

WATER SECTOR DEVELOPMENT  
AND INSTITUTIONAL IMPROVEMENTS PIU

Environmental Management Plan

**Rehabilitation of Tertiary Irrigation Networks in  
Lori, Gegarkunik and Shirak Marzes**

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## Contents

|  |    |
|--|----|
| Glossary   | 3  |
| Executive Summary  | 4  |
| 1 Introduction   | 6  |
| 2 Project Description  | 6  |
| 3 Description of existing environmental and social conditions        | 14 |
| 4 Environmental and Social Impacts                                   | 29 |
| 5 Mitigation and Enhancement Measures                                | 29 |
| 6 Institutional Responsibilities, Reporting and Budget               | 32 |
| 6.1 Institutional Responsibilities                                   | 32 |
| 6.2 Reporting Format and Schedule                                    | 33 |
| 6.3 Budget   | 33 |
| 7 Public Consultations   | 34 |
| 8 Environmental and Social Clauses for Civil Works' Contracts        | 35 |
| 9 Main Findings  | 35 |
| Annexes  | 36 |
| Annex A: Environmental Management Plan: Mitigation Measures          | 36 |
| Annex B: Monitoring Plan   | 42 |
| Annex C: Incident Report Form  | 44 |
| Annex D: Check List of Potential Environmental and Social Impacts    | 45 |
| Annex E: Environmental and Social Clauses for Civil Works' Contracts | 52 |
| Annex F: Minutes of Public Consultation Meetings                     | 56 |

## Glossary

|             |   |
|-------------|---|
| AMD         | Armenian Dram   |
| CJSC        | Closed Joint Stock Company                              |
| DM          | Distance Marker (or “Picket Number”)                    |
| EMP         | Environmental Management Plan                           |
| ESHSP       | Environmental, Social, Health and Safety Plan           |
| GoA         | Government of Armenia                                   |
| IA          | Infrastructure Activity                                 |
| IAP         | Irrigated Agriculture Project                           |
| ICID        | International Commission on Irrigation and Drainage     |
| MCA-Armenia | Millennium Challenge Account - Armenia SNCO             |
| MCC         | Millennium Challenge Corporation                        |
| NGO         | Non-Governmental Organization                           |
| NSS         | National Statistical Service of the Republic of Armenia |
| PAP         | Project Affected Party                                  |
| RAP         | Resettlement Action Plan                                |
| RA          | Republic of Armenia                                     |
| RPF         | Resettlement Policy Framework                           |
| SNCO        | State Non Commercial Organization                       |
| TO          | Task Order  |
| USD         | United States of America Dollars                        |
| WB          | World Bank  |
| WTM         | Water-to-Market Activity                                |
| WUA         | Water User Association                                  |

## Executive Summary

Rehabilitation of tertiary irrigation network is envisaged under the Additional Financing of the Irrigation Rehabilitation Emergency Project (IREP). These tertiary irrigation networks are located in Lori, Gegarkunik and Shirak Marzes and belong to the communities under the command of the Nalband, Sevan and Shirak Irrigation Schemes: Lori Marz, Nalband I/S – Jrashen community, being within the service area of “Getik” WUA, Gegarkunik Marz, Sevan I/S – Verin Getashen, Martuni, Dzoragbyur, Astghadzor, Vaghashen communities, being within the service area of “Martuni” WUA, Shirak Marz, Shirak I/S – Megrashen community within the service area of “Shirak” WUA. Rehabilitation of tertiary irrigation networks was envisaged under the MCA-Armenia program. For this purposes Environmental Management Plan was prepared under the MCA-Armenia program, however because of the limited time and resources these rehabilitation works were not carried out under the MCA-Armenia program. For this purposes the Environmental Impact Assessment (EIA), including the Environmental Management Plan (EMP), was prepared by the Mott MacDonald, Inc. Environmental and Social Assessment and Oversight Consultant (ESAOC), based on the final designs prepared by the Design Consultant - Institute of Water Problems and Hydraulic Engineering after Academician V. Yeghiazarov CJSC (Armenia) in association with WYG International Ltd. (UK) and Jen Financial, Engineering and Management Consulting Limited (Armenia), under the contract IA-07/002 for Design and Construction Supervision for Rehabilitation of Tertiary Irrigation Canals. The EIA and EMP were prepared based on the requirements set by the RA legislation, RA Law on Environmental Impact Assessment, MCC Environmental Guidelines, MCC Gender Policy and the World Bank’s (WB) Operational Policy on Involuntary Resettlement (OP4.12). However, because of the limited time and resources the proposed rehabilitation works were not carried out under the MCA-Armenia program.

Currently the WB considers Additional Financing of IREP to address rehabilitation of tertiary irrigation networks. EMP prepared under the MCA-Armenia program for Nalband, Gegarkunik, and Shirak Irrigation Schemes includes tertiary irrigation networks of above mentioned 7 communities of three marzes to be rehabilitated in the scope of the IREP AF, thus the EMP prepared by MCA-Armenia is applicable for rehabilitation of the above tertiary irrigation networks.

Rehabilitation of the tertiary canals of 7 communities in Lori, Gegarkunik, and Shirak marzes will improve the operation of the tertiary networks of the communities by providing reliable supply of irrigation water for the agricultural lands. It will contribute to the expansion of irrigated lands and increasing volumes of agricultural production, increased food security, growing incomes in agricultural sector, thereby reducing the number of poor population and the migration in the area. In addition, this will encourage farmers to expand irrigated agricultural production and apply high value crops. The anticipated overall positive environmental and social impacts from the improved tertiary canals in the project area will be long-term and cumulative contributing to the improvement of social and economic conditions in affected communities.

The likely adverse environmental impacts expected as a result of rehabilitation works are expected to be insignificant, short-term and localized. These may include, but are not limited to the following: pollution of surface and ground water resources; degradation of agricultural lands and landscape, soil erosion due to improper disposal of excavated soil, sediments and

construction waste; spillage of oil and other substances during the rehabilitation; use of temporary construction sites (camps, machinery sites, storage facilities, etc); use of borrow pits; temporary air pollution related to increased truck traffic during the civil works; noise and vibration disturbances of flora and fauna and local population during trench excavation, as well as other likely impacts on biodiversity. The study of baseline environmental data, site investigations and analyses revealed no major environmental impacts to be likely caused by implementation of the proposed rehabilitation works, assuming proper application and monitoring of the EMP. The expected impacts, depending on rehabilitation works implementation, will be small-scale and temporary.

Adverse social impacts may occur in case it is required to temporarily or permanently use private lands or other assets for implementation of the rehabilitation works. If the rehabilitation and/or further operation and maintenance of the tertiary canal results in temporary or permanent use of lands and/or other assets, project affected parties (PAPs) shall be compensated in accordance with the requirements of the Resettlement Policy Framework (RPF), Armenian legislation the World Bank's Operational Policy on Involuntary Resettlement (OP 4.12). A Resettlement Action Plan (RAP) will be developed consistent with the RFP and will be implemented prior to construction in the affected areas to ensure proper compensation to the affected people. Inventory and analysis of technical and social data obtained from the design phase, as well as site investigations demonstrate that no land take is likely to be required for the rehabilitation of the targeted tertiary networks.

For the tertiary irrigation networks with possible site-specific impacts, adequate mitigation measures were proposed in **Annex A**. These measures are specifically developed for the design, rehabilitation and operation phases of the project to address any of the identified negative environmental and social impacts and duly consider public concerns and views that were obtained in the design phase, in the process of informal and formal consultations with the public affected by the project. The Design Consultant and the Technical Supervision Consultant are responsible for implementation of the EMP, including the mitigation measures specified in the Annex A. The monitoring plan to ensure compliance with the requirements of **Annex A** is described in **Annex B**. A set of environmentally and socially sound clauses for civil works contracts is incorporated in the Technical Specifications for tertiary networks of Nalband, Gegarkunik and Shirak irrigation schemes and included in **Annex E**.

## 1. Introduction

Rehabilitation of tertiary irrigation network is envisaged under the Additional Financing of the Irrigation Rehabilitation Emergency Project (IREP). These tertiary irrigation networks are located in Lori, Gegarkunik and Shirak marzes and belong to the communities under the command of the Nalband, Sevan and Shirak Irrigation Schemes: Lori Marz, Nalband I/S – Jrashen community, being within the service area of “Getik” WUA, Gegarkunik Marz, Sevan I/S – Verin Getashen, Martuni, Dzoragbyur, Astghadzor, Vaghashen communities, being within the service area of “Martuni” WUA, Shirak Marz, Shirak I/S – Megrashen community within the service area of “Shirak” EUA. Rehabilitation of tertiary irrigation networks was envisaged under the MCA-Armenia program. For this purpose Environmental Management Plan was prepared under the MCA-Armenia program, however because of the limited time and resources these rehabilitation works were not carried out under the MCA-Armenia program.

Currently the WB considers Additional Financing of IREP to address rehabilitation of tertiary irrigation networks. Taking into account that EMP prepared under the MCA-Armenia program for Nalband, Gegarkunik and Shirak Irrigation Schemes includes tertiary irrigation networks of above 7 communities of three marzes to be rehabilitated in the scope of the IREP AF, so the EMP prepared by MCA-Armenia is applicable for rehabilitation of mentioned tertiary irrigation networks. This EMP covers rehabilitation of nearly 26.0 km of degraded irrigation networks and/or stretches thereof.

The rehabilitation works are expected to start in 2012 and finished until April, 2013 (depending on the complexity of the system and volume of works) and will be carried out mainly during the off-irrigation season. If civil works are to be implemented during the irrigation period, the Construction contractor will need to ensure uninterrupted irrigation water supply by providing by-pass channels or other means, which are subject to approval by the respective WUA.

## 2 Project Description

This chapter was developed using the baseline environmental and social data collected and provided by the Design Consultants – “Jrtuk” Ltd, “Jrarbi” Ltd., “Haygiughshinnakhagits” Ltd.

Tertiary irrigation networks envisaged for rehabilitation are located in Jrashen, Verin Getashen, Martuni, Dzoraghbiur, Astghadzor, Vaghashen and Megrashen communities of Lori, Gegarkunik and Shirak Marzes of the RA and get water from the main canals of Nalband, Sevan and Shirak Irrigation Schemes.

The Table 1 below presents key data on the tertiary irrigation networks to be rehabilitated under the Additional Financing of the Irrigation Rehabilitation Emergency Project, data on the length of the canal and stretches to be rehabilitated in each community, irrigated land area before and after rehabilitation.

Table 1: Key data on tertiary irrigation networks in Lori, Gegharkounik and Shirak Marzes planned for rehabilitation under the Additional Financing of the Irrigation Rehabilitation Emergency Project

| No.  | Name of the community     | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total length of the canal (km) | Length of the stretches to be rehabilitated (km) |
|--|---------------------------|---|--|--------------------------------|--|
| <b><i>Lori Marz, Nalband Irrigation Scheme</i></b>     |                           |   |  |                                |  |
| <b><i>“Getik” WUA</i></b>                              |                           |   |  |                                |  |
| 1.   | Jrashen                   | 86  | 153                                      | 2.4                            | 1.7  |
|  | <b>Total: Nalband I/S</b> | <b>86</b>                                 | <b>153</b>                               | <b>2.4</b>                     | <b>1.7</b>                                       |
| <b><i>Gegarkunik Marz, Sevan Irrigation Scheme</i></b> |                           |   |  |                                |  |
| <b><i>“Martuni” WUA</i></b>                            |                           |   |  |                                |  |
| 2.   | Verin Getashen            | 140                                       | 182                                      | 14.4                           | 4.9  |
| 3.   | Martuni                   | 198                                       | 256                                      | 10.8                           | 7.7  |
| 4.   | Dzoraghbiur               | 130                                       | 169                                      | 7.6                            | 3.0  |
| 5.   | Astghadzor                | 120                                       | 156                                      | 5.3                            | 4.1  |
| 6.   | Vaghashen                 | 130                                       | 169                                      | 4.5                            | 3.2  |
|  | <b>Total: Sevan I/S</b>   | <b>718</b>                                | <b>932</b>                               | <b>42.6</b>                    | <b>22.9</b>                                      |
| <b><i>Shirak Marz, Shirak Irrigation Scheme</i></b>    |                           |   |  |                                |  |
| <b><i>“Shirak” WUA</i></b>                             |                           |   |  |                                |  |
| 12.  | Megrashen                 | 64  | 93                                       | 2.8                            | 1.4  |
|  | <b>Total: Shirak I/S</b>  | <b>64</b>                                 | <b>93</b>                                | <b>2.8</b>                     | <b>1.4</b>                                       |
|  | <b>TOTAL:</b>             | <b>868</b>                                | <b>1178</b>                              | <b>47.8</b>                    | <b>26</b>  |

Further is the description of the existing state of tertiary canals and proposed rehabilitation works.

#### **Jrashen community, Lori Marz**

The irrigation network of Jrashen community is located at the elevation of 1680 m above sea level. It is envisaged for rehabilitation B-1, B-2 and B-3 distributors of Jrashen community located under command of Nalband Irrigation Scheme, within the service area of “Getik” WUA for irrigation of 153 ha of community lands. The total length of the tertiary irrigation network of Jrashen community is 2.4 km. The length of the sections proposed for rehabilitation is 1.7 km including 561 m section of B-1, 806 m section of B-2 and 263 m section of B-3.

B-2 and B-3 distributors represent the continuation of the existing distributors, and B-1 is the continuation of B-3 distributor. Water metering structures will be installed at the headworks of the existing distributors.

15 m long section of B-1 distributor is made of PII-60 half-pipes which are completely destroyed, 52 m long section is made of D=200-400 mm steel pipes, and 494 m section goes in an earth canal. Pipes are located mainly close to the buildings and garages and are in poor state.

47 m long section of B-2 distributor is made of D=200-400 mm steel pipes and 759 m section is an earth canal. Pipes are located mainly close to the buildings and garages and are in poor state.

263 m long section of B-3 distributor is made of PII-60 half-pipes which are completely destroyed.

All distributors go along community streets. Distributors B-2 and B-3 go along streets with completely demolished asphalt covering, and B-1 – along unpaved streets. No asphalt rehabilitation is envisaged.

There are no structures on the distributors.

Distributors were in operation for about 30-40 years. During this period no repair or preventive maintenance was carried out which resulted in unsatisfactory condition of the network. As a result, fields are not supplied with the required quantity of irrigation water which results in reduction of agricultural production, and many plots are not cultivated.

It is envisaged to dismantle all degraded PII-60 half-pipes, D=200-400 mm steel pipes and rehabilitate all distributors with PII-40 half-pipes, construct supports for PII-40 half-pipes, arrange outlets, distributing wells, pipe-crossings and outlet structures at the end-tail sections of distributors and install gates on the distributing wells.

The following tables presents the data on the tertiary irrigation network in Jrashen community.

