Karmir to fill in Geghardalich reservoir influence the water balance of the river Azat?

Answer

Martiros Nalbandyan: River Karmir haven't direct access to the river Azat. However there isn't such a danger as the reservoir will be filled in late spring and early summer months when the river Azat is also flooded and there is no water shortage.

Question

Vanush Muradyan: During the construction phase, trenches will be dug. Who will be responsible for refilling of the trenches and the recovery of the area? I'm concerned firstly, about the trenches to be refilled in time and secondly about the dust that can be raised by the wind from the soil dug out from the trenches and laying for a long time. It will cause inconvenience for the people that temporally stay in the highlands to breed their cattle.

Answer

Martiros Nalbandyan: The construction works will be implemented by sections and the refilling of the trenches will not be delayed. This means at some sections the pipelines will be laid and the trenches will be refilled and the area will be recovered after welding the pipes. The

construction activities will proceed under the supervision of the design company, technical supervision company and the client (PIU).

Question

Shavarsh Sargsyan: Is there any opportunity for the local people from the affected communities to be involved in the construction works described by you so as to mitigate the unemployment issue?

Answer

Marine Vardanyan: Indeed, there is such an opportunity. The construction contractor has to offer temporal employment to local people (it is one of the requirements of the ESIA report as a measure to mitigate inconvenience caused by construction activities to local communities). At the same time, hiring local people will reduce costs of the contractor and shall be profitable for him. There is an existing precedent: contractor hired for the reconstruction of Meghri irrigation scheme did hire local workforce to undertake his task.

Question

Artavazd Hakobyan: I wonder if the construction works can disturb the irrigation water supply during the irrigation period.

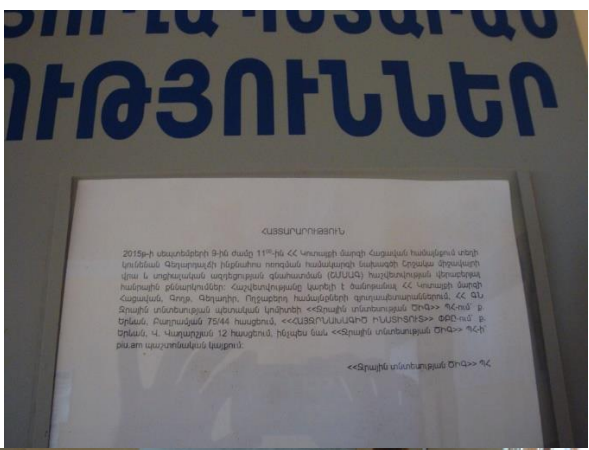
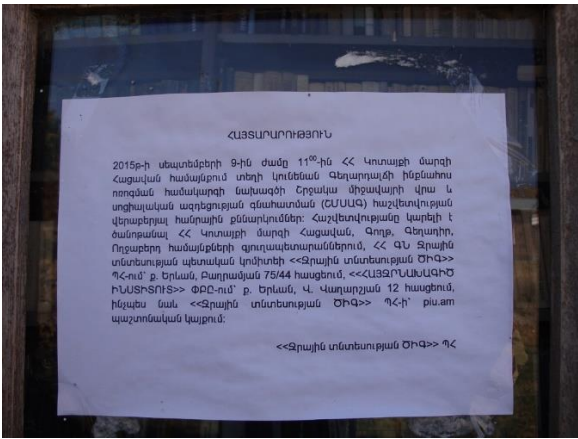
Answer

Marine Vardanyan: The construction activities that can hinder the irrigation water supply will be implemented during the non-irrigation season to ensure irrigation water supply continuity. The construction contractor will also provide access to people to their houses, facilities, lands, etc.

Statement

Artavazd Hakobyan: Our community (Goght) had concerns about reconstruction of Geghadalich irrigation scheme according to the developed design, however the designer provided reasonable justification that the proposed reconstruction will not cause water scarcity resulting in unmet demand of Goght community for irrigation water supply. Therefore, our community has nothing against the planned reconstruction and wishes works to start without further delay understanding urgent need to improve irrigation service delivery to several communities being serviced by the Geghardach scheme.

At the end, the participants expressed their positive opinion about the upcoming reconstruction of the Geghardalich irrigation scheme, noting current problems that arise during the irrigation season mostly related to the irregular operation of the pumping station. The participants appreciated the planned intervention of the Project and requested to start the construction works as soon as possible to shortly supply the communities with gravity irrigation water.



MINUTES

of public consultation meeting of the revised ESIA Report of the construction design of Gegardalich gravity irrigation scheme (including Gilanlar feeding canal)

Ararat Province of the RA, v. Dvin

December 5, 2016, 10.00 am

The announcement of public discussions was published in Armenian daily “Hayastani Hanrapetutyun” on 22.11.2016. The advertisements were posted in the municipalities of Gogt, Dvin and Upper Dvin. One copy of the printed report was provided to the each of municipalities of Gogt, Dvin and Upper Dvin and governments of Kotayk and Ararat Provinces.