Table 2. Key data on the tertiary irrigation network of Jrashen community

| No. | Name of the distributor | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total canal/ pipe length (km) | Canal/ pipe length planned for rehabilitation (km) |
|-----|-------------------------|---|--|-------------------------------|--|
| 1.  | B-1                     | 86  | 153                                      | 2.4                           | 0.561  |
| 2.  | B -2                    |   |  |                               | 0.806  |
| 3.  | B-3                     |   |  |                               | 0.263  |
|     | <b>Total</b>            | <b>86</b>                                 | <b>153</b>                               | <b>2.4</b>                    | <b>1.63</b>  |

### Verin Getashen Community, Gegarkunik Marz

The irrigation network of Verin Getashen community is located at the elevation of 1975 m above sea level. It is envisaged for rehabilitation 8 distributors - B-1, B-2, B-3, B-4, B-5, B-6, B-7 and B-8 of under command of Sevan irrigation scheme, within the service area of “Martuni” WUA for irrigation of 182 ha of community lands.

All distributors represent the continuation of existing ones. Water metering structures are installed at the headworks of the existing distributors. Total length of distributors is 14.415 km, total length of sections proposed for rehabilitation is 4.9 km. Distributors B-1, B-2, B-3, B -5, B-6, B-7 and B-8 have an earth bed, 574 m of distributor B-4 with total length of 1078.5 m is made of D=500 mm steel pipes, the remaining section has earth bed. Steel pipes are completely degraded causing significant losses of irrigation water.

Distributors B-1, B-2, B-4 (L=353 m), B-6 and B-8 pass through the homestead plots, distributors B-3, B-4 (L=725 m), B-5 and B-7 go along streets and roads.

There are no engineering structures on the distributors, or they are completely demolished. Water source of the community is Agrija River. Some plots are irrigated by gravity, and the others – by Agrija pumping station.

The distributors were in operation for about 30-40 years. During this period no repair or preventive maintenance works were carried out which resulted in unsatisfactory condition of the network. As a result, the plots are not supplied with the required quantity of irrigation water which results in reduction of agricultural production and many plots are not irrigated.



The following table presents the data on the tertiary irrigation network in Verin Getashen community.

Table 3. Key data on the tertiary irrigation network of Verin Getashen community

| No. | Name of the distributor | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total Canal/ Pipe Length (km) | Canal/ Pipe length planned for rehabilitation (km) | Type of precast elements for rehabilitation |
|-----|-------------------------|---|--|-------------------------------|--|---|
| 1.  | B-1                     | 140                                       | 182                                      | 1950                          | 4.9  | PII-40                                      |
| 2.  | B-2                     |   |  | 1864                          |  | PII-40                                      |
| 3.  | B-2-1                   |   |  | 356                           |  | PII-40                                      |
| 4.  | B-2-2                   |   |  | 425                           |  | PII-40                                      |
| 5.  | B-3                     |   |  | 165                           |  | PII-40                                      |
| 6.  | B-3-1                   |   |  | 789                           |  | PII-40                                      |
| 7.  | B-4                     |   |  | 3250                          |  | JIP-4, PII-40                               |
| 8.  | B-4-1                   |   |  | 910                           |  | PII-40                                      |
| 9.  | B-4-2                   |   |  | 891                           |  | PII-40                                      |
| 10. | B-5                     |   |  | 1651                          |  | LP-4  |
| 11. | B-6                     |   |  | 1020                          |  | PII-40                                      |
| 12. | B-7                     |   |  | 487                           |  | JIP-4                                       |
| 13. | B-8                     |   |  | 657                           |  | PII-40                                      |
|     | <b>Total:</b>           | <b>140</b>                                | <b>182</b>                               | <b>14.415</b>                 | <b>4.9</b>   | JIP-4 - 1450M<br>PII-40 - 3739M             |

It is also envisaged to construct all necessary structures on the distributors: distributing wells, outlets, pipe-crossings and install gates on wells.

### **Martuni Community, Gegarkunik Marz**

The irrigation network of Martuni community is located at the elevation of 1975 m above sea level. It is envisaged for rehabilitation 15 distributors - B-1, B-2, B-2-1, B-3, B-4, B-5, B-6, B-7, B-7-1, B-7-2, B-8, B-9, B-9-1, B-10 and B-13 of Martuni community located under command of Sevan irrigation Scheme, within the service area of “Martuni WUA for irrigation of 256 ha of community lands. The total length of distributors is 10.84 km, the total length of sections proposed for rehabilitation – 7.7 km.

All distributors go along community streets and irrigate homestead plots. There are no engineering structures on the distributors, or they are completely demolished. Water source of the community is Martuni pumping station, Manasi and Sari streams and Agrija River. Homestead plots are irrigated by gravity system.

Distributors were in operation for about 30-40 years. During this period no repair or preventive maintenance works were carried out which resulted in unsatisfactory condition of the network. As a result, the fields are not supplied with the required quantity of irrigation water which results in reduction of agricultural production and many plots are not irrigated.

Table 4. Key data on the tertiary irrigation network of Martuni community

| No  | Name of the distributor | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total length (km) | Length of canal proposed for rehabilitation (m) | Type of precast elements for rehabilitation |
|-----|-------------------------|---|--|-------------------|---|---|
| 1.  | B-1                     | 198                                       | 256                                      | 10.8              | 7.7   | PII-40                                      |
| 2.  | B-2                     |   |  |                   |   | JIP-4                                       |
| 3.  | B-2-1                   |   |  |                   |   | JIP-4                                       |
| 4.  | B-3                     |   |  |                   |   | PII-40                                      |
| 5.  | B-4                     |   |  |                   |   | PII-40                                      |
| 6.  | B-5                     |   |  |                   |   | JIP-4                                       |
| 7.  | B-6                     |   |  |                   |   | PII-40                                      |
| 8.  | B-7                     |   |  |                   |   | PII-40                                      |
| 9.  | B-7-1                   |   |  |                   |   | PII-40                                      |
| 10. | B-7-2                   |   |  |                   |   | PII-40                                      |
| 11. | B-8                     |   |  |                   |   | JIP-4                                       |
| 12. | B-9                     |   |  |                   |   | PII-40                                      |
| 13. | B-9-1                   |   |  |                   |   | PII-40                                      |
| 14. | B-10                    |   |  |                   |   | PII-40                                      |
| 15. | B-13                    |   |  |                   |   | PII-40                                      |
|     | <b>Total:</b>           | <b>198</b>                                | <b>256</b>                               | <b>10.8</b>       | <b>7.7</b>                                      | JIP-4 – 2611 m<br>PII-40 -3842 m            |

It is also envisaged to construct all necessary structures on the distributors, supports for PII-40 and JIP-4 half-pipes, pipe-crossings, distributing wells and to install gates on wells.

### **Dzoragyug Community, Gegarkunik Marz**

The irrigation network of Dzoragyug community is located at the elevation of 2000 m above sea level. It is envisaged to rehabilitate B-1, B-1-1, B-2, B-2-1, B-2-2, B-3, B-3-1 and B-4 distributors of Dzoragiugh community located under command of Sevan Irrigation Scheme within the service area of “Martuni WUA, for irrigation of 169 ha of community lands. The total length of distributors is 7.630 km, the total length of sections proposed for rehabilitation is 3.0 km.

All distributors of Dzoragyug community have earth bed, they have no engineering structures and pass along the streets with asphalt cover, except for B-2 distributor which passes along the street with sand-gravel cover.

Distributors were in operation for about 30-40 years. During this period no repair or preventive maintenance were carried out which resulted in unsatisfactory condition of the network. As a result of poor condition of the irrigation network, fields are not supplied with the required quantity of irrigation water which results in the reduction of agricultural production and many plots are not irrigated.

The following table presents key data on the tertiary irrigation network in Dzoragyug community.

Table 5. Key data on the tertiary irrigation network of Dzoragyug community

| No. | Name of the distributor | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total length (km) | Total length planned for rehabilitation (km) | Type of precast elements for rehabilitation |
|-----|-------------------------|---|--|-------------------|--|---|
| 1.  | B-1                     | 130                                       | 169                                      | 1.860             | 0.673  | PII-40                                      |
| 2.  | B -1-1                  |   |  | 0.452             | 0.193  | PII-40                                      |
| 3.  | B-2                     |   |  | 2.010             | 0.738  | PII-40                                      |
| 4.  | B-2-1                   |   |  | 0.620             | 0.207  | JIP-4                                       |
| 5.  | B-2-2                   |   |  | 0.160             | 0.080  | JIP-4                                       |
| 6.  | B-3                     |   |  | 0.763             | 0.3775                                       | PII-40                                      |
| 7.  | B-3-1                   |   |  | 0.965             | 0.399  | PII-40                                      |
| 8.  | B-4                     |   |  | 0.800             | 0.332  | PII-40                                      |
|     | <b>Total:</b>           | <b>130</b>                                | <b>169</b>                               | <b>7.63</b>       | <b>3.0</b>                                   |   |

Rehabilitation of B-1, B-1-1, B-2, B-3, B-3-1 and B-4 distributors will be carried out by PII-40 precast flumes, and B-2-1 and B-2-2 distributors – by JIP-4 flumes taking into account their further rehabilitation for the purpose of expansion of irrigated areas.

It is also envisaged to construct all necessary structures on the distributors and their end-tail sections, pipe-crossings, distributing wells, and install gates on the wells.

### **Astghadzor Community, Gegarkunik Marz**

The tertiary irrigation network of Astghadzor community is located at the elevation of 2170 m above sea level. It is proposed to rehabilitate Dzor Aru canal, B-1 and B-2 distributors located under command of Sevan Irrigation Scheme, within the service area of “Martuni” WUA. Rehabilitation of the tertiary irrigation network of Astghadzor community will enable uninterrupted operation of distributors and their structures which will reduce water losses from the networks, supply 156 ha of community’s lands with required volume of irrigation water,

which will improve cultivating of truck crops and orchards and improve the crop yield.

Canals' inspection was carried out with water full canals. Dzori Aru is located outside the community is completely earth canal without intake headwork structure. B-1 and B-1-1 distributors pass through the community streets. They have irregular cross-sections, outlet structures are missing.

Water losses in the tertiary canals make up about 65% according to WUA, community and PIU's representatives. The water does not reach the lands located far from the intakes structures. Outlet structures of distributors are not made in professional manner. Distributors and their structures are in unsatisfactory conditions.

Total length of stretches proposed for rehabilitation is 4122 m including 1480 m long Dzor Aru canal, 732 m long section of B-1 distributor and 1910 m long section of B-1-12 distributor.

Dzor Aru canal gets water from Astghadzor River and is located outside the community, B-1 and B-1-1 distributors get water from Dzori Aru canal and pass through the community – on the left and the right sides of the streets. It is envisaged to perform rehabilitation of the tertiary irrigation network with LP-4 precast flumes.

The following table presents key data on the tertiary irrigation network in Astghadzor community.

Table 6. Key data on the tertiary irrigation network of Astghadzor community.

| No. | Name of the distributor | Irrigated Area before Rehabilitation (ha) | Irrigated Area after Rehabilitation (ha) | Total Canal/ Pipe Length (km) | Canal/ Pipe length planned for rehabilitation (km) |
|-----|-------------------------|---|--|-------------------------------|--|
| 1.  | Dzori Aru canal         | 120                                       | 156                                      | 5.3                           | 1.480  |
| 2.  | B-1                     |   |  |                               | 0.732  |
| 3.  | B -1-1                  |   |  |                               | 1.910  |
|     | <b>Total</b>            | <b>120</b>                                | <b>156</b>                               | <b>5.3</b>                    | <b>4.122</b>                                       |

Repairing works will be carried out with providing normal water supply during irrigation season.

### **Vaghashen Community, Gegarkunik Marz**

The tertiary irrigation network of Vaghashen community is located at an elevation of 1950 m above sea level. It is envisaged to repair Vaghashen community's Durni Aru and Dari Taki Aru canals located under command of Sevan Irrigation Scheme, within the service area of "Martuni" WUA. Repairing of the tertiary irrigation network of Vaghashen community will enable uninterrupted operation of canals and their structures which will reduce water losses from the networks, supply 169 ha of community lands with required volume of irrigation water and improve cultivating of truck crops and orchards and improve the crop yield.

Inspection of canals was carried out with water-full canals. Dzori Aru canal passes across the community streets. Two sections of canal are proposed for rehabilitation: first has an earth bed and the second is made of monolithic concrete and has a rectangular cross-section. Durni aru canal goes along homestead plots along its entire length. It consists of 4 sections: the first has an earth bed, the second is made of monolithic concrete and has a rectangular cross-section (deteriorated); the third one is made of precast flumes which are destroyed; the fourth is made

of with metal pipes which are rusted and rotted.

Water losses in tertiary canals make up about 65% according WUA, community and PIU’s representatives, which makes impossible water supply to the lands located far from intakes structures. Outlet structures of distributors are not professionally made. Distributors and their structures are in unsatisfactory conditions.

The total length of Durni Aru Dari Taki Aru canals is 4.5 km, the total length of sections proposed for rehabilitation is 3.2 km.

Required structures will be installed along the full length of the distributors providing normal water supply during irrigation season and distributors emptying in the off-irrigation season.

The following table presents key data on the tertiary irrigation network in Vaghashen community.

Table 7. Key data on the tertiary irrigation network of Vaghashen community.

| No. | Name of the distributor | Irrigated area before rehabilitation (ha) | Irrigated area after rehabilitation (ha) | Total canal/ pipe length (km) | Canal/ pipe length planned for rehabilitation (km) |
|-----|-------------------------|---|--|-------------------------------|--|
| 1.  | Duri Aru canal          | 130                                       | 169                                      | 4.5                           | 3.2  |
| 2.  | Dari taki aru canal     |   |  |                               |  |
|     | <b>Total</b>            | <b>130</b>                                | <b>169</b>                               | <b>4.5</b>                    | <b>3.2</b>   |

### Megrashen Community, Shirak Marz

The tertiary irrigation network of Megrashen community is located at the elevation of 1657 m above sea level. It is envisaged to rehabilitate Megrashen community’s B-1-1, B-1-2 and B-1-3 distributors located under command of Shirak Irrigation Scheme, within the service area of “Shirak” WUA for irrigation of 93 ha of community lands. 50% of irrigated areas is planted by vegetables, melons and gourds and 50% - by orchards. The total length of tertiary irrigation network is 2.8 km, the total length of sections proposed for rehabilitation – 1458 m, including 570 m long section of B-1-1, 390 m long section of B-1-2 and 498 m long section of B-1-3.

All distributors go along the streets with earth covering. Engineering structures on the distributors are missing.

Tertiary canals were in operation for about 30-40 years. During this period no repair or preventive maintenance were carried out which resulted in unsatisfactory condition of the network. As a result of poor condition of the irrigation network, the fields are not supplied with the required water quantity which results in reduction of agricultural production and many plots are not irrigated.

It is proposed to rehabilitate distributors B-1-1 and B-1-2 with D=219x4 mm steel pipes, and distributor B-1-3 – with PII-40 precast flumes.

It is also envisaged to construct distributing units, discharging wells, outlets, pipe-crossings and structures at the end-tail sections of distributors.

The following table presents key data on the tertiary irrigation network in Megrashen community.