Participants

Artstrun Abrahamyan	Leader of Dvin community
Arayik Babloyan	Tax collector
Bayandur Aleksanyan	Sheapherd
Martiros Nalbandyan	WSPIU Environmental Expert
Marine Mnatsakanyan	Tax collector
Gohar Baregamyan	Manager of Art Unit
Artur Zakaryan	Agricultural specialist
Gayane Mkrtchyan	Inhabitant of Dvin
Hasmik Arakelyan	Inhabitant of Dvin
Armenak Khurshudyan	Sheapherd
Marine Vardanyan	WSPIU Social Expert
Marine Karapeyan	Inhabitant of Dvin
Tatevik Nazaryan	Inhabitant of Dvin
Anushavan Avetisyan	Inhabitant of Dvin
Knarik Grigoryan	Inhabitant of Dvin
Badalyan Astgik	Inhabitant of Dvin
Hakobyan Zoya	Inhabitant of Dvin

ՅՈՒՑԱԿ

Պերպրատչի ինքնառու ոռոգման իամակարգի կառուցման նախագի (ներառյալ Գլխավորի մոտեցնող ջրանցքի կառուցումը) փոփոխված ՇՄՍԱԿ հաշվետվության վերաբերյալ 2016թ-ի դեկտեմբերի 5-ին 22 Արարտի մարզի Դվինի գյուղապետարանում կայացած հանրային քննարկումների մասնակիցների

N	Անուն, Ազգանուն	Պաշտոն, Մասնագիտություն	Հեռախոսահամար	Ստորագրություն
1	Արթուր Արթուրյան	համայնագործ	093-88-01-10	
2	Արշակ Մանուկյան	հյուսիս-արևմտ	077-54-51-54	
3	Արմենյան Գրիգոր	համայնագործ	094 18 14 73	
4	Արմենյան Գրիգոր	ՋՏ ՎԻՖԻ Վերջին	041-111-450	
5	Արմենյան Գրիգոր	համայնագործ	093-91-34-61	
6	Արմենյան Գրիգոր	ՋՏ ՎԻՖԻ Վերջին	094 48 90 29	
7	Արմենյան Գրիգոր	Գյուղ - Վանաձոր	022366132	
8	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	094837763	
9	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	077-67-62-62	
10	Արմենյան Գրիգոր	համայնագործ		
11	Արմենյան Գրիգոր	ՋՏ ՎԻՖԻ Վերջին	094588830	
12	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	098965635	
13	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	077-88-19-07	
14	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	098-27-19-27	
15	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	098-45-53-77	
16	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	094-15-64-55	
17	Արմենյան Գրիգոր	Գ. ՎԻՖԻ Վերջին	077-56-96-38	

Speeches/ Presentations

Martiros Nalbandyan welcomed the participants of meeting and told that the major objective of the meeting was to discuss the supplemented ESIA report of the Gegardalich gravity irrigation scheme. He informed participants that the additional elaborations were due to construction of Gilanlar canal which was not planned originally in the project. M. Nalbandyan briefly explained the history of inclusion of Gilanlar canal into the project and informed that Gilanlar canal and its headworks will be constructed on the lands included into the administrative area of Dvin and Upper Dvin communities. He also explained the people of communities that in that case Dvin and Upper Dvin will be considered impacted communities, and this public meeting was organized to inform the population and find out its position on the issue. M.Nalbandyan briefly presented the main sections of ESIA report, investigation results, description of the areas which potentially may be associated with the project and the possible impact of the project on those areas. He especially addressed the issue of construction of Gilanlar canal and presented possible impacts on those lands of Dvin community where the civil works for construction of the canal will be carried out, described the mitigation measures to reduce the impacts and the corresponding responsible agencies. Then M.Nalbandyan invited the PIU's Social Expert to present in more details the social issues associated with the project in general, and in particular with Gilanlar canal, and the results of social assessment.

Marine Vardanyan presented general social issues, possible impacts, the results of conducted studies and the developments associated with the construction of Gilanlar canal. She presented to participants the methodology applied for assessment of the project's social impact on the impacted communities and especially addressed the possible impacts from the construction of Gilanlar canal and corresponding mitigation measures. M. Vardanyan noted that the farms involved in seasonal cattle breeding in those areas may be impacted to some extent, however the impacts are manageable and the project provides for mitigation measures. In particular, M. Vardanyan stated that the limitations of the access of cattle to watering points and to Gilanlar River were considered as a possible impact during construction of the canal. In order to mitigate the expected impacts, the design provides for installation of temporary crossings/ bridges over trenches. In future, once the construction is over (during operation phase) the canal will be covered by concrete slabs which will serve as bridges and ensure the access of cattle to the river so there won't be any need for the temporary crossings/bridges. She attracted attention of the participants to the fact the gravity irrigation project will have mainly positive impacts at the operation stage and reduce the rate of population migration, improve agricultural development and reduce poverty level. She also noted the temporary job opportunities for the population of summer farms at the construction stage (even for women, who may work as cleaners or cooks, if they do not want to do other job). She also talked about the land use: 1.21ha of land will be used permanently for the canal and 1.56ha of land will be used temporarily for access of machinery during construction phase. Then she presented the GRM details explaining the participants how and to whom they can express their feedback about the project, concerns and/or complaints related to the construction or operation of the scheme; how and when the grievance will be responded and when it will be addressed if the issue is within the WSPIU's eligibility. She provided the participants with the GRM contact information. **Martiros**

Nalbandyan suggested the meeting participants to present their concerns regarding environmental and social issues and ask questions about the general project and Gilanlar canal in particular.

Question

Artur Zakaryan: Is there a risk that diversion of additional water from Gilanlar mudflow stream to Gegardalich Reservoir will negatively impact the downstream water balance and water users?

Answer

Martiros Nalbandyan: The water will be taken from Gilanlar mudflow stream only during forecasted draught years and only during spring floods. The capacity of Gilanlar canal allows the diversion of only 30% of the flow, and the 70% of the flow to be left in the stream is quite sufficient to cover the downstream water demand and not to harm the specific ecological systems of the area. Considering that Gilanlar is a mudflow stream and has only seasonal flow during spring flood season, no stable water biodiversity is developed in the stream. As regards water resources to be taken through Gilanlar canal in draught years, it will not have negative impact in terms of water balance, as this water flows into Azat Reservoir located at the lower elevations of the area, then almost the same volume of water is pumped by a 4-stage cascade of pumping stations to the target areas of Gegardalich project. Thus, the water potentially taken from Gilanlar mudflow stream during spring flood will be accumulated in Gegardalich Reservoir and supplied by gravity to the target communities of the project replacing the current pumped delivery.

Question

Bayandur Avetisyan: What are the volumes of civil works especially in case of Gilanlar canal? May the concerned quantities be so high to pose serious obstacles to cattle grazing by the population of summer cattle farms?

Answer

Marine Vardanyan: The civil works will be conducted at the headworks of the canal and along about 2 km long alignment. No large quantities of civil works will be implemented and definitely there will be no risk for grazing the cattle or damaging/ reducing the pasture areas. In order to prevent temporary nuisance and ensure the access of cattle to the drinking water, the design provides for construction of crossings and temporary bridges along the trench. They will ensure the movement of cattle. During construction the supervision will be implemented by relevant specialists of the Designer, Technical Supervisor and the Employer (WSPIU).

Question

Artsrun Abrahamyan: Does these works relate in any way with the Kahtsrashen gravity irrigation scheme? Dvin is one of the beneficiary communities of Kahtsrashen gravity irrigation scheme, so if there is any relation, please describe.

Answer

Martiros Nalbandyan: There is no direct relation, however both Kahtsrashen and Gegardalich gravity irrigation schemes are being constructed under the same Irrigation System Enhancement Project. These schemes have different water sources and beneficiary communities.

Question

Anushavan Avetisyan: At what stage is the Kahtsrashen gravity irrigation scheme and when we can expect to have gravity irrigation water in our communities?

Answer

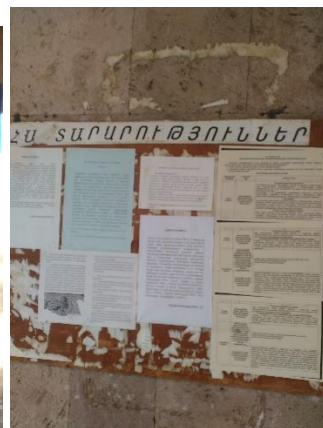
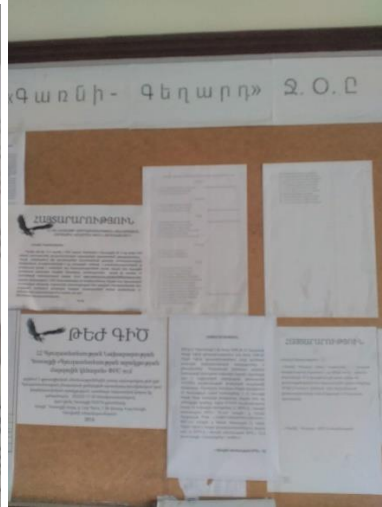
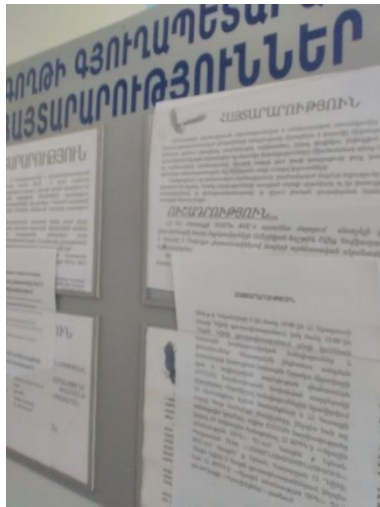
Martiros Nalbandyan: As you are aware, some people of Garni have some concerns relating the design of Kahtsrashen gravity irrigation scheme. Currently compromise solutions are being discussed and agreed. The works will be continued after their approval.

Marine Vardanyan: The PIU has developed and introduced Grievance Redress Mechanism / System. If any of the inhabitants have some concerns or complaints at any stage of the project implementation, she/he may apply to corresponding specialists of the PIU, who will consistently find urgent solution to the raised issue. The corresponding contact data are contained in the leaflets provided to village municipality. They are also posted in PIU's web site piu.am. You may use that information to address your complaints or concerns regarding both Kahtsrashen and Gegardalich gravity irrigation schemes.

Final speech

Artsrun Abrahamyan. Thank you for organization of these discussions. They indeed were important to inform the community leaders and people about the works and projects implemented within their administrative area. Regarding construction of the headworks and canal at Gilanlar, Dvin community has no objections and welcomes implementation of all such projects. Please also take into account that although these lands are included within the administrative area of Dvin community, they are very far from the community at the elevation of 2,500-3,000 m asl and are used only by seasonal farmers and sheapherds for cattle grazing. Please be consistent at the construction stage and conduct adequate supervision to ensure the compliance with the design and implementation of mitigation measures presented by you.

Photos of advertisements about public meetings in Gogt, Dvin and Upper Dvin.



Photos of participants of public consultations in Dvin.



MINUTES

of public consultation meeting of the revised ESIA Report of the construction design of Gegardalich gravity irrigation scheme (including Gilanlar feeding canal)

Ararat Province of the RA, v. Upper Dvin

December 5, 2016, 12.00 am

The announcement of public discussions was published in Armenian daily “Hayastani Hanrapetutyun” on 22.11.2016. The advertisements were posted in the municipalities of Gogt, Dvin and Upper Dvin. One copy of the printed report was provided to the each of municipalities of Gogt, Dvin and Upper Dvin and governments of Kotayk and Ararat Provinces.