Table 8. Key data on the tertiary irrigation network of Megrashen community.

| No. | Name of the distributor | Irrigated Area before Rehabilitation (ha) | Irrigated Area after Rehabilitation (ha) | Total Canal/ Pipe Length (km) | Canal/ Pipe length planned for rehabilitation (km) |
|-----|-------------------------|---|--|-------------------------------|--|
| 1.  | B-1-1                   | 64  | 93                                       | 2.8                           | 1.4  |
| 2.  | B -1-2                  |   |  |                               |  |
| 3.  | B-1-3                   |   |  |                               |  |
|     | <b>Total</b>            | <b>64</b>                                 | <b>93</b>                                | <b>2.8</b>                    | <b>1.4</b>   |

### 3 Description of Existing Conditions

#### 3.1 Climate

The climate for the project affected communities is described at the Marz level.

##### *Lori Marz*

##### *Jrashen community*

Jrashen community is located in Lori Marz, in a dry subtropical climate zone. In July the average air temperature is 18-20Co. In summer the maximum air temperature reaches up to 37Co. In January the average air temperature is -0 - -2°C. The minimum air temperature reaches up to -24°C. The number of non-frost days is 220-240. The annual perceptions make up 550-600 mm. The annual evaporation is 800-900 mm; the air maximum humidity is 5-6 millibar.

The following Tables represent the climate conditions for Jrashen community.

Table 9. Air temperature in Jrashen Community

| Elevation, a.s.l. (m) | Average monthly air temperature, °C |      |     |     |      |      |      |      |      |     |     |     | Average annual | Absolute minimum | Absolute maximum |
|-----------------------|-------------------------------------|------|-----|-----|------|------|------|------|------|-----|-----|-----|----------------|------------------|------------------|
|                       | I                                   | II   | III | IV  | V    | VI   | VII  | VIII | IX   | X   | XI  | XII |                |                  |                  |
| 1680 m                | -1.0                                | -0.4 | 2.9 | 8.5 | 13.0 | 16.2 | 19.3 | 18.9 | 15.2 | 9.8 | 5.3 | 1.2 | 9.1            | -24              | 37               |

Table 10. Air humidity in the Jrashen community of Lori Marz

| Community | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average annual |
|-----------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|----------------|
|           | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                |
|           | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                |
| Jrashen   | 65                       | 66 | 71  | 70 | 73 | 76 | 72  | 71   | 74 | 76 | 72 | 66  | 71 |                |

Table 11. Precipitation and snow cover in Jrashen community of Lori Marz

| Community | Precipitation, mm             |    |     |    |     |     |     |      |    |    |    |     |     | Annual |
|-----------|-------------------------------|----|-----|----|-----|-----|-----|------|----|----|----|-----|-----|--------|
|           | Average monthly daily maximum |    |     |    |     |     |     |      |    |    |    |     |     |        |
|           | By months                     |    |     |    |     |     |     |      |    |    |    |     |     |        |
|           | I                             | II | III | IV | V   | VI  | VII | VIII | IX | X  | XI | XII |     |        |
| Jrashen   | 21                            | 26 | 41  | 58 | 100 | 107 | 60  | 45   | 43 | 43 | 29 | 16  | 593 |        |

### **Gegarkunik Marz**

The climate of the project affected area is specified by cold winter and cool summer. January is the coldest month and July-August are the warmest months. The average annual temperature is 4.6°C, the absolute minimum is -31°C and the absolute maximum is +32°C. The average annual air humidity is 68% and annual precipitation is 436 mm. The precipitations are mainly in May-June. Snow cover is developed in November and starts melts in April. The number of days with snow cover is 140. Snow layer thickness is 1.0÷1.2 m. The maximal soil frost depth in the area is 117 cm.

### **Verin Getashen Community**

Community lands are represented by meadow steppe soils which occupy meadow steppe and partly Sub-Alpine zones, 1800-2600 m above sea level. The soil was developed under moderate cold and wet climate conditions. In summer the maximum air temperature reaches up to 32°C. The minimum air temperature reaches up to -38°C. The annual air average temperature is 2.0-3.0°C. The annual precipitation makes up 500-600 mm, no stable snow cover is developed. The annual evaporation is 750-800; humidity indicator is 1.5-2.0.

The following tables represent the climate conditions of Verin Getashen community.

Table 12. Air temperature in Verin Getashen community of Gegarkunik Marz

| Elevation<br>,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |     |      |      |      |      |     |     |      | Average<br>annual | Absolute<br>minimum | Absolute<br>maximu<br>m |
|------------------------------|-------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|-------------------|---------------------|-------------------------|
|                              | I                                   | II   | III  | IV  | V   | VI   | VII  | VIII | IX   | X   | XI  | XII  |                   |                     |                         |
| 1975 m                       | -5.7                                | -5.8 | -1.7 | 4.8 | 9.0 | 12.9 | 16.0 | 15.8 | 12.7 | 7.5 | 2.4 | -2.9 | 5.4               | -32                 | 34                      |

Table 13. Air humidity in Verin Getashen community of Gegarkunik Marz

| Community         | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average<br>annual |
|-------------------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|-------------------|
|                   | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                   |
|                   | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                   |
| Verin<br>Getashen | 68                       | 69 | 70  | 66 | 67 | 69 | 71  | 70   | 66 | 62 | 65 | 67  | 68 |                   |

Table 14. Precipitation and snow cover in Verin Getashen community of Gegarkunik Marz

| Community         | Precipitation, mm             |    |     |    |    |    |     |      |    |    |    |     |     | Annual |
|-------------------|-------------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|-----|--------|
|                   | Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |     |        |
|                   | By months                     |    |     |    |    |    |     |      |    |    |    |     |     |        |
|                   | I                             | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |     |        |
| Verin<br>Getashen | 45                            | 42 | 70  | 86 | 84 | 68 | 31  | 17   | 19 | 51 | 54 | 38  | 595 |        |

### ***Martuni community***

Community lands are represented by meadow steppe soils which occupy meadow steppe and partly Sub-Alpine zones, 1800-2600 m above sea level. The soil was developed under moderate cold and wet climate conditions. In summer the maximum air temperature reaches up to 32°C. The minimum air temperature goes down to -38°C. The annual air average temperature is 2.0-3.0°C. The annual perceptions make 500-600 mm, no stable snow cover is developed. The annual evaporation is 750-800; humidity indicator is 1.5-2.0.

The following tables represent the climate conditions of the community.

Table 15. Air temperature in Martuni community of Gegarkunik Marz

| Elevation,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |     |      |      |      |      |     |     |      | Average<br>annual | Absolute<br>minimum | Absolute<br>maximum |
|--------------------------|-------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|-------------------|---------------------|---------------------|
|                          | I                                   | II   | III  | IV  | V   | VI   | VII  | VIII | IX   | X   | XI  | XII  |                   |                     |                     |
| 2001 m                   | -5.7                                | -5.8 | -1.7 | 4.8 | 9.0 | 12.9 | 16.0 | 15.8 | 12.7 | 7.5 | 2.4 | -2.9 | 5.4               | -32                 | 34                  |

Table 16. Air humidity in Martuni community of Gegarkunik Marz

| Community | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average<br>annual |
|-----------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|-------------------|
|           | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                   |
|           | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                   |
| Martuni   | 68                       | 69 | 70  | 66 | 67 | 69 | 71  | 70   | 66 | 62 | 65 | 67  | 68 |                   |

Table 17. Precipitation and snow cover in Martuni community of Gegarkunik Marz

| Community | Precipitation, mm             |    |     |    |    |    |     |      |    |    |    |     |     | Annual |
|-----------|-------------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|-----|--------|
|           | Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | By months                     |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | I                             | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |     |        |
| Martuni   | 45                            | 42 | 70  | 86 | 84 | 68 | 31  | 17   | 19 | 51 | 54 | 38  | 595 |        |

### ***Dzoragyug Community***

Community lands are represented by meadow steppe soils which occupy meadow steppe and partly Sub-Alpine zones, 1800-2600 m above sea level. The soil was developed in moderate cold and wet climate conditions. In summer the maximum air temperature reaches up to 32°C. The minimum air temperature goes down to -38°C. The annual air average temperature is 2.0-3.0°C. The annual perceptions is 500-600 mm, no stable snow cover is developed. The annual evaporation is 750-800; humidity indicator is 1.5-2.0.

Table 18. Air temperature in Dzoragyug community of Gegarkunik Marz

| Elevation,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |     |      |      |      |      |     |     |      | Average<br>annual | Absolute<br>minimum | Absolute<br>maximum |
|--------------------------|-------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|-------------------|---------------------|---------------------|
|                          | I                                   | II   | III  | IV  | V   | VI   | VII  | VIII | IX   | X   | XI  | XII  |                   |                     |                     |
| Dzoragyug                | -5.7                                | -5.8 | -1.7 | 4.8 | 9.0 | 12.9 | 16.0 | 15.8 | 12.7 | 7.5 | 2.4 | -2.9 | 5.4               | -32                 | 34                  |



Table 19. Air humidity Dzoragyug community of Gegarkunik Marz

| Community | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average annual |
|-----------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|----------------|
|           | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                |
|           | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                |
| Dzoragyug | 68                       | 69 | 70  | 66 | 67 | 69 | 71  | 70   | 66 | 62 | 65 | 67  | 68 |                |

Table 20. Precipitation and snow cover in Dzoragyug community of Gegarkunik Marz

| Community | Precipitation, mm             |    |     |    |    |    |     |      |    |    |    |     |     | Annual |
|-----------|-------------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|-----|--------|
|           | Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | By months                     |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | I                             | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |     |        |
| Dzoragyug | 45                            | 42 | 70  | 86 | 84 | 68 | 31  | 17   | 19 | 51 | 54 | 38  | 595 |        |

### ***Astghadzor Community***

***Astghadzor*** community is located in Gegarkunik Marz. The annual air average temperature is 4.5°C. The maximum temperature in summer reaches +34°C. In winter the temperature reaches -32°C. Annual precipitation is 720 mm, relative air humidity is 69%, maximal precipitations are registered in May-June, maximal frost depth is 112 cm.

The following tables represent the climate conditions in Astghadzor community.

Table 21. Air temperature in Astghadzor community of Gegarkunik Marz

| Elevation<br>,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |     |      |      |      |      |     |     |      | Average annual | Absolute minimum | Absolute maximum |
|------------------------------|-------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|----------------|------------------|------------------|
|                              | I                                   | II   | III  | IV  | V   | VI   | VII  | VIII | IX   | X   | XI  | XII  |                |                  |                  |
| 1945                         | -5.7                                | -5.8 | -1.7 | 4.8 | 9.0 | 12.9 | 16.0 | 15.8 | 12.8 | 7.5 | 2.4 | -2.9 | 5.4            | -32              | 34               |

Table 22. Air humidity in Astghadzor community of Gegarkunik Marz

| Community  | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average annual |
|------------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|----------------|
|            | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                |
|            | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                |
| Astghadzor | 68                       | 69 | 70  | 66 | 67 | 69 | 71  | 70   | 66 | 62 | 65 | 67  | 68 |                |

Table 23. Precipitation and snow cover in Astghadzor community of Gegarkunik Marz

| Community  | Precipitation, mm<br>Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |        |
|------------|--|----|-----|----|----|----|-----|------|----|----|----|-----|--------|
|            | By months  |    |     |    |    |    |     |      |    |    |    |     | Annual |
|            | I  | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |        |
| Astghadzor | 24   | 30 | 44  | 56 | 71 | 70 | 45  | 29   | 32 | 41 | 36 | 23  | 501    |
|            | 25   | 34 | 30  | 39 | 41 | 69 | 42  | 37   | 59 | 37 | 84 | 36  | 84     |

### ***Vaghashen Community***

Vagashen community is located in Gegarkunik Marz. The average annual air temperature is 5.4°C. In summer the temperature reaches +34°C (maximum). The minimal registered temperature is -32°C. Annual precipitation is 500 mm (average monthly), relative air humidity is 68%. Maximal precipitations are registered in May-June, maximal frost depth is 112 cm

The following tables present climate conditions for the community.

Table 24. Air temperature in Vaghashen community of Gegarkunik Marz

| Elevation<br>,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |     |      |      |      |      |     |     |      | Average<br>annual | Absolute<br>minimum | Absolute<br>maximum |
|------------------------------|-------------------------------------|------|------|-----|-----|------|------|------|------|-----|-----|------|-------------------|---------------------|---------------------|
|                              | I                                   | II   | III  | IV  | V   | VI   | VII  | VIII | IX   | X   | XI  | XII  |                   |                     |                     |
| 1945                         | -5.7                                | -5.8 | -1.7 | 4.8 | 9.0 | 12.9 | 16.0 | 15.8 | 12.8 | 7.5 | 2.4 | -2.9 | 5.4               | -32                 | 34                  |

Table 25. Air humidity in Vaghashen community of Gegarkunik Marz

| Community | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |                   |
|-----------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|-------------------|
|           | By months                |    |     |    |    |    |     |      |    |    |    |     | Average<br>annual |
|           | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |                   |
| Vaghashen | 68                       | 69 | 70  | 66 | 67 | 69 | 71  | 70   | 66 | 62 | 65 | 67  | 68                |

Table 26. Precipitation and snow cover in Vaghashen community of Gegarkunik Marz

| Community | Precipitation, mm<br>Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |        |
|-----------|--|----|-----|----|----|----|-----|------|----|----|----|-----|--------|
|           | By months  |    |     |    |    |    |     |      |    |    |    |     | Annual |
|           | I  | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |        |
| Vaghashen | 24   | 30 | 44  | 56 | 71 | 70 | 45  | 29   | 32 | 41 | 36 | 23  | 501    |
|           | 25   | 34 | 30  | 39 | 41 | 69 | 42  | 37   | 59 | 37 | 84 | 36  | 84     |

### ***Shirak Marz***

Megrashen community is located in Shirak Marz. The average temperature in July is within +13-16°C: The maximal temperature in summer reaches +38°C. The average temperature in

January is between -7 - -9.5°C. The minimal temperature goes down to -41°C: The annual precipitation is 450-550 mm. The average annual humidity is 70%.

The following tables represent the climate conditions for Meghrashen Community.

Table 27. Air temperature in Megrashen community of Shirak Marz

| Elevation<br>,<br>a.s.l. (m) | Average monthly air temperature, °C |      |      |     |      |      |      |      |      |     |     |      | Average<br>annual | Absolute<br>minimum | Absolute<br>maximu<br>m |
|------------------------------|-------------------------------------|------|------|-----|------|------|------|------|------|-----|-----|------|-------------------|---------------------|-------------------------|
|                              | I                                   | II   | III  | IV  | V    | VI   | VII  | VIII | IX   | X   | XI  | XII  |                   |                     |                         |
| 1680                         | -9.5                                | -7.5 | -1.5 | 6.5 | 11.6 | 15.2 | 19.2 | 19.2 | 15.0 | 8.3 | 1.6 | -5.3 | 6.1               | -41                 | 38                      |

Table 28. Air humidity in Megrashen community of Shirak Marz

| Community | Air relative humidity, % |    |     |    |    |    |     |      |    |    |    |     |    | Average<br>annual |
|-----------|--------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|----|-------------------|
|           | By months                |    |     |    |    |    |     |      |    |    |    |     |    |                   |
|           | I                        | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |    |                   |
| Megrashen | 82                       | 81 | 76  | 67 | 66 | 65 | 60  | 57   | 61 | 69 | 77 | 82  | 70 |                   |

Table 29. Precipitation and snow cover in Megrashen community of Shirak Marz

| Community | Precipitation, mm             |    |     |    |    |    |     |      |    |    |    |     |     | Annual |
|-----------|-------------------------------|----|-----|----|----|----|-----|------|----|----|----|-----|-----|--------|
|           | Average monthly daily maximum |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | By months                     |    |     |    |    |    |     |      |    |    |    |     |     |        |
|           | I                             | II | III | IV | V  | VI | VII | VIII | IX | X  | XI | XII |     |        |
| Megrashen | 25                            | 25 | 30  | 56 | 93 | 75 | 46  | 38   | 32 | 38 | 27 | 24  | 509 |        |

## Biological diversity

### Lori Marz

The biodiversity and ecosystems of Armenia are very rich due to the geographical position, complicated geological structure, altitude and the fact that flora and fauna are in different boundaries of the state. Intensive human activity has adversely impacted the rich biodiversity of Armenia's ecosystems and their components. Being one of the biggest economic activities, agriculture is also considered to be the activity that most upsets the balance of nature components, endangering the biodiversity of Armenia. Thus, this assessment report aims at minimizing the impact of agricultural processes on atmosphere, water, soil as well as flora and fauna in the area affected by implementation of the proposed rehabilitation of tertiary system project.