Participants

Lyudmila Petrova	Leader of Upper Dvin community
Olya Petrova	Operator
Hakob Harutyunyan	Sheapherd
Martiros Nalbandyan	WSPIU Environmental Expert
Sergey Abramov	Deputy Community Leader
Janna Abdalova	Librarian
Roza Grigoryan	Director of Culture Center
Ashot Muradyan	Sheapherd
Marine Vardanyan	WSPIU Social Expert
Kharazov Samvel	Farmer
Kharazov Seroj	Farmer
Ioanov Edward	Inhabitant
Tamrazov Simon	Inhabitant
Nikolayev Kostya	WUA Site Manager
Tamrazova Milena	Staff secretary

ՑՈՒՑԱԿ

Գեղարդյալձի ինքնահոս ոռոգման համակարգի կառուցման նախագծի (ներառյալ Գիլանլարի մոտեցնող ջրանցքի կառուցումը) փոփոխված ՇՄՍԱԳ հաշվետվության վերաբերյալ 2016թ-ի դեկտեմբերի 5-ին ՀՀ Արարտի մարզի Վերին Դվինի գյուղապետարանում կայացած հանրային քննարկումների մասնակիցների

N	Անուն, Ազգանուն	Պաշտոն, Մասնագիտություն	Հեռախոսահամար	Ստորագրություն
1	Հրաչյան Պետրոս	ճշգրտիչ	093819713	<i>[Signature]</i>
2	Սյու Պարոնյան	պետարար	093916291	<i>[Signature]</i>
3	Հակոբ հարությունյան	Հովիվ		<i>[Signature]</i>
4	Սարգսյան Եսայան	ՋՏ. ՑԻԳ Բնա. Տն. Գն.	091 111 450	<i>[Signature]</i>
5	Սեդրակ Սարգսյան		093748319	<i>[Signature]</i>
6	Մանուկ Սարգսյան	գրադարանավար	093849071	<i>[Signature]</i>
7	Ռուսա Գրիգորյան	դասուցի քան. ցու.	055 077274	<i>[Signature]</i>
8	Նորիկ Սարգսյան	ապր. ար.	077 23 20 11	<i>[Signature]</i>
9	Մարկոս Մարգարյան	ՕԻԳ և այլ ծառ.	094588830	<i>[Signature]</i>
10	Խաչատրյան Վահագն	հաշվաբան	093644172	<i>[Signature]</i>
11	Խաչատրյան Արմեն	հաշվաբ.		<i>[Signature]</i>
12	Խոսրոսյան Հրաչյա	Բնակիչ	077560788	<i>[Signature]</i>
13	Յանյան Վր. Ս.	Բնակիչ		<i>[Signature]</i>
14	Գրիգորյան Լուսինե	Բնակիչ	093931916	<i>[Signature]</i>
15	Գրիգորյան Կարյա	ԱԶՕ "Վ ԴԵ. ԱԳ"	093089868	<i>[Signature]</i>
16	Սարգսյան Վր. Ս.	արհ. գաղտ.	098507033	<i>[Signature]</i>

Speeches/ Presentations

Martiros Nalbandyan welcomed the participants of meeting and told that the major objective of the meeting was to discuss the supplemented ESIA report of the Gegardalich gravity irrigation scheme. He informed participants that the additional elaborations were due to construction of Gilanlar canal which was not planned originally in the project. M. Nalbandyan briefly explained the history of inclusion of Gilanlar canal into the project and informed that Gilanlar canal and its headworks will be constructed on the lands included into the administrative area of Dvin and Upper Dvin communities. He also explained the people of communities that in that case Dvin and Upper Dvin will be considered impacted communities, and this public meeting was organized to inform the population and find out its position on the issue. M.Nalbandyan briefly presented the main sections of ESIA report, investigation results, description of the areas which potentially may be associated with the project and the possible impact of the project on those areas. He especially addressed the issue of construction of Gilanlar canal and presented possible impacts on those lands of Dvin community where the civil works for construction of the canal will be carried out, described the mitigation measures to reduce the impacts and the corresponding responsible agencies. Then M.Nalbandyan invited the PIU's Social Expert to present in more details the social issues associated with the project in general, and in particular with Gilanlar canal, and the results of social assessment.

Marine Vardanyan presented general social issues, possible impacts, the results of conducted studies and the developments associated with the construction of Gilanlar canal. She presented to participants the methodology applied for assessment of the project's social impact on the impacted communities and especially addressed the possible impacts from the construction of Gilanlar canal and corresponding mitigation measures. M. Vardanyan noted that the farms involved in seasonal cattle breeding in those areas may be impacted to some extent, however the impacts are manageable and the project provides for mitigation measures. In particular, M. Vardanyan stated that the limitations of the access of cattle to watering points and to Gilanlar River were considered as a possible impact during construction of the canal. In order to mitigate the expected impacts, the design provides for installation of temporary crossings/ bridges over trenches. In future, once the construction is over (during operation phase) the canal will be covered by concrete slabs which will serve as bridges and ensure the access of cattle to the river so there won't be any need for the temporary crossings/bridges. She attracted attention of the participants to the fact the gravity irrigation project will have mainly positive impacts at the operation stage and reduce the rate of population migration, improve agricultural development and reduce poverty level. She also noted the temporary job opportunities for the population of summer farms at the construction stage (even for women, who may work as cleaners or cooks, if they do not want to do other job). She also talked about the land use: 0,65ha of land will be used permanently for the canal and 0,98ha of land will be used temporarily for access of machinery during construction phase. Then she presented the GRM details explaining the participants how and to whom they can express their feedback about the project, concerns and/or complaints related to the construction or operation of the scheme; how and when the grievance will be responded and when it will be addressed if the issue is within the WSPIU's eligibility. She provided the participants with the GRM contact information. **Martiros Nalbandyan** suggested the meeting participants to present their concerns regarding environmental

and social issues and ask questions about the general project and Gilanlar canal in particular.