### Flora

The surveyed area is in Lori floristic zone characterized by steppe–gramineous, motley-gramineous steppe type vegetation, with tragacanth elements. The area grasslands are

represented by feather fescue, brome-grass-fescue-coeleria, brome-grass-fescue, bluegrass, wheatgrass, shrub motley-brome-grass, tragacanth plants symbioses. In the southern parts they are ablated and on the slopes, where dampness is insufficient, the motley grass prevails: *Thymus L.*, *Achylea L.*, *Verascum L.*, *Nepeta L.*, *Betonica grandiflora L.*, *Salvia L.*, *Eringium campestre L.* At this background some species of gramine like *Stipa stenophylla*, *Dactylis L.* prevail. On the north the slopes are occupied by papilionaceous - *Trifolium pratense*, *T. Trichocephalum*, *T. Alpestre*, *Medicago sativa* dominating.

The steppe grasslands surrounding the Tertiary canals area are never covered with high grass cover. Gramines prevail, and grass cover is mainly of steppe type vegetation. Prevailing species are: *Bromus fibrosus*, *Pyretrum myrophyllum*, *Festuca sulcata*, *Xeranthemum squarrosus*, *Koeleria nitidula* and *Thymus*. They are followed by *Helichrysum plinthocalyx*, *Carex stenophylla*, *Alyssum tortuosum*, *Agropyrum trichophorum*, *Aegilops cylindrica*, *Medicago sativa*, *Onobrychis transcaucasica*, *Inula cordata* and other species. In the dry stony and overpastured parts the elements of tragacanth steppe are found *Astragalus microcephalus*, *A. Aureus* and *A. legurus*. Here and there *Acantholimon glumaceum* is also found. *Thymus kotchyanus*, *Scutellaria orientalis*, *Veronica orientalis*, *Ziziphora serpyllacea*, *Agropyrum cristatum*, *Stipa stenophylla* and others are common. Sea buckthorn brakes is widely spread in the Chichkhan river basin.

Within the project area the Pambak valley is nothing but a deep gorge covered with riverbed and sub-riverbed thin forest shrubs: brier, barberries, linden, spindle-tree, willow, poplar, pine, service tree, dew-berry and other tree and shrubs plant species followed by thick vegetation of *Plantago major*, *Menta arvensis*, *Urtica L.*, *Tussilago farfara*, *Cichorium intibus* etc.

Within the tertiary canals project areas, despite the lack of unique ecosystems, some species recorded in the Red Book of Armenia are likely to occur in the Pambak valley: Woad Takhtajyani (*Isatis Takhtadjanii*) and Caucasus Snow Rose (*Rhododendron caucasicum*).

### Fauna

The investigated area is characterized by relatively poor and monotone invertebrate group. From mollusks *Cionella lubrica*, *Vertigo antivertigo*, *Deroceras transcausicum*, *Truncatellina calligratis*, *Phenacolimax annularis* etc., from cicadas there is *Bradyporus dilatatus*, grasscoppers - *Montana armeniaca*, two-winged flies - *Eumerus sogdianus*, beetles- *Bruchidius armeniacus*, *Cryptocephalus moravi*, and some other vertebrates.

Around the rivers, reservoirs and open channels *Bufo viridis*, *Rana ridibunda* and *Rana macrocnemis* occur. Herpetofauna is represented by Armenian lizard (*Lacerta armeniaca*), Daly's lizard (*L. dahli*), Valentin's Rock lizard (*Lacerta valentini*), Nairian lizard (*L. nairiensis*), Armenian viper (*Vipera raddei*), steppe viper (*V. erivanensis*), Blue Racer (*Coluber ravergieri*) and other species, nearby the reservoirs and rivers there are found water grass-snake (*Natrix tessellata*) and common grass-snake (*N. Natrix*).

From birds (Aves) there occur *Emberiza hortulana*, *Oenanthe deserti*, *Hirundo rustica*, *Alauda arvensis*, *Aunthus campestris*, *Passar montanus*, *Circus cianeus*, *Eremophila alpestris*, *Silvia hortensis*, *Melanocorypha bimaculata*, *Ptyonoprogne rupestris*, *Corvus corone*, *C. Frugilegus*, *Motacilla alba*, *Sitta tephronota*, *Lanius collorio*, *Anthus spinoletta*, *Carduelis flavirostris*, *Ficedula hypoleuca*, *Thurdus viscivorus*, *T. torquatus*, and other birds. Passerines (*Passeriformes*) and falconiforms (*Falconiformes*) are widely spread.

From mammals (*Mammalia*), besides widely spread species, such as hare (*Lepus europaeus*), fox (*Vulpes vulpes*), wolf (*Canis lupus*), there are some mainly spread species of rodent class. The area is favorable for shrubs compagnol (Msubterraneus), stone marten (*Martes foina*), marine snow shrew (*M.anomalus*) and other species.

The ichtyofauna of the Pambak River is represented by Riffle Minnow (*Alburnoides bipunctatus*), Trout (karmrakhayt) (*Salmo trutta fario*), Kura koghak (*Varicorhinus capoeta capoeta*), Barbel (*beghlou*) (*Barbus lacerta cyri*), Sliz loach (*Nemachilus brandti*).

From mammals recorded in the Red Book of Armenia: Marbled Polecat (*Vormela peregusna*), and from birds: Eurasian Griffon (*Aquila chrysaetos fulva*), Bearded Vulture (*Gyps Fulvus fulvus*), Nothern Raven (*Corvus corax corax*), Barred Warbler (*Sylvia nisoria nisoria*), Blue Rock Thrush (*Monticola solitarius solitarius*), Blue Throat (*Luscinia svecica occidentalis*)

There are no specially protected areas directly under the command area of Tertiary Canals

### **Shrak marz**

The biodiversity and ecosystems of Armenia are very rich due to the geographical position, complicated geological structure, altitude and the fact that flora and fauna are in different boundaries of the state. Intensive human activity has adversely impacted the rich biodiversity of Armenia's ecosystems and their components. Being one of the biggest economic activities, agriculture is also considered to be the activity that most upsets the balance of nature components, endangering the biodiversity of Armenia. Thus, this assessment report aims at minimizing the impact of agricultural processes on atmosphere, water, soil as well as flora and fauna in the area affected by implementation of the proposed rehabilitation of tertiary system project.

### Flora

Till 2200 m altitude the plants are lawn-steppe, where plant cover is represented by steppe and lawn species. *Festuca ovina*, *Sh. F. valesiaca*, *Bromus variegatus*, *Phelum phleoides*, *Koeleris cristata* and other species are spread here. The areas at altitudes of 2300-2800m are covered by Alpine valleys, which have various species and are covered to various extents by various plants.

Natural forage herbs are represented by dry cereals and grain-crops, poecilophyllous, wet cereal-butterfly, deciduous, bush and high-grass species. Depending on land and climatic conditions, here *Festuca varia*, *Poa longifolia*, *P.alpina*, *Phleum alpinu* occurs. Alpine vegetation season generally starts at the end of April and in the beginning of May. Vegetation fluctuation takes place very promptly. No Red book species are located in the project area.

### Fauna

Unlike plants, animals are movable and have wide inter-zonal habitat and can spread in different landscape zones. Mountain-steppe and sub-alpian zones are characterized with the following mollusks: *Vertigo substrata*, *Euxina somchetica*, *Caucasian olophrum*, *Pterostrichus*, saddle and steppe sagas are spread. Among mammals the following species occur here: *Lepus europaeus*, *Vulpes vulpes*, *Canis lupus*, *Muridae*, *Microtinae*. Herpentofauna here is poor, mainly being represented by *Lacerta valentini*, *Vipera darevskii*, *Vipera erivanensis species*. Among birds *Passeriformes* and *Falconiformes* are spread.

From mammals recorded in the Red Book of Armenia published in 1987: Marbled Polecat (*Vormela peregusna*), and from birds: Rock Thrush (*Monticola saxatilis saxatilis*), Blue Rock Thrush (*Monticola solitarius solitarius*), Blue Throat (*Luscinia svecica*). There are no specially protected natural areas (SPNA) within the area affected by rehabilitation of tertiary canals. The project will not have any impact on the protected area.

## **Gegharkunik marz**

### **Flora**

The flora of Sevan Lake basin has explicitly expressed mosaic pattern with well-expressed vertical zoning due to various dispositions of mountains around the lake and their slopes, terrain peculiarities and other factors.

The entire area of Gegharkunik Marz is included in the Sevan floristic region where 55 rare and disappearing plant species registered in the Armenian Red Book and 22 endemic species are met.

The state of population of most important among 18 endemic species out of 22 that are found in this region is as follows: the population of Fedoroff bean terfoil (*Cousinia fedorovii*), Olga figwort (*Scrophularia olgae*) and Sevan mullein (*Verbascum sevanense*) may be considered sufficient. The species are represented by all ages and grow in rather dense population.

### **Fauna**

Four types of amphibians are met in this area according to literature data. They belong to the group of Salientia: laughing frog (*Rana ridibunda*), small Asian frog (*Rana macrocnemis*), green toad (*Bufo viridis*), and Shelkovnikov tree frog (*H.a.shelkovnikovi*).

The reptiles are represented by sand lizard (*Lacerta agilis*), striped lizard (*Lacerta strigata*) and *Lacerta trilineata*. The most common is sand lizard that develops dense population in the forests around Tsovagjugh village and the lake. The striped lizard develops dense population within shore areas of Lake Sevan near Shorja village. The species of water snakes are most common in spring, and mountain steppe water snake may be seen at the foot of Areguni and Sevan Ridges.

There are 267 bird species in Sevan National Park and its protected areas that belong to 17 different classes.

44 classes of mammals are found within the area of Gegharkunik Marz according to respective literature. They belong to 6 different classes: insect-eaters (Insectivora)-7 species, rodents (Rodentia)-15 species, hare (*Logomorpha*)-1 species, night bats (Chiroptera)-7 species, vermins (Carnivora) - 11 species, hoofed mammals (Artiodactyla)-3 species. Six species of mammals registered in the Red Book of Armenia (porcupine, sea-otter, brown bear, marten, wild forest cat and Beozaryan goat).

There are no specially protected areas (among those currently functioning) within the project area of Vardenis gravity system. The specially protected areas observed in the vicinity are as follows:

The conservation area of "Sevan" National Park starts at Sevan mountain pass, at the elevation of 2114.4m and passes through Areguni, Sevan, and East Sevan pleated mountain chains and divides volcanic mountain shields of Vardenis and Geghama. The boundary of the zone goes

to Yereva-Sevan highway from the divide of Geghama volcanic mountain shield. It passes through South-Western borders of Geghamavan, Tsaghkunk and Ddmashen villages. Afterwards, it goes to the North and passes through the Western border of Zovaber village, mounting up the slope of Pambak mountain chain. Afterwards, the boundary of the zone passes through the divide of the Dzknaget River to Sevan mountain pass.

“Gilli” reserve is located in the South-East of the National Park, at the estuary of Gilli canal, The Masrik River and the Geghamasar River. It has 1810 ha surface of which the earth area comprises 1325 ha and the water area comprises 485ha. Total length of the boundary is 23.3 km. The reserve area stretches to about 10.4 km long and 1.8 km wide.

The above-mentioned specially protected natural areas are located at a distance of minimum 14 km from the project area and cannot be affected as a result of project implementation.

## **Soil properties and erosion**

### **Jrashen community, Lori Marz**

Project affected area is located in Lori marz. The forest brown soils are mostly spread in the marz in Virahayots, Gugark and Pampak mountain slopes at elevations of 500-1700m a.s.l. in an area with moderately warm and non-stable humid climate, that are covered with forests and bushes.

The forest brown soils are characterized with weak separation of genetic horizons. The humus content in the cultivated lands of the affected area is moderate to sufficient, with the content of humus 4-10%, in limeless type of soils the soil reaction index is neutral (pH is within the range of 6.5–7.4), and in carbonate soil pH varied within 7.6–8.3.

These soils can be distinguished by sufficient hydrophysical properties in humus layer of forested areas soils density ranges within 43–50%. These soils have high velocity of water penetration, which in first hour comprises 340mm. The soils are characterized with low content of nitrogen, and average and sufficient content of phosphorus and potassium.

Majority of forest soils are of low strength (lower than 40 cm), about 30% have average strength (40-60 cm). Mechanical composition of majority of soils is loam, there are also lands with clay mechanical composition, which are covering 20-25% of the zone area. Majority of land in project area are of moderate and high stoniness (20-50m<sup>3</sup>/ ha and more), and about 39% of the zone area is free or contain limited amount of stones. More than half of this lands is eroded (mostly weak).

### **Verin Getashen Community, Gegharkunik marz**

Verin Getashen Community is situated in Martuni region of Gegharkunik Marz 1985 - 3000m above sea level with command area is 1975m above sea level. According to the soil zone the community belongs to steppe soil zone which has mountainous black soils. According to cadastral evaluation zones of agricultural soil types the area is located in Sevan valuation region. According to agricultural soil type irrigation terms the community area is included into the area of 47 and 48.

Clear distinguishing of genetic horizons is characteristic for black soils. According to their mechanical structure these soils are mainly low- and mid-clay sand and in separate parts heavy clay sand soils are also evident. The canal command area is mainly stoneless and mid stony grounds (0-205m<sup>3</sup>/ha). The command area agricultural lands are of average thickness (40-60cm).

The command area cultivated lands contain humus in medium portions and sufficient, where the content of humus is 4-10% , while the land reaction indicator, i.e. the pH is 6.6-8.0. It means that these lands generally have neutral and sometimes weakly acid and weakly alkaline reaction and an absorption capacity of 35-55mg equivalent in 100g land. The area land have the best indicators for their water-physical features. Field humidity is 440mm in one meter black soil, from which only 210mm is available. The soil density is 1.0-1.18g/cm<sup>3</sup>, the overall porosity is 50-55%, and the drainage for the first hour is 70-100mm.

The command area agricultural lands have no salination, alkalization, bogging and toxicities. The soil ecological condition depends on the chemical content and mineral degree of the water as well. Water source form the rehabilitated tertiary canals are Martuni and Agrichi rivers. The water has been multifacedly assessed. It is not polluted with mineral and organic pollutants, and will not have negative impacts on the meliorative condition of the irrigation areas. The ground water in the command area is 5m deep and can have no impact on the land quality either.

Operation of rehabilitated canals and agricultural activities in irrigation areas are not expected to be impeded by sediment impacts. Only very little sediments can be in spring, sometimes in summer, because of river flood. It will be supervised by the operators with intake management structures.

The command area has very weak erosion. In the conditions of improved water supply such phenomena will not take place if water users maintain watering norms characteristic of the territory and crops and apply precise watering media.

In Martuni region and the command area maximum deepness of land freezing is 116cm :

According to RA SNiP II-6-02-2006, Appendices A&B and RA seismic zone map, the command area is located in the second seismic zone with speed of 0.3g and seismic degree of 8-9 bals according to MSK-64 table.

### **Martuni Community, Gegharkunik marz**

Martuni Community is situated in Martuni region of Gegharquniq Marz 1900 - 3000m above sea level with command area is 2001m above sea level. According to the soil zone the community belongs to steppe soil zone which has mountainous black soils. According to cadastral evaluation zones of agricultural soil types the area is located in Sevan valuation region. According to agricultural soil type irrigation terms the community area is included into the area of 47 and 48.

Clear distinguishing of genetic horizons is characteristic for black soils. According to their mechanical structure these soils are mainly low- and mid-clay sand and in separate parts heavy clay sand soils are also evident. The canal command area is mainly stoneless and mid stony grounds (0-205m<sup>3</sup>/ha). The command area agricultural lands are of average thickness (40-60cm).



The command area cultivated lands contain humus in medium portions and sufficient, where the content of humus is 4-10% , while the land reaction indicator, i.e. the pH is 6.6-8.0. It means that these lands generally have neutral and sometimes weakly acid and weakly alkaline reaction and an absorption capacity of 35-55mg equivalent in 100g land. The area land have the best indicators for their water-physical features. Field humidity is 440mm in one meter black soil, from which only 210mm is available. The soil density is 1.0-1.18g/cm<sup>3</sup>, the overall porosity is 50-55%, and the drainage for the first hour is 70-100mm.

The command area agricultural lands have no salination, alkalization, bogging and toxicities. The soil ecological condition depends on the chemical content and mineral degree of the water as well. Water source from the rehabilitated tertiary canals are Martuni and Agrichi rivers. The water has been multifacely assessed. It is not polluted with mineral and organic pollutants, and will not have negative impacts on the meliorative condition of the irrigation areas. The ground water in the command area is 5m deep and can have no impact on the land quality either.

Operation of rehabilitated canals and agricultural activities in irrigation areas are not expected to be impeded by sediment impacts. Only very little sediments can be in spring, sometimes in summer, because of river flood. It will be supervised by the operators with intake management structures.

The command area has very weak erosion. In the conditions of improved water supply such phenomena will not take place if water users maintain watering norms characteristic of the territory and crops and apply precise watering media.

In Martuni region and the command area maximum deepness of land freezing is 116cm :

According to RA SNiP II-6-02-2006, Appendices A&B and RA seismic zone map, the command area is located in the second seismic zone with speed of 0.3g and seismic degree of 8-9 bales according to MSK-64 table.

### **Dzoragyugh Community, Gegharkunik marz**

Dzoragyugh Community is situated in Martuni region of Gegharkunik Marz 1900 - 3000m above sea level with command area is 2001m above sea level. According to the soil zone the community belongs to steppe soil zone which has mountainous black soils. According to cadastral evaluation zones of agricultural soil types the area is located in Sevan valuation region. According to agricultural soil type irrigation terms the community area is included into the area of 47 and 48.

Clear distinguishing of genetic horizons is characteristic for black soils. According to their mechanical structure these soils are mainly low- and mid-clay sand and in separate parts heavy clay sand soils are also evident. The canal command area is mainly stoneless and mid stony grounds (0-205m<sup>3</sup>/ha). The command area agricultural lands are of average thickness (40-60cm).

The command area cultivated lands contain humus in medium portions and sufficient, where the content of humus is 4-10% , while the land reaction indicator, i.e. the pH is 6.6-8.0. It means that these lands generally have neutral and sometimes weakly acid and weakly alkaline reaction and an absorption capacity of 35-55mg equivalent in 100g land. The area land have the best indicators for their water-physical features. Field humidity is 440mm in one meter black soil,

from which only 210mm is available. The soil density is 1.0-1.18g/cm<sup>3</sup>, the overall porosity is 50-55%, and the drainage for the first hour is 70-100mm.

The command area agricultural lands have no salination, alkalization, bogging and toxicities. The soil ecological condition depends on the chemical content and mineral degree of the water as well. Water source from the rehabilitated tertiary canals are Martuni and Agrichi rivers. The water has been multifacetedly assessed. It is not polluted with mineral and organic pollutants, and will not have negative impacts on the meliorative condition of the irrigation areas. The ground water in the command area is 5m deep and can have no impact on the land quality either.

Operation of rehabilitated canals and agricultural activities in irrigation areas are not expected to be impeded by sediment impacts. Only very little sediments can be in spring, sometimes in summer, because of river flood. It will be supervised by the operators with intake management structures.

The command area has very weak erosion. In the conditions of improved water supply such phenomena will not take place if water users maintain watering norms characteristic of the territory and crops and apply precise watering media.

In Martuni region and the command area maximum deepness of land freezing is 116cm :

According to RA SNiP II-6-02-2006, Appendices A&B and RA seismic zone map, the command area is located in the second seismic zone with speed of 0.3g and seismic degree of 8-9 balls according to MSK-64 table.

### **Astghadzor community, Gegharkunik marz**

Astghadzor Community is situated in Martuni region of Gegharkunik Marz 1900-3000m above sea level with command area is 1945m above sea level. According to the soil zone the community belongs to steppe soil zone which has mountainous black soils. According to cadastral evaluation zones of agricultural soil types the area is located in Sevan valuation region. According to agricultural soil type irrigation terms the community area is included into the area of 47 and 48.

Clear distinguishing of genetic horizons is characteristic for black soils. According to their mechanical structure these soils are mainly low- and mid-clay sand and in separate parts heavy clay sand soils are also evident. The canal command area is mainly stoneless and mid stony grounds (0-205m<sup>3</sup>/ha). The command area agricultural lands are of average thickness (40-60cm).

The command area cultivated lands contain humus in medium portions and sufficient, where the content of humus is 4-10%, while the land reaction indicator, i.e. the pH is 6.6-8.0. It means that these lands generally have neutral and sometimes weakly acid and weakly alkaline reaction and an absorption capacity of 35-55mg equivalent in 100g land. The area lands have the best indicators for their water-physical features. Field humidity is 440mm in one meter black soil, from which only 210mm is available. The soil density is 1.0-1.18g/cm<sup>3</sup>, the overall porosity is 50-55%, and the drainage for the first hour is 70-100mm.

The command area agricultural lands have no salination, alkalization, bogging and toxicities. The soil ecological condition depends on the chemical content and mineral degree of the water

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as well. Water source from the rehabilitated tertiary canals are Martuni and Agrichi rivers. The water has been multifacetedly assessed. It is not polluted with mineral and organic pollutants, and will not have negative impacts on the meliorative condition of the irrigation areas. The ground water in the command area is 5m deep and can have no impact on the land quality either.

Operation of rehabilitated canals and agricultural activities in irrigation areas are not expected to be impeded by sediment impacts. Only very little sediments can be in spring, sometimes in summer, because of river flood. It will be supervised by the operators with intake management structures.

The command area has very weak erosion. In the conditions of improved water supply such phenomena will not take place if water users maintain watering norms characteristic of the territory and crops and apply precise watering media.

In Martuni region and the command area maximum deepness of land freezing is 116cm :

According to RA SNiP II-6-02-2006, Appendices A&B and RA seismic zone map, the command area is located in the second seismic zone with speed of 0.3g and seismic degree of 8-9 bala according to MSK-64 table.

### **Vaghashen community, Gegharkunik marz**

Vaghashen community is situated in Martuni region of Gegharkunik Marz 1900-3000m above sea level with command area is 1945m above sea level. According to the soil zone the community belongs to steppe soil zone which has mountainous black soils. According to cadastral evaluation zones of agricultural soil types the area is located in Sevan valuation region. According to agricultural soil type irrigation terms the community area is included into the area of 47 and 48.

Clear distinguishing of genetic horizons is characteristic for black soils. According to their mechanical structure these soils are mainly low- and mid-clay sand and in separate parts heavy clay sand soils are also evident. The canal command area is mainly stoneless and mid stony grounds (0-205m<sup>3</sup>/ha). The command area agricultural lands are of average thickness (40-60cm).

The command area cultivated lands contain humus in medium portions and sufficient, where the content of humus is 4-10%, while the land reaction indicator, i.e. the pH is 6.6-8.0. It means that these lands generally have neutral and sometimes weakly acid and weakly alkaline reaction and an absorption capacity of 35-55mg equivalent in 100g land. The area lands have the best indicators for their water-physical features. Field humidity is 440mm in one meter black soil, from which only 210mm is available. The soil density is 1.0-1.18g/cm<sup>3</sup>, the overall porosity is 50-55%, and the drainage for the first hour is 70-100mm.

The command area agricultural lands have no salination, alkalization, bogging and toxicities. The soil ecological condition depends on the chemical content and mineral degree of the water as well. Water source from the rehabilitated tertiary canals are Martuni and Agrichi rivers. The water has been multifacetedly assessed. It is not polluted with mineral and organic pollutants, and will not have negative impacts on the meliorative condition of the irrigation areas. The ground water in the command area is 5m deep and can have no impact on the land quality either.

Operation of rehabilitated canals and agricultural activities in irrigation areas are not expected to be impeded by sediment impacts. Only very little sediments can be in spring, sometimes in summer, because of river flood. It will be supervised by the operators with intake management structures.

The command area has very weak erosion. In the conditions of improved water supply such phenomena will not take place if water users maintain watering norms characteristic of the territory and crops and apply precise watering media

In Martuni region and the command area maximum deepness of land freezing is 116cm :

According to RA SNiP II-6-02-2006, Appendices A&B and RA seismic zone map, the command area is located in the second seismic zone with speed of 0.3g and seismic degree of 8-9 balls according to MSK-64 table.

### **Meghrashen community, Shirak marz**

The natural soils in the Meghrashen Community of Shirak Marz belong to steppe humus zone. The territory lands are mountainous black soils. According to agricultural land types the community lands are included into the Akhuryan-Spitak cadastre valuation zone.

Clear distinguishing of genetic horizons is characteristic for black soils. According to the mechanical content the command area lands are in general middle loamy soil, strong and mid loamy soil. The lands contain not much stones (5-20m<sup>2</sup>/ha). The command area agricultural lands have mainly mid thickness (40-60cm) and in some places are thicker – 60cm and more.

According to the content of humus, cultivated lands of canal command area are considered to be of mid and sufficient humus, where the content of humus is 4-12%; the land reaction indicator, i.e. the pH is 6.4-8.1, that is the lands in general have neutral, sometimes weakly alkaline reaction. The lands have mid and strong absorption capacity (35-55mg/equivalent in 100g soil). According to the water physical qualities the lands of canal command area are evident for the best indicators: the land density is 1.0-1.17g/cm<sup>2</sup>; the overall porosity is 50-55%, and the speed of water absorbing is 70-100 for the first hour.

Black soils of the command area are supplied with azoth weakly, with phosphor weakly and medium, with potassium medium.

### **Social-economic conditions**

All seven communities affected (Jrashen, Verin Getashen, Martuni, Dzoragiugh, Astghadzor, Vaghashen and Meghrashen) are within the service area of three WUAs: Jrashen community is within the service area of “Getik” WUA, Verin Getashen, Martuni, Dzoragiugh, Astghadzor, Vaghashen communities are within the service area of “Martuni” WUA and Meghrashen community is within the service area of “Shirak” WUA. All water users of above mentioned communities are members of WUAs. In all WUAs are established problem-solving commissions for examination and decision making if any dispute arise concerning the water distribution.

Water users in all communities affected are cultivating cereals (wheat mostly), vegetables and fruits, including grapes, fodder crops, etc. Due to poor condition of the water conveyance infrastructure the farming activities has declined. Due to low incomes from farming and lack of job opportunities, in all the communities affected there is a permanent and seasonal out migration. Mostly men of working age work abroad, especially in the Russian Federation and financially support their families. In these households mainly women run the farms, supported by children and elder family members. Water users are expected to benefit from the rehabilitation of tertiary irrigation networks under the Additional Financing of the Irrigation Rehabilitation Emergency Project (IREP AF).

According to the general opinion of the people affected by the project that was obtained by the Design Consultant during the design phase, the proposed rehabilitation of the selected tertiary canals are considered to be important for the well being of their community water users. The project is expected to promote and intensify the land cultivation activities by local farmers. It is envisaged that the increased water availability will lead to improvement of incomes and living standards and will help reducing youth emigration.

#### **4 Environmental and Social Impacts**

Only rehabilitation works on existing canals are to be carried out. Due to its rehabilitation nature, the proposed project is not likely to cause significant negative environmental and/or social impacts. Rehabilitation works envisages improvement of irrigation canals in 7 communities of three Marzes of the RA: Jrashen community in Lori marz, Verin Getashen, Martuni, Dzoragiugh, Astghadzor and Vaghashen communities in Gegharkounik Marz, and Shirak community in Shirak Marz. This will ensure an uninterrupted irrigation of the existing arable lands as well as extension of irrigated lands at the expense of significantly reduced water losses and improved management of water resources available. Due to the nature of rehabilitation works proposed by the project, it is not likely to cause significant adverse environmental and/or social impacts. Rehabilitation of tertiary irrigation networks and degraded stretches thereof will bring positive changes to delivery of irrigation water providing water users with required dependable amount of water. This will increase food security, incomes in agricultural sector thereby reducing the number of poor population and the migration in the area. In addition, improved water delivery will encourage farmers to expand irrigated agricultural production and apply high value crops. The expected overall positive environmental and social impacts from the improved tertiary irrigation networks will be long-term and cumulative contributing to the improvement of social and economic conditions in affected communities and in general reducing the pressure on marginal areas. Almost no site specific impacts are revealed due to the similar nature of rehabilitation works proposed for all the tertiary irrigation networks to be improved under the Project.

The adverse impacts are likely to occur during rehabilitation and operation phases of the proposed project. These may include, but are not limited to the following: pollution of surface and ground water resources; degradation of soil, landscape and soil erosion because of improper disposal of excavated materials and construction waste, spillage of oil and toxic substances during the construction; use of temporary construction sites (camps, machinery sites, storage facilities, etc); use of borrow pits; temporary air pollution related to increased truck traffic during the rehabilitation; noise and vibration disturbances during trench excavation; as well as potential impacts on flora and fauna, etc. Social adverse impacts may occur as a result of temporary and/or permanent use of private and/or community owned lands for rehabilitation

works. Rehabilitation works of tertiary irrigation networks will be carried out within the alienation zone of the existing tertiary irrigation networks. Permanent and/or temporary use of public or private lands or other assets will not be required for the implementation of those works. In case any resettlement issue occurs during the implementation of rehabilitation, the works will be terminated and will recommence after the development and implementation of the RAP in accordance with the requirements of the RA legislation and WB requirements.