Question

Lyudmila Petrova: Can you show on the map the approximate location of the civil works?

Answer

Martiros Nalbandyan showed on the schematic map the areas relating to the design of Gegardalich gravity irrigation scheme. Then he specified the location of civil works for Gilanlar canal and its headworks on the map of administrative area of the community which was available in the village municipality.

Opinion

Nikolayev Kostya: The water of that area never reaches Upper Dvin. Our community gets irrigation water from Artashat canal. The possible water intake from Gilanlar mudflow stream will not impact the irrigation water of our community. However, the agreement of the community is required for passing through these lands.

Clarification

Martiros Nalbandyan: The designer has received the agreement of the community. The permit of the community for civil works also is available. The main purpose of today's meeting is to inform the people of Upper Dvin about envisaged project, in particular about the construction of Gilanlar canal and listen to their position or concerns in that regard.

Question

Sergey Abramov: What design will have the conduit? Will it be an open canal or the water will be conveyed through a pipeline?

Answer

Martiros Nalbandyan: It will be an open concrete canal covered at some sections by concrete slabs. This solution will solve two issues: (i) these concrete slabs will serve as bridges for free movement of cattle of sheep herd; (ii) they will be located at sections with high probability of snow storms. The concrete cover will prevent canal from plugging by snow and allow the collection and transfer of the water in dry years to Gegardalich reservoir even in early spring.

Clarification

Marine Vardanyan: In order to prevent temporary nuisance and ensure the access of cattle to the drinking water, the design provides for construction of crossings and temporary bridges along the trench. They will ensure the movement of cattle. During construction the supervision will be implemented by relevant specialists of the Designer, Technical Supervisor and the Employer (WSPIU).

Question

Lyudmila Petrova: Although these lands are within the administrative area of the community, they are too far, and even we do not know it well. So it would be good to know if the flora and fauna of the area was sufficiently investigated, are there any plant species registered in the Red Book which may be impacted as a result of civil works?

Answer

Martiros Nalbandyan: It is very good that the community raises such question. A detailed biodiversity study of the project area was conducted under the main design of Gegardalich gravity irrigation scheme. The relevant specialist of the design consultant made additional field visits to the area of Gilanlar canal to implement visual investigations. According to the results of those investigations, there are no endangered species or species registered in the Red Book which may be impacted by project implementation. Considering the geographic location of the area (2,700-3,000m asl), it has very low biodiversity indicators. Nevertheless, all the possible impacts were identified and mitigations measures were provided. You may become familiar with them in the Environmental and Social Management Plan, which is attached to the report as an annex and is provided to you.

Marine Vardanyan: The PIU has developed and introduced Grievance Redress Mechanism / System. If any of the inhabitants have some concerns or complaints at any stage of the project implementation, she/he may apply to corresponding specialists of the PIU, who will consistently find urgent solution to the raised issue. The corresponding contact data are contained in the leaflets provided to village municipality. They are also posted in PIU's web site piu.am. You may use that information to address your complaints or concerns regarding both Kahtsrashen and Gegardalich gravity irrigation schemes.

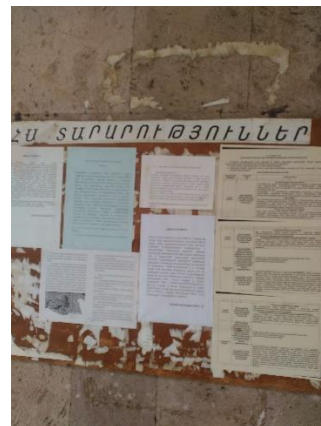
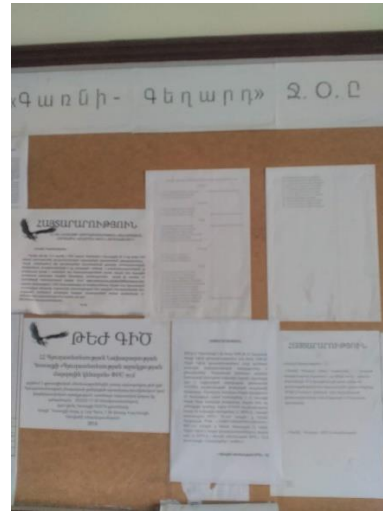
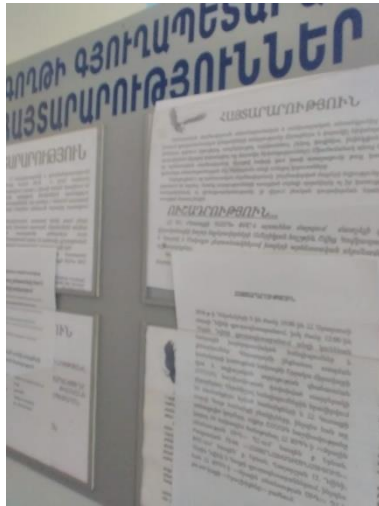
Question to the community people

Lyudmila Petrova: What do you think? Should we give our consent to the civil works for construction of Gilanlar canal on the lands included into the administrative area of our community? The question refers especially to those farmers who have mountains plot within this area and are engaged in seasonal farming. Do you have any concerns?

Community population did not express any serious concern. They asked once again to implement the civil works in a manner to minimize the harm to the nature and cause less temporary nuisance to population as it was presented by the persons responsible for the project and is provided by the design.

Lyudmila Petrova wished success to the project and expressed readiness to assist in administrative issues in terms of agreements expected from the community and other procedures.

Photos of advertisements about public meetings in Gogt, Dvin and Upper Dvin.