Short-term social adverse impacts may occur only in cases when cutting plants and/or demolition of light structures appearing within the alienation zone of the main canal cannot be avoided. It is expected that within the proposed project such adverse impact will be avoided through application of appropriate construction techniques. However, if conduct of construction works is not possible without cleaning of the alienation zone from cultivated plants and/or structures, a RAP will be developed in accordance with RPF as required by the Word Bank's OP/BP 4.12 Involuntary Resettlement.

The likely negative environmental and social impacts of the construction phase are expected to be localized and short-term. As a result of timely and proper implementation of this Environmental Management Plan with practical implementation of mitigation measures presented in Annex A to this report, all identified potential negative impacts can be prevented and minimized. In addition to this, regular monitoring over the civil works, in accordance with the Monitoring Plan provided in Annex B, will ensure effective implementation of mitigation measures included in EMP. A possible negative environmental impact of the operation phase may be an increased use of agrochemicals in the areas of the project coverage, provided that with improved access to irrigation, farmers opt to increase volume of high value crops grown in their fields and apply increased amount of pesticides. This can be mitigated by carrying out a public information campaign on the optimal use of pesticides and extending some elements of the integrated pest management (IPM) relevant in the current country contest.

## **5 Mitigation and Enhancement Measures**

The likely negative environmental and social impacts are expected to be localized and short-term. As a result of timely and proper implementation of this Environmental Management Plan with appropriate mitigation measures, which is presented in **Annex A** to this report, all these potential negative impacts can be prevented and minimized.

The mitigation and enhancement measures are proposed for the design of the rehabilitation project, the rehabilitation and further operation of the tertiary canals that shall be undertaken by executing agencies to prevent and/or minimize the likely adverse environmental and social impacts listed above.

### ***Design Phase***

Environmental and social mitigation requirements shall be incorporated into final design, technical specifications and tender documents to be implemented by the Construction Contractor and the agency operating the system in order to prevent and mitigate the potential adverse impacts.

The final design documents package shall include a list of approved borrow pits and agreed spoil disposal sites; permits, agreements obtained from the relevant local/regional authorities for use of borrow pits and sites for disposal of wastes as appropriate; list of construction preparation temporary sites such as access roads, construction camps, transport and machinery sites, storage facilities, etc.

The final design documents shall also provide, to the extent possible, such technical approaches and solutions to the rehabilitation of separate stretches of the main canals where encroachments of the alienation zone are observed that do not require demolition of temporary and permanent private properties (structures, fences, poles, fruit trees, etc). In case the demolition (including tree cutting) or dislocation of private/state holdings is required for the rehabilitation works, a resettlement action plan (RAP) shall be prepared based on the existing RPF and in agreement with the guiding principles of the WB OP 4.12. Compensation will then be provided to the affected population according to RAP.

### ***Construction Phase***

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

- the use of already existing quarries and disposal sites, according to the requirements set in the appropriate permits and agreements obtained at the design phase;
- zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment should be maintained by the contractor;
- all vegetative cover should be restored to its original condition;
- sites for storage of oil and chemicals should be properly equipped to minimize the risks of polluting soils and waters;
- dust and noise from the construction site should be minimized, especially in resident areas, public places, near schools, etc.

If historical and/or cultural monuments or artifacts are unexpectedly found during earthworks, the construction contractors must cease the works and provide relevant information to the State Agency for Protection of Historical and Cultural Monuments which, after due consideration of the findings, shall recommend whether the works can be continued or the design must be revised.

### ***Operational Phase***

During operation it is essential that canal beds be periodically maintained to ensure proper conveyance, to avoid stagnation, to prevent flooding and damages caused by frost.

The detailed mitigation measures to be undertaken by the executing agencies are presented in **Annex A** to this document.

The following enhancement measures are proposed to strengthen the positive impacts expected as a result of rehabilitation of the selected tertiary networks of Lori, Gegarkunik and Shirak Marzes:

- Involve the local population in project related activities (e.g. work force during construction phase, etc.);
- Increase local water users' knowledge on more efficient water management through providing training and practice, on-farm water management, higher value agricultural production, etc.;
- Raise awareness of integrated pest management and sound application of pesticides among water users;
- Build capacity of local water users through provision of credits;
- Support the institutional strengthening of the water supply and delivery organizations (Water Supply Agencies and Water Users Associations).

## **6 Institutional Responsibilities, Reporting and Budget**

Institutional responsibility for implementation of the proposed mitigation measures will be shared amongst the following agencies:

### **6.1 Institutional Responsibilities**

Institutional responsibility for implementation of the proposed mitigation measures will be shared amongst the following agencies:

#### **Executing agencies**

Executing Agencies are responsible for executing the measures of the EMP. During the design phase, the executing agency, FS/FD Consultant, Design Consultant shall ensure that all the necessary permits and agreements (e.g. permits for the disposal of excavated materials, wastes, and demolition debris, etc.) are obtained from relevant state and local authorities before the construction works are tendered out. Executing agencies during construction phase (Construction contractors) shall take the responsibility for physical implementation of mitigation measures provided under the EMP, as well as for obtaining all permits and agreements related to construction activities (e.g. agreement with Historic and Cultural Monuments Protection Agency if any new historical/cultural/archaeological monument or artifacts are unexpectedly found during civil works) in accordance with the WB Environmental Policies and applicable environmental and social legislation of the Republic of Armenia.

#### **Supervising agencies**

Supervising Agencies are responsible for supervising the executing agencies to ensure that they execute the mitigation measures as planned. The Construction Supervision Company hired by PIU for daily supervision over the implementation of civil works will be responsible for supervising the timely, proper and reliable implementation of works and measures as provided by the EMP (including oversight over the environmental and social aspects of all activities implemented under the project in order to ensure that mitigation measures are designed and implemented properly to prevent and minimize likely adverse environmental and social impacts).



The supervising agencies will also ensure that all necessary agreements and permits are obtained by the appropriate contractors from relevant state and local authorities before the construction works are tendered out. The WB may request to check if such permits are issued and valid (e.g., not expired) as well as if the EMP mitigation and monitoring aspects are implemented on the ground during the canal rehabilitation phases according to the WB Environmental Policies and applicable Armenian environmental and social legislation.

### **Monitoring agencies**

Monitoring agencies are in charge of monitoring the extent of implementation and the effectiveness of the mitigation and enhancement measures and of adjusting the program if needed. Monitoring agencies will be responsible for covering all measures requiring some sort of monitoring by PIU/WB.

The government entities with respective mandates, in particular the Ministry of Nature Protection and its affiliated agencies (State Environmental Inspectorate etc.), the Ministry of Health (State Hygienic Anti-Epidemiologic Inspectorate) and the Ministry of Culture (Historic and Cultural Monuments Protection Agency) may also be involved in the monitoring activities, as a part of their mandate.

## **6.2 Reporting Format and Schedule**

The Construction Supervision Company, working in cooperation with the Construction Contractor, will be responsible for reporting to PIU on the implementation of the mitigation measures included in Annex A and according to the monitoring plan presented in Annex B. The Incident Report Form shall be completed and submitted to PIU if any major environmental and social occurrences are observed (such as spills, explosions, etc.). The Incident form is presented in Annex C.

## **6.3 Budget**

The budget for civil works contracts includes costs allocated for implementation of environmental and social mitigation measures. Appropriate mitigation measures to be fulfilled by the construction contractor are presented in Annex A.

The rates of EMP measures are estimated mainly on the basis of quantities dismantling/removing of r/c LR-4 & LR-6 flumes, old monolithic concrete lining, cleaning/removing of canal sediments provided in BOQs, cleaning of the sites after completion of civil works, and transportation of wastes. The distance of removal is agreed with local authorities. The difference in rates comes from the quantity of r/c LR-4 & LR-6 flumes, concrete lining, sediments and the removal distance.

The tertiary canal canals in communities of Lori, Gegarkunik and Shirak Marzes are made of r/c LR-4 & LR-6 flumes or lined with monolithic concrete, which have to be dismantled and removed; therefore the cost of implementation of mitigation measures is estimated at 1.15% of the cost of the total construction contract.

## 7 Public Consultations

According to the FS/FD Consultant's report the area affected by the rehabilitation works of tertiary irrigation network in Lori, Gegharkunik and Shirak Marzes covers 12 communities, including: Jrashen community of Lori Marz, under command of the Nalband Irrigation Scheme, in the service area of "Getikt" WUA; Verin Getashen, Martuni, Dzoragiugh, Astghadzor, Vaghashen communities of Gegharkunik Marz under command of the Sevan Irrigation Scheme, in the service area of "Martuni" WUA; and Meghrashen community of Shirak marz under command of the Shirak Irrigation Scheme, in the service area of "Shirak" WUA.

The socio-economic investigations of the project affected communities included discussions with local WUAs and village administrative heads, as well as the Marzpetaran and community councils covering the following subjects of concern to the local population:

- to avoid resettlement problems as much as possible;
- to minimize the use of private lands;
- to determine the possibility of the free use of margins on the existing roads;
- to assess the feasibility of implementation of the proposed works within the alienation zone of the existing infrastructure;
- to assess environmental problems, etc.

The aim of the public consultations was to discuss the environmental and social issues related to the rehabilitation of tertiary canal systems in the selected communities. The overall description of the scope and activities to be implemented under the AF of the IREP, details of the proposed rehabilitation activities, potential negative impacts, the envisaged mitigation measures, the importance of the project activities for the local people, the expected outcomes and other issues were presented and discussed at each meeting. Appropriate records have been developed about the public consultations held in the communities and the participants have confirmed their participation with a signature on an appropriate attendance paper.

Public consultations for tertiary canals rehabilitation project were conducted in the above mentioned communities. Prior announcements on the upcoming public consultations were made in each affected community, by placing notifications at the publicly accessible places and verbal announcements made to the WUAs, community heads and councils, Marzpetarans, etc. Information bulletins were prepared and distributed among the participants and other concerned parties. The consultations involved representatives from the Design Consultant, CS Team, PIU, WUAs, community leaders and farmers.

Participants from all communities involved in the public consultations attached high importance to the rehabilitation of the proposed tertiary canals and made propositions in relation to the implementation of the activities. Particularly, the participants suggested take into consideration duration of irrigation season in affected communities while implementing civil works in order to not disturb implementation of agricultural works. They were interested in methods of water distribution once the canal construction is completed and whether the sufficient number of outlets is envisaged. The participants from affected communities raised questions related to duration and quality of construction works. They also suggested involving local population in construction activities.

The participants, including the women, attached high significance to the implemented activities in general. They were interested in all the details of the activities; whether an oversight over the

quality of the implemented works is planned, and the schedule of the implemented activities. They also underlined the importance of the quality of the activities that are to be implemented, asking to provide high quality standard work. There were suggestions to involve local workforce in the civil works process. In addition, women participants emphasized the importance of reliable irrigation water supply, which they consider as a crucial factor in ensuring high income from agricultural production in order to take care of their family needs.

All questions raised in the communities received exhaustive answers from the specialists of PIU. The environmental and social issues presented by the concerned people and the associated mitigation measures have been included in the Environmental Management Plan of tertiary canals system.

## **8 Environmental and Social Clauses for Civil Works' Contracts**

Most negative impacts that are likely to occur during the rehabilitation works may be mitigated by including appropriate clauses into the civil works contracts. This EMP shall be made a part of the Technical Specification and incorporated into the Civil Works Contract. These clauses are included in Annex E of this document

## **9 Main Findings**

This EMP examined the implementation of the proposed rehabilitation of the selected tertiary irrigation networks. All the likely negative environmental and social impacts are to be short-term and localized and envisaged to be prevented and/or mitigated and the positive impacts strengthened in the result of implementation of mitigation and enhancement measures included in the Environmental Management Plan (**Annex A**) and environmental and social clauses of the civil works' contracts (**Annex E**).

The positive socio-economic and environmental effects of the project outweigh the likely environmental risks associated with its implementation. Implementation of the project will improve the productivity of irrigated arable lands, as well as quality and quantity of the crops applied leading to improved social and economic welfare of the local farmers, including men and women. It will provide with more reliable supply of irrigation water with considerable savings in operation and maintenance costs and water losses will be significantly reduced. All these will facilitate extension of irrigated land holdings thereby reducing erosion and desertification.

## Annexes

### Annex A: Environmental Management Plan: Mitigation Measures

| POTENTIAL NEGATIVE IMPACT  | ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES   | EXECUTING AGENCY | SUPERVISING AGENCY | COST<br>(To be quantified where possible)      | TIMING        |
|--|--|------------------|--------------------|--|---------------|
| <i>Design Phase</i>  |  |                  |                    |  |               |
| Pollution of water and soil, degradation of landscapes 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.  | FS/FD Consultant | PIU                | Part of the contract with the FS/FD Consultant | During design |
|  | Develop a list and specifications for construction temporary sites such as access roads, construction camps, transport and machinery maintenance sites, storage facilities, etc.                                       | FS/FD Consultant | PIU                | Part of the contract with the FS/FD Consultant | During design |
| Temporary air pollution (dust) related to the transportation of construction materials and truck traffic                               | Develop the traffic management plan on canal service roads to ensure smooth traffic flow and safety both for workers, local traffic and population   | FS/FD Consultant | PIU                | Part of the contract with the FS/FD Consultant | During design |
| Landscape degradation and soil erosion   | Develop measures to strengthen the steep slopes with vegetation, grass and plants or gabions. Consider the use of plant species characteristic for the landscape in the course of restoration of the vegetation cover. | FS/FD Consultant | PIU                | Part of the contract with the FS/FD Consultant | During design |

| <b>POTENTIAL NEGATIVE IMPACT</b>   | <b>ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES</b>   | <b>EXECUTING AGENCY</b> | <b>SUPERVISING AGENCY</b> | <b>COST</b><br>(To be quantified where possible) | <b>TIMING</b>                                  |
|--|---|-------------------------|---------------------------|--|--|
|  | 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 storing the excavated soils.  | FS/FD Consultant        | PIU                       | Part of the contract with the FS/FD Consultant   | During design                                  |
| Temporary or permanent taking 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 system, which, to the extent possible, allow implementation of construction works without demolition and dislocation of private and community properties. Any taking of property, permanent or temporary, will be in compliance with WB OP4.12, the RPF and a RAP. | FS/FD Consultant        | PIU                       | Part of the contract with the FS/FD Consultant   | During design                                  |
|  | If dislocation and/or demolition or temporary or permanent use of the assets is required for implementation of the works, the compensation shall be envisaged for the affected people in compliance with WB OP4.12, the RPF and a RAP.  | FS/FD Consultant        | PIU                       | Part of the contract with the FS/FD Consultant   | During design                                  |
|  | Servitudes must be ensured for the temporary and permanent use of community and private lands (if applicable).  | FS/FD Consultant        | PIU                       | Part of the contract with the FS/FD Consultant   | During design, before construction works start |

| POTENTIAL NEGATIVE IMPACT  | ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES  | EXECUTING AGENCY        | SUPERVISING AGENCY                  | COST<br>(To be quantified where possible)         | TIMING   |
|--|---|-------------------------|-------------------------------------|---|--|
| <i>Construction Phase</i>  |   |                         |                                     |   |  |
| Pollution of water and soil, degradation of landscapes as a result of improper disposal of excavated materials and construction wastes | Removal of old cement linings and accumulated silt.   | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                            |
|  | Maintain zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment.   | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                            |
|  | 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.  | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | After obtaining of permit, during construction works |
|  | Maintain appropriate operating rules for the camps in identified suitable sites, including safe handling of control of access, adequate drainage, etc.  | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                            |
| Spillage of oil or toxic substances  | Implement the measures to control spillage of toxic substances that will be included in construction contracts, including: guidelines for the proper storage and sitting of hazardous material such as oil, grease, fuel, asphalt, or ignitable and corrosive materials; lubricants will be collected in clearly marked containers and reused if possible, or disposed of at properly regulated offsite locations; water samples will be taken and tested for oil when there is a risk of spills or leakages to canal waters, surface waters, or groundwater. | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                            |

| <b>POTENTIAL NEGATIVE IMPACT</b>  | <b>ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES</b>  | <b>EXECUTING AGENCY</b> | <b>SUPERVISING AGENCY</b>           | <b>COST</b><br>(To be quantified where possible)  | <b>TIMING</b>             |
|---|--|-------------------------|-------------------------------------|---|---------------------------|
| Temporary air pollution (dust) related to the transportation of construction materials and truck traffic noise and vibration disturbances | Use closed/covered trucks for transportation of construction materials and wastes. Depending on season, wash truck tires as appropriate at the specially designed car washing sites to control tracking mud and dust onto paved roads. | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |
|   | Clean the surrounding area from dust by water sprinkling (except in Winter), remove excess materials and clean the sites upon completion of activities   | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |
|   | Provide workers that deal with hazardous materials or exposed to dust with necessary protection gear, and follow applicable regulations and procedures as established by GoA authorities.  | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |
|   | 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  | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |
| Impacts on safety of personnel  | Workers during cement pouring and while using heavy equipment shall have and use safety equipment.   | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |
| Impacts on historic-cultural monuments or artifacts   | Cease the works as soon as historical and cultural monuments or artifacts are encountered and immediately provide relevant information to the State Agency for Historical and Cultural Monuments Protection                            | Construction Contractor | PIU through Construction Supervisor | GoA funding if urgent excavations are required    | During construction 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.   | Construction Contractor | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works |

| <b>POTENTIAL NEGATIVE IMPACT</b>   | <b>ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES</b>  | <b>EXECUTING AGENCY</b>     | <b>SUPERVISING AGENCY</b>           | <b>COST</b><br>(To be quantified where possible)  | <b>TIMING</b>   |
|--|--|-----------------------------|-------------------------------------|---|---|
|  | Dump excavated soils and substances only within the areas designated for that purpose.   | Construction Contractor     | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                                 |
|  | Restore landscape to quasi-original vegetation cover after completion of rehabilitation works.   | Construction Contractor     | PIU through Construction Supervisor | Part of the contract with Construction Contractor | During construction works                                 |
| Temporary or permanent taking of property or productive assets, including peoples' access to such assets, (including tree cutting) that appear within the alienation zone that hinder construction works | If it is required to develop and implement the Resettlement Action Plan, and/or obtain servitude, the construction works will start after the compensations are paid to the project affected persons (PAPs) and servitudes acquired. These must be guided by the Armenian legislation and WB guidelines. | GoA through relevant entity | PIU                                 | GoA funding                                       | Before construction works start in the particular section |
|  | If demolition and/or dislocation is required, the project affected persons will be compensated in accordance with WB OP4.12 before the construction starts.  | GoA through relevant entity | PIU                                 | GoA funding                                       | Before construction works start in the particular section |
| <b><i>Operation Phase</i></b>  |  |                             |                                     |   |   |
| Hydrological issues of flooding, low flow and water stagnation   | Maintain the water conduit and hydro-technical structures to minimize the risk for water stagnation and accidents.   | WSA, WUA                    | SCWS                                | Regular Operation and Maintenance cost            | During operation  |
|  | Operate the water intakes in such a way that the water withdrawal is properly controlled to avoid withdrawing more water than allowed.   | WSA, WUA                    | SCWS                                | Regular Operation and Maintenance cost            | During operation  |
|  | Maintain the canal beds and hydraulic structures to avoid water stagnation.  | WSA, WUA                    | SCWS                                | Regular Operation and Maintenance cost            | During operation  |



| <b>POTENTIAL NEGATIVE IMPACT</b>   | <b>ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES</b>  | <b>EXECUTING AGENCY</b>                          | <b>SUPERVISING AGENCY</b> | <b>COST</b><br>(To be quantified where possible)                               | <b>TIMING</b>   |
|--|--|--|---------------------------|--|---|
|  | Regularly clean slit from the canals bed and dispose the removed slit in the approved waste disposal sites. The removed slit can be also applied in the farm-fields as a fertilizer. | WSA, WUA   | SCWS                      | Regular Operation and Maintenance cost   | During operation  |
| Negative impact on human and environmental health as a result of increased use of pesticides in the areas with improved irrigation | Conduct of public awareness campaign and extension of applicable IPM technologies to water users   | PIU through pest management consultant, WSA, WUA | SCWS                      | Included in the project procurement plan as procurement of consulting services | Although this impact is expected during operation, the mitigation measure is proactive and will be applied during operation |
| Siltation in canals  | Training of WSA staff on proper operation and maintenance  | PIU/WSA  | SCWS                      | Regular operation and maintenance  | During operation  |

## Annex B: Monitoring Plan

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

| <b>Phase</b>        | <b>What parameter is to be monitored?</b> | <b>Where is the parameter to be monitored?</b> | <b>How is the parameter to be monitored?/ type of monitoring equipment</b> | <b>When is the parameter to be monitored? (frequency of measurement or continuous)</b> | <b>Cost</b>                          | <b>Reporting Agency</b>             |
|---------------------|---|--|--|--|--------------------------------------|-------------------------------------|
| <b>Design</b>       | Material borrows and dumps                | At the design consultant                       | Perspective borrows and dumps identified                                   | During the design  | Minimal additional design cost       | PIU                                 |
|                     | Road accessibility to the structures      | At the design consultant                       | Inspection   | During the design  | Minimal additional design cost       | PIU                                 |
| <b>Construction</b> | Soil erosion                              | In new cutting areas and slopes                | Inspections at site and soils mechanical information                       | During and after construction work, when deemed necessary                              | Minimal additional construction cost | PIU through Construction Supervisor |
|                     | Water pollution                           | In water bodies                                | Inspection   | During construction works  | Minimal additional construction cost | PIU through Construction Supervisor |
|                     | Air pollution/dust                        | At working site                                | Visual inspection  | During earth works, when deemed necessary  | Minimal additional construction cost | PIU through Construction Supervisor |
|                     | Noise                                     | At working site                                | Inspection of noise levels (dB)  | During earth works and blast, when deemed necessary and on complaint                   | Minimal additional construction cost | PIU through Construction Supervisor |
|                     | Conservation of vegetation resources      | At working site                                | Inspection   | When cutting and restoring used areas  | Minimal additional construction cost | PIU through Construction Supervisor |

| <b>Phase</b>     | <b>What parameter is to be monitored?</b>                                   | <b>Where is the parameter to be monitored?</b>  | <b>How is the parameter to be monitored?/ type of monitoring equipment</b> | <b>When is the parameter to be monitored? (frequency of measurement or continuous)</b> | <b>Cost</b>  | <b>Reporting Agency</b>             |
|------------------|---|---|--|--|--|-------------------------------------|
|                  | Staff safety (protective equipment)   | At work site                                    | Inspection   | Unannounced inspections during work  | Minimal additional construction cost                 | PIU through Construction Supervisor |
|                  | Overall workers' camp site conditions                                       | On the camp site during construction activities | Inspection   | According to the existing regulations  | Minimal additional construction cost                 | PIU through Construction Supervisor |
|                  | Conduct of campaign for rising awareness of IPM and sound use of pesticides | WUA offices and water user communities          | Inspection Survey  | After formal launch of the campaign  | Minimal additional cost to operational budget of PIU | PIU                                 |
| <b>Operation</b> | Maintenance of irrigation delivery system                                   | On site   | Inspection   | Continuous – full scale desiltation required yearly                                    | Routine operation and maintenance cost               | WSA, WUA                            |
|                  | Maintenance of irrigation off-takes and other structures                    | On site   | Inspection   | When needed  | Routine operation and maintenance cost               | WSA, WUA                            |

## Annex C: Incident Report Form

### REHABILITATION OF TERTIARY IRRIGATION NETWORKS IN LORI, GEGHARKOUNIK AND SHIRAK MARZES

|    |                                     |   |
|----|-------------------------------------|---|
| 1  | Date:                               |   |
| 2  | Tertiary Canal:                     |   |
| 3  | Location:                           |   |
| 4  | Construction Contractor:            |   |
| 5  | Marz and Community:                 |   |
| 6  | WUA                                 |   |
| 7  | Incident Type:                      |   |
| 8  | Severity:                           | <input type="checkbox"/> High<br><input type="checkbox"/> Medium<br><input type="checkbox"/> Low            |
| 10 | Reported By:                        |   |
| 11 | Description of Incident Root Cause: |   |
| 12 | Corrective Action Taken:            |   |
| 13 | Corrective Action to be Taken:      |   |
| 14 | Action Taken to Prevent Recurrence: |   |
| 15 | Corrective Action Carried Out By:   |   |
| 16 | Close Out By:                       |   |
| 17 | Close Out Date:                     |   |
| 18 | Person Involved:                    |   |
| 19 | Machine Involved:                   |   |
| 20 | Contractor/Sub Contractor Involved: |   |
| 21 | Third Party Involvement:            |   |
| 22 | 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: Check List of Potential Environmental and Social Impacts

Project Name/location: **Rehabilitation of Jrashen Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Haygiughshinnakhagits" Ltd.), FS/FD Team

Date(s) of Assessment: August, 2011

| For each environmental effect place a cross (X) in one or two of the columns |                         | Positive impact likely | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgement possible at present | Comments   |
|--|-------------------------|------------------------|--------------------------|------------------|--------------------------|------------------------|----------------------------------|--|
|  |                         |                        |                          |                  |                          |                        |                                  | <i>N/A = Environmental effect is Not Applicable in this case<br/>For detailed explanation refer to the appropriate sections of this EMP</i>                        |
| Hydrology  | 1-1 Low flow regime     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 1-2 Flood regime        |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 1-3 Operation of dams   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 1-4 Fall of water table |                        |                          | X                |                          |                        |                                  | <i>Ground water in this area is 3-5 m deep.</i>  |
|  | 1-5 Rise of water table |                        |                          | X                |                          |                        |                                  | <i>Ground water in this area is 3-5 m deep.</i>  |
| Pollution  | 2-1 Solute dispersion   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 2-2 Toxic substances    |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 2-3 Organic pollution   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 2-4 Anaerobic effects   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 2-5 Gas emissions       |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
| Soils  | 3-1 Soil salinity       |                        |                          | X                |                          |                        |                                  |  |
|  | 3-2 Soil properties     |                        | X                        |                  |                          |                        |                                  |  |
|  | 3-3 Saline groundwater  |                        |                          | X                |                          |                        |                                  |  |
|  | 3-4 Saline drainage     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 3-5 Saline intrusion    |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
| Sediments  | 4-1 Local erosion       |                        |                          |                  |                          | X                      |                                  |  |
|  | 4-2 Hinterland effect   |                        |                          | X                |                          |                        |                                  |  |
|  | 4-3 River morphology    |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 4-4 Channel regime      |                        |                          | X                |                          |                        |                                  |  |
|  | 4-5 Sedimentation       |                        | X                        |                  |                          |                        |                                  |  |
| Ecology  | 4-6 Estuary erosion     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 5-1 Project lands       |                        |                          |                  |                          | X                      |                                  |  |
|  | 5-2 Water bodies        |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 5-3 Surrounding area    |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 5-4 Valleys & shores    |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 5-5 Wetlands & plains   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 5-6 Rare species        |                        |                          | X                |                          |                        |                                  | <i>No specially protected areas observed</i>   |
|  | 5-7 Animal migration    |                        |                          |                  |                          | X                      |                                  | <i>Temporarily, caused by civil works</i>  |
| Socio-economic   | 5-8 Natural industry    |                        |                          | X                |                          |                        |                                  |  |
|  | 6-1 Population change   |                        |                          | X                |                          |                        |                                  |  |
|  | 6-2 Income & amenity    |                        |                          | X                |                          |                        |                                  |  |
|  | 6-3 Human migration     |                        |                          | X                |                          |                        |                                  |  |
|  | 6-4 Resettlement        |                        |                          | X                |                          |                        |                                  | <i>All the works will be implemented within the alienation zone of the existing infrastructure.</i>  |
|  | 6-5 Women's role        |                        |                          | X                |                          |                        |                                  |  |
|  | 6-6 Minority groups     |                        |                          | X                |                          |                        |                                  | <i>Existing minority groups equally share project benefits.</i>  |
|  | 6-7 Sites of value      |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of this project</i>  |
|  | 6-8 Regional effects    |                        |                          | X                |                          |                        |                                  |  |
|  | 6-9 User involvement    |                        |                          | X                |                          |                        |                                  | <i>The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase.</i> |
| Health   | 6-10 Recreation         |                        |                          | X                |                          |                        |                                  |  |
|  | 7-1 Water & sanitation  |                        |                          | X                |                          |                        |                                  |  |
|  | 7-2 Habitation          |                        |                          | X                |                          |                        |                                  |  |
|  | 7-3 Health services     |                        |                          | X                |                          |                        |                                  |  |
|  | 7-4 Nutrition           |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 7-5 Relocation effect   |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 7-6 Disease ecology     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 7-7 Disease hosts       |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 7-8 Disease control     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 7-9 Other hazards       |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
| Imbalances   | 8-1 Pests & weeds       |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 8-2 Animal diseases     |                        |                          | X                |                          |                        |                                  | <i>N/A within the context of tertiary canals</i>   |
|  | 8-3 Aquatic weeds       |                        | X                        |                  |                          |                        |                                  |  |
|  | 8-4 Structural damage   |                        |                          | X                |                          |                        |                                  |  |
|  | 8-5 Animal imbalances   |                        |                          | X                |                          |                        |                                  |  |
| <b>Number of crosses</b>   |                         | <b>0</b>               | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                         | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>  |

Project Name/location: **Rehabilitation of Verin Gtashen Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Haygiughshinnakhagits" Ltd.) FS/FD Team