Photos of participants of public consultations in Upper Dvin



Annex M: Agreements on Community Land Use

Goght community

The main pipeline section from St. 0+00 to St. 140+00 of the Geghardalich gravity system in the Goght village area passes through lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

A. Hakobyan

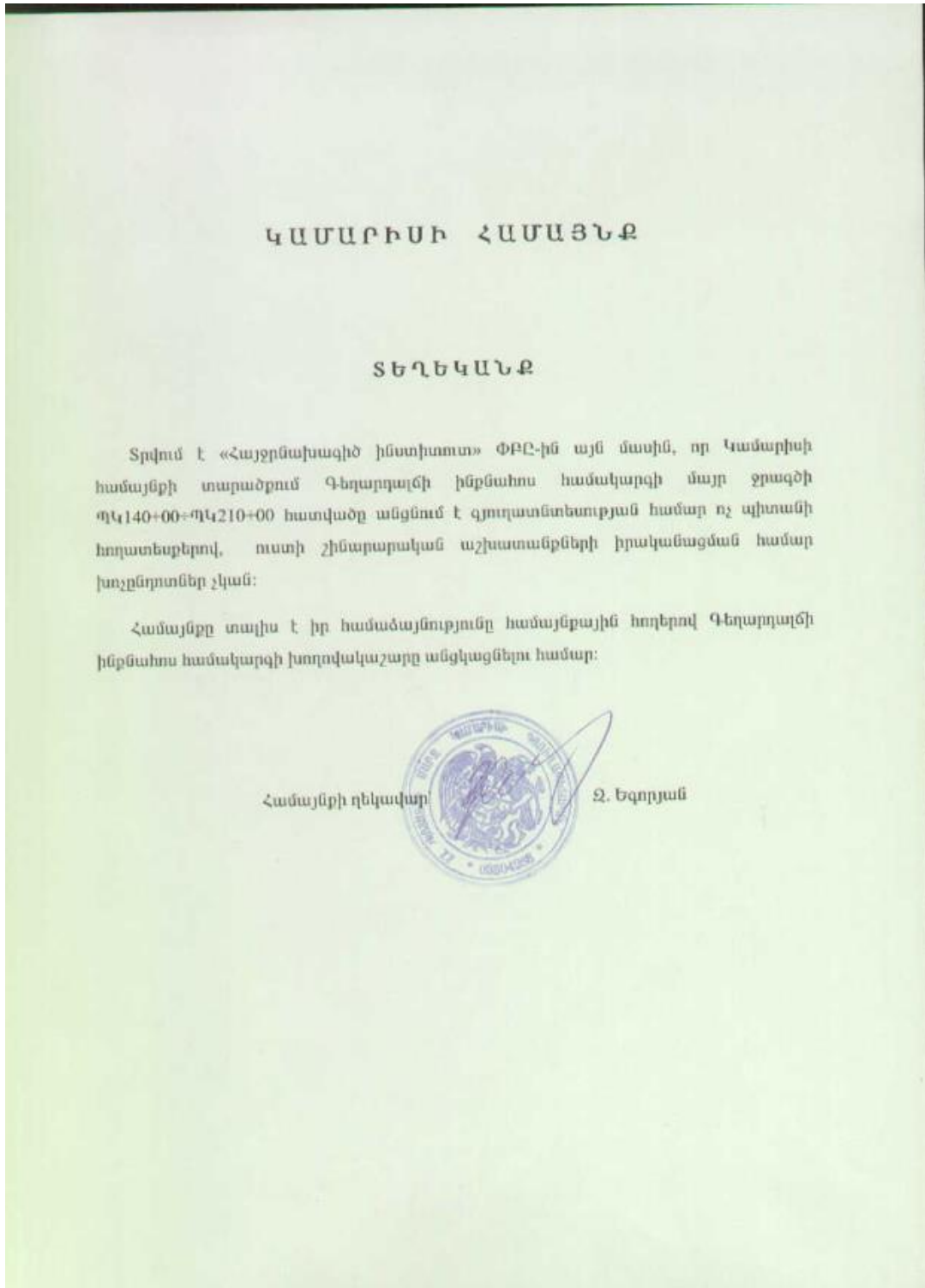


Kamaris community

The main pipeline section from St. 140+00 to St. 210+00 of the Geghardalich gravity system in the Kamaris village area passes through lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

Z. Yegoryan



The main pipeline section from St. 210+00 to St. 258+60 of the Geghardalich gravity system in the Voghjaberd village area passes through lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

N. Melkonyan



Geghadir Community

The Geghadir-Hatzavan branch of the Geghardalich gravity system in the Geghadir village area passes through lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

H. Sargsyan

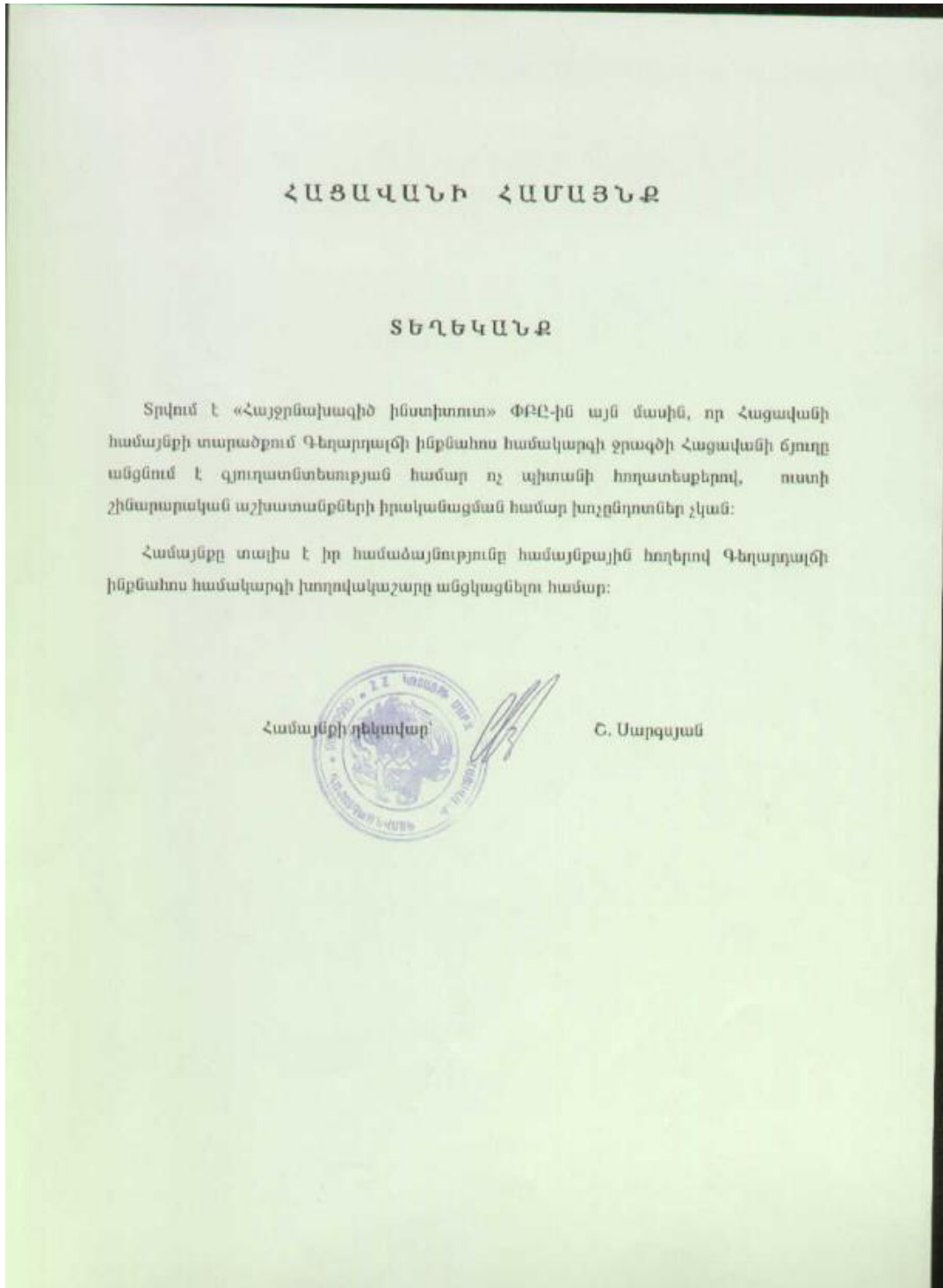


Hatzavan Community

The Hatzavan branch of the Geghardalich gravity system in the Hatzavan village area passes through lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

S. Sargsyan



The Geghardalich gravity system passes through Dvin community lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

A. Abrahamyan



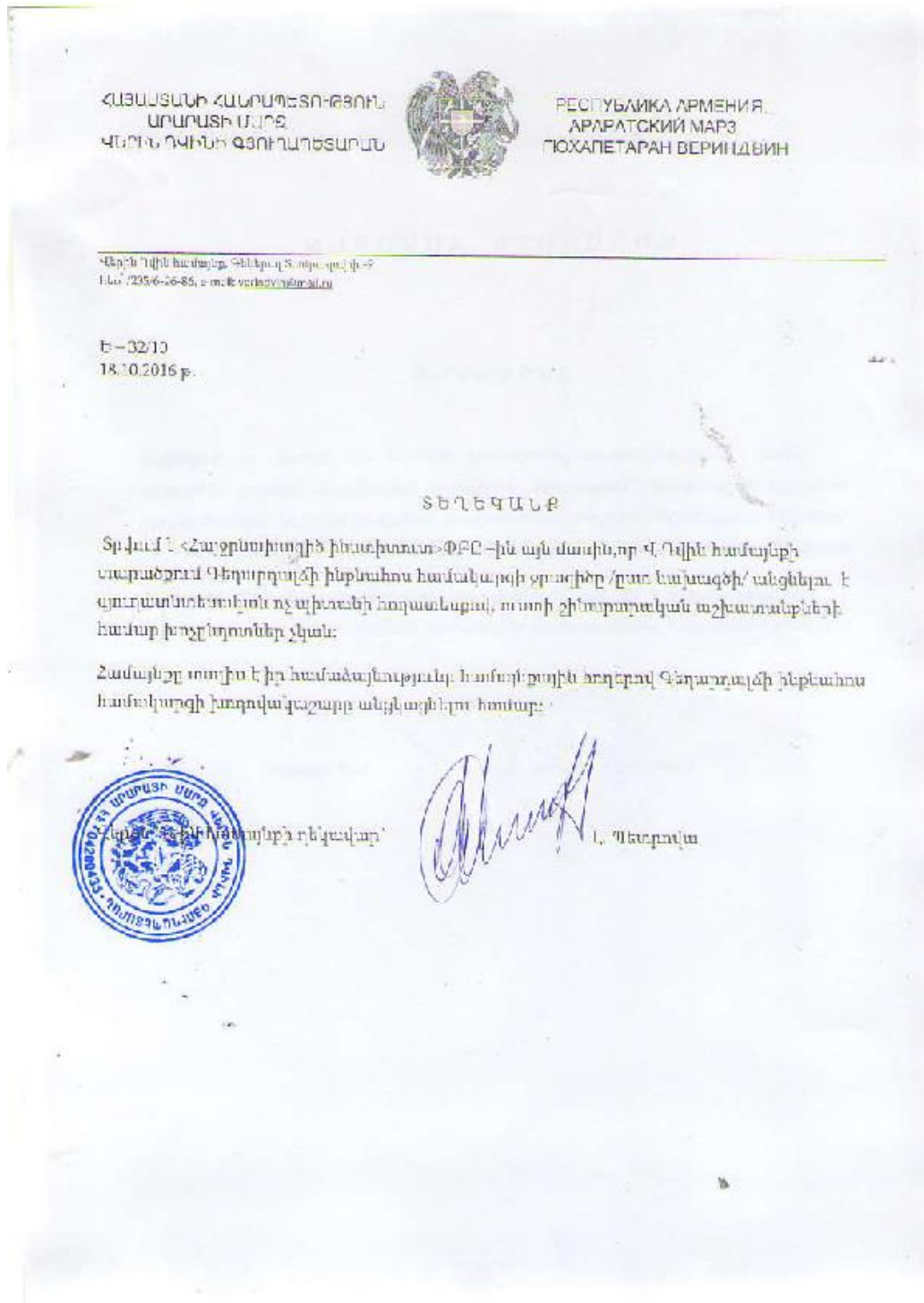
Verin Dvin Community

Notice

The Geghardalich gravity system passes through Verin Dvin community lands unsuitable for agriculture, so there are no obstacles to implement construction works. The community agrees for laying the pipeline of the Geghardalich gravity system through lands of the village.

Head of community

L. Petrova



Annex N. Resolution of the Council of Goght Community

Letterhead of the Council of Goght Community of the Republic of Armenia

RA Kotayk Region
E-mail goght.kotayq@mta.gov.am
Tel : 093 55-65-19

Resolution N23

June 02, 2016

on

**the obligatory and priority construction of additional feeding canal to Geghardalich Reservoir
from Gilanlar River**

Given the situation emerged around the construction of Geghardalich gravity irrigation scheme, as well as the inhabitants' concern about sustainable and sufficient irrigation water supply, and governed by the requirements of the paragraph 6 of Article 11 of the RA law on "Local Self-Government", the Council of Goght Community has decided the following:

Apply to the "Water Sector PIU" SA for obligatory and priority inclusion of the construction of additional feeding canal to Geghardalich Reservoir from Gilanlar River in order to ensure sufficient water for Geghardalich gravity scheme and sustainable irrigation water supply to Goght community and to all the communities which are proposed to be supplied from the reservoir, and to reduce the risks in future potential dry years.

(6) in favor

(0) against

(0) abstention]

1. Galstyan Samvel
2. Hovasapyan Babik
3. HovsepyanVarich
4. Movsisyan Aleksan
5. Stepanyan Artem
6. Harutyunyan Levon

Community Leader - A. Hakobyan



ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԳՈՂԹ ՀԱՄԱՅՆՔԻ ԱՎԱԳԱՆԻ

Հայաստանի Հանրապետության Կոտայքի մարզի
Գողթ համայնք, հրապարակի 1 E-mail goght.kotayq@mta.gov.am 093556519

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02 հունիսի 2016 թ N 23

**ԳԻԼԱՆԼԱՐ ԳԵՏԻՑ ԳԵՂԱՐԴԱԼԻՃ ՋՐԱՄԲԱՐԸ ՄՆՈՒՅՈՂ ԼՐԱՑՈՒՑԻՉ ՄՈՏԵՑՆՈՂ
ՋՐԱՆՑՔԻ ՊԱՐՏԱԴԻՐ ԵՎ ԱՌԱՋՆԱՀԵՐԹ ԿԱՌՈՒՅՄԱՆ ՄԱՍԻՆ:**

Շաշվի առնելով Գեղարդալճի ինքնահոս համակարգի կառուցման շուրջ ստեղծված իրավիճակը, ինչպես նաև կայուն և բավարար ոռոգման ջրամատակարարման վերաբերյալ բնակչության շրջանում առկա մտահոգությունները և ղեկավարվելով “Տեղական ինքնակառավարման մասին” Հայաստանի Հանրապետության օրենքի 11-րդ հոդվածի 6-րդ մասի պահանջները՝

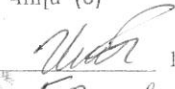
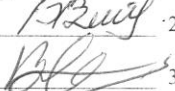
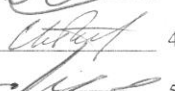
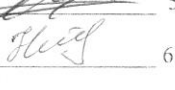


Գողթ համայնքի ավագանին որոշում է .

Գեղարդալճի ինքնահոս համակարգի և Գողթ համայնքի համար բավարար քանակությամբ ջրային պաշարներ ապահովելու նպատակով դիմել <<Ջրային տնտեսության ՕԻԳ>> ՊԷ-ին՝ Գեղարդալճի ինքնահոս համակարգի կառուցման ծրագրում պարտադիր և առաջնահերթ ներառել Գիլանլար գետից Գեղարդալիճը սնուցող լրացուցիչ մոտեցնող ջրանցքի կառուցումը, ինչը թույլ կտա ապահովել կայուն ոռոգման ջրամատակարարում Գեղարդալիճ ջրամբարից սնվող և նախատեսվող բոլոր համայնքներին և կնվազեցնի ռիսկերը հետագա հնարավոր սակավաջուր տարիներին:

Կողմ (6)

Դեմ (0)

Չեռնպահ (0)

-  1. Գալստյան Սամվել
-  2. Հովասաթյան Բաբիկ
-  3. Հովսեփյան Վարիչ
-  4. Մովսիսյան Ալեքսան
-  5. Ստեփանյան Արտեմ
-  6. Հարությունյան Լևոն

Համայնքի ղեկավար՝

Ա. Հակոբյան



Annex O. Photos made during joint site visit on June 24, 2016