Date(s) of Assessment: August, 2011

|                          |                         | Positive impact likely   | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--------------------------|-------------------------|--|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|                          |                         | For each environmental effect place a cross (X) in one or two of the columns |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology                | 1-1 Low flow regime     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-2 Flood regime        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-3 Operation of dams   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-4 Fall of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|                          | 1-5 Rise of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution                | 2-1 Solute dispersion   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-2 Toxic substances    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-3 Organic pollution   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-4 Anaerobic effects   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-5 Gas emissions       |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils                    | 3-1 Soil salinity       |  |                          | X                |                          |                        |                                 |   |
|                          | 3-2 Soil properties     |  | X                        |                  |                          |                        |                                 |   |
|                          | 3-3 Saline groundwater  |  |                          | X                |                          |                        |                                 |   |
|                          | 3-4 Saline drainage     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 3-5 Saline intrusion    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments                | 4-1 Local erosion       |  |                          |                  |                          | X                      |                                 |   |
|                          | 4-2 Hinterland effect   |  |                          | X                |                          |                        |                                 |   |
|                          | 4-3 River morphology    |  |                          | X                |                          |                        |                                 |   |
|                          | 4-4 Channel regime      |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 4-5 Sedimentation       |  | X                        |                  |                          |                        |                                 |   |
| Ecology                  | 4-6 Estuary erosion     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-1 Project lands       |  |                          |                  |                          | X                      |                                 |   |
|                          | 5-2 Water bodies        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-3 Surrounding area    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-4 Valleys & shores    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-5 Wetlands & plains   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-6 Rare species        |  |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|                          | 5-7 Animal migration    |  |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
| Socio-economic           | 5-8 Natural industry    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-1 Population change   |  |                          | X                |                          |                        |                                 |   |
|                          | 6-2 Income & amenity    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-3 Human migration     |  |                          | X                |                          |                        |                                 |   |
|                          | 6-4 Resettlement        |  |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|                          | 6-5 Women's role        |  |                          | X                |                          |                        |                                 |   |
|                          | 6-6 Minority groups     |  |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|                          | 6-7 Sites of value      |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 6-8 Regional effects    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-9 User involvement    |  |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
| Health                   | 6-10 Recreation         |  |                          | X                |                          |                        |                                 |   |
|                          | 7-1 Water & sanitation  |  |                          | X                |                          |                        |                                 |   |
|                          | 7-2 Habitation          |  |                          | X                |                          |                        |                                 |   |
|                          | 7-3 Health services     |  |                          | X                |                          |                        |                                 |   |
|                          | 7-4 Nutrition           |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-5 Relocation effect   |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-6 Disease ecology     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-7 Disease hosts       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-8 Disease control     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-9 Other hazards       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances               | 8-1 Pests & weeds       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-2 Animal diseases     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-3 Aquatic weeds       |  | X                        |                  |                          |                        |                                 |   |
|                          | 8-4 Structural damage   |  |                          | X                |                          |                        |                                 |   |
|                          | 8-5 Animal imbalances   |  |                          | X                |                          |                        |                                 |   |
| <b>Number of crosses</b> |                         | <b>0</b>   | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |

Project Name/location: **Rehabilitation of Martuni Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Haygiughshinnakhagits" Ltd.) FS/FD Team

Date(s) of Assessment: August, 2011

|                          |                         | Positive impact likely   | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--------------------------|-------------------------|--|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|                          |                         | For each environmental effect place a cross (X) in one or two of the columns |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology                | 1-1 Low flow regime     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-2 Flood regime        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-3 Operation of dams   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-4 Fall of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|                          | 1-5 Rise of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution                | 2-1 Solute dispersion   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-2 Toxic substances    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-3 Organic pollution   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-4 Anaerobic effects   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-5 Gas emissions       |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils                    | 3-1 Soil salinity       |  |                          | X                |                          |                        |                                 |   |
|                          | 3-2 Soil properties     |  | X                        |                  |                          |                        |                                 |   |
|                          | 3-3 Saline groundwater  |  |                          | X                |                          |                        |                                 |   |
|                          | 3-4 Saline drainage     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 3-5 Saline intrusion    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments                | 4-1 Local erosion       |  |                          |                  |                          | X                      |                                 |   |
|                          | 4-2 Hinterland effect   |  |                          | X                |                          |                        |                                 |   |
|                          | 4-3 River morphology    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 4-4 Channel regime      |  |                          | X                |                          |                        |                                 |   |
|                          | 4-5 Sedimentation       |  | X                        |                  |                          |                        |                                 |   |
|                          | 4-6 Estuary erosion     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Ecology                  | 5-1 Project lands       |  |                          |                  |                          | X                      |                                 |   |
|                          | 5-2 Water bodies        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-3 Surrounding area    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-4 Valleys & shores    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-5 Wetlands & plains   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-6 Rare species        |  |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|                          | 5-7 Animal migration    |  |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
|                          | 5-8 Natural industry    |  |                          | X                |                          |                        |                                 |   |
| Socio-economic           | 6-1 Population change   |  |                          | X                |                          |                        |                                 |   |
|                          | 6-2 Income & amenity    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-3 Human migration     |  |                          | X                |                          |                        |                                 |   |
|                          | 6-4 Resettlement        |  |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|                          | 6-5 Women's role        |  |                          | X                |                          |                        |                                 |   |
|                          | 6-6 Minority groups     |  |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|                          | 6-7 Sites of value      |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 6-8 Regional effects    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-9 User involvement    |  |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
|                          | 6-10 Recreation         |  |                          | X                |                          |                        |                                 |   |
| Health                   | 7-1 Water & sanitation  |  |                          | X                |                          |                        |                                 |   |
|                          | 7-2 Habitation          |  |                          | X                |                          |                        |                                 |   |
|                          | 7-3 Health services     |  |                          | X                |                          |                        |                                 |   |
|                          | 7-4 Nutrition           |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-5 Relocation effect   |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-6 Disease ecology     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-7 Disease hosts       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-8 Disease control     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-9 Other hazards       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances               | 8-1 Pests & weeds       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-2 Animal diseases     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-3 Aquatic weeds       |  | X                        |                  |                          |                        |                                 |   |
|                          | 8-4 Structural damage   |  |                          | X                |                          |                        |                                 |   |
|                          | 8-5 Animal imbalances   |  |                          | X                |                          |                        |                                 |   |
| <b>Number of crosses</b> |                         | <b>0</b>   | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |

Project Name/location: **Rehabilitation of Dzoragiugh Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Haygiughshinnakhagits" Ltd.) FS/FD Team

Date(s) of Assessment: August, 2011

| For each environmental effect place a cross (X) in one or two of the columns |                          | Positive impact likely | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--|--------------------------|------------------------|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|  |                          |                        |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology  | 1-1 Low flow regime      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-2 Flood regime         |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-3 Operation of dams    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-4 Fall of water table  |                        |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|  | 1-5 Rise of water table  |                        |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution  | 2-1 Solute dispersion    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-2 Toxic substances     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-3 Organic pollution    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-4 Anaerobic effects    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-5 Gas emissions        |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils  | 3-1 Soil salinity        |                        |                          | X                |                          |                        |                                 |   |
|  | 3-2 Soil properties      |                        | X                        |                  |                          |                        |                                 |   |
|  | 3-3 Saline groundwater   |                        |                          | X                |                          |                        |                                 |   |
|  | 3-4 Saline drainage      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 3-5 Saline intrusion     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments  | 4-1 Local erosion        |                        |                          |                  |                          | X                      |                                 |   |
|  | 4-2 Hinterland effect    |                        |                          | X                |                          |                        |                                 |   |
|  | 4-3 River morphology     |                        |                          | X                |                          |                        |                                 |   |
|  | 4-4 Channel regime       |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 4-5 Sedimentation        |                        | X                        |                  |                          |                        |                                 |   |
| Ecology  | 4-6 Estuary erosion      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-1 Project lands        |                        |                          |                  |                          | X                      |                                 |   |
|  | 5-2 Water bodies         |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-3 Surrounding area     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-4 Valleys & shores     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-5 Wetlands & plains    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-6 Rare species         |                        |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|  | 5-7 Animal migration     |                        |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
| Socio-economic   | 5-8 Natural industry     |                        |                          | X                |                          |                        |                                 |   |
|  | 6-1 Population change    |                        |                          | X                |                          |                        |                                 |   |
|  | 6-2 Income & amenity     |                        |                          | X                |                          |                        |                                 |   |
|  | 6-3 Human migration      |                        |                          | X                |                          |                        |                                 |   |
|  | 6-4 Resettlement         |                        |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|  | 6-5 Women's role         |                        |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|  | 6-6 Minority groups      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 6-7 Sites of value       |                        |                          | X                |                          |                        |                                 |   |
|  | 6-8 Regional effects     |                        |                          | X                |                          |                        |                                 |   |
| Health   | 6-9 User involvement     |                        |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
|  | 6-10 Recreation          |                        |                          | X                |                          |                        |                                 |   |
|  | 7-1 Water & sanitation   |                        |                          | X                |                          |                        |                                 |   |
|  | 7-2 Habitation           |                        |                          | X                |                          |                        |                                 |   |
|  | 7-3 Health services      |                        |                          | X                |                          |                        |                                 |   |
|  | 7-4 Nutrition            |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-5 Relocation effect    |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-6 Disease ecology      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-7 Disease hosts        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-8 Disease control      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances   | 7-9 Other hazards        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-1 Pests & weeds        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-2 Animal diseases      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-3 Aquatic weeds        |                        | X                        |                  |                          |                        |                                 |   |
|  | 8-4 Structural damage    |                        |                          | X                |                          |                        |                                 |   |
|  | 8-5 Animal imbalances    |                        |                          | X                |                          |                        |                                 |   |
|  | <b>Number of crosses</b> | <b>0</b>               | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |



|                          |                         | Positive impact likely   | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--------------------------|-------------------------|--|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|                          |                         | For each environmental effect place a cross (X) in one or two of the columns |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology                | 1-1 Low flow regime     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-2 Flood regime        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-3 Operation of dams   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-4 Fall of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|                          | 1-5 Rise of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution                | 2-1 Solute dispersion   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-2 Toxic substances    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-3 Organic pollution   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-4 Anaerobic effects   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-5 Gas emissions       |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils                    | 3-1 Soil salinity       |  |                          | X                |                          |                        |                                 |   |
|                          | 3-2 Soil properties     |  | X                        |                  |                          |                        |                                 |   |
|                          | 3-3 Saline groundwater  |  |                          | X                |                          |                        |                                 |   |
|                          | 3-4 Saline drainage     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 3-5 Saline intrusion    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments                | 4-1 Local erosion       |  |                          |                  |                          | X                      |                                 |   |
|                          | 4-2 Hinterland effect   |  |                          | X                |                          |                        |                                 |   |
|                          | 4-3 River morphology    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 4-4 Channel regime      |  |                          | X                |                          |                        |                                 |   |
|                          | 4-5 Sedimentation       |  | X                        |                  |                          |                        |                                 |   |
|                          | 4-6 Estuary erosion     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Ecology                  | 5-1 Project lands       |  |                          |                  |                          | X                      |                                 |   |
|                          | 5-2 Water bodies        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-3 Surrounding area    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-4 Valleys & shores    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-5 Wetlands & plains   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-6 Rare species        |  |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|                          | 5-7 Animal migration    |  |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
|                          | 5-8 Natural industry    |  |                          | X                |                          |                        |                                 |   |
| Socio-economic           | 6-1 Population change   |  |                          | X                |                          |                        |                                 |   |
|                          | 6-2 Income & amenity    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-3 Human migration     |  |                          | X                |                          |                        |                                 |   |
|                          | 6-4 Resettlement        |  |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|                          | 6-5 Women's role        |  |                          | X                |                          |                        |                                 |   |
|                          | 6-6 Minority groups     |  |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|                          | 6-7 Sites of value      |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 6-8 Regional effects    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-9 User involvement    |  |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
|                          | 6-10 Recreation         |  |                          | X                |                          |                        |                                 |   |
| Health                   | 7-1 Water & sanitation  |  |                          | X                |                          |                        |                                 |   |
|                          | 7-2 Habitation          |  |                          | X                |                          |                        |                                 |   |
|                          | 7-3 Health services     |  |                          | X                |                          |                        |                                 |   |
|                          | 7-4 Nutrition           |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-5 Relocation effect   |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-6 Disease ecology     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-7 Disease hosts       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-8 Disease control     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-9 Other hazards       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances               | 8-1 Pests & weeds       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-2 Animal diseases     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-3 Aquatic weeds       |  | X                        |                  |                          |                        |                                 |   |
|                          | 8-4 Structural damage   |  |                          | X                |                          |                        |                                 |   |
|                          | 8-5 Animal imbalances   |  |                          | X                |                          |                        |                                 |   |
| <b>Number of crosses</b> |                         | <b>0</b>   | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |

Project Name/location: **Rehabilitation of Vaghashen Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Jarabi" Ltd.) FS/FD Team

Date(s) of Assessment:: July 2011

| For each environmental effect place a cross (X) in one or two of the columns |                          | Positive impact likely | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--|--------------------------|------------------------|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|  |                          |                        |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology  | 1-1 Low flow regime      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-2 Flood regime         |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-3 Operation of dams    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 1-4 Fall of water table  |                        |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|  | 1-5 Rise of water table  |                        |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution  | 2-1 Solute dispersion    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-2 Toxic substances     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-3 Organic pollution    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-4 Anaerobic effects    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 2-5 Gas emissions        |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils  | 3-1 Soil salinity        |                        |                          | X                |                          |                        |                                 |   |
|  | 3-2 Soil properties      |                        | X                        |                  |                          |                        |                                 |   |
|  | 3-3 Saline groundwater   |                        |                          | X                |                          |                        |                                 |   |
|  | 3-4 Saline drainage      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 3-5 Saline intrusion     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments  | 4-1 Local erosion        |                        |                          |                  |                          | X                      |                                 |   |
|  | 4-2 Hinterland effect    |                        |                          | X                |                          |                        |                                 |   |
|  | 4-3 River morphology     |                        |                          | X                |                          |                        |                                 |   |
|  | 4-4 Channel regime       |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 4-5 Sedimentation        |                        | X                        |                  |                          |                        |                                 |   |
| Ecology  | 4-6 Estuary erosion      |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-1 Project lands        |                        |                          |                  |                          | X                      |                                 |   |
|  | 5-2 Water bodies         |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-3 Surrounding area     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-4 Valleys & shores     |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-5 Wetlands & plains    |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 5-6 Rare species         |                        |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|  | 5-7 Animal migration     |                        |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
| Socio-economic   | 5-8 Natural industry     |                        |                          | X                |                          |                        |                                 |   |
|  | 6-1 Population change    |                        |                          | X                |                          |                        |                                 |   |
|  | 6-2 Income & amenity     |                        |                          | X                |                          |                        |                                 |   |
|  | 6-3 Human migration      |                        |                          | X                |                          |                        |                                 |   |
|  | 6-4 Resettlement         |                        |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|  | 6-5 Women's role         |                        |                          | X                |                          |                        |                                 |   |
|  | 6-6 Minority groups      |                        |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|  | 6-7 Sites of value       |                        |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|  | 6-8 Regional effects     |                        |                          | X                |                          |                        |                                 |   |
| Health   | 6-9 User involvement     |                        |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
|  | 6-10 Recreation          |                        |                          | X                |                          |                        |                                 |   |
|  | 7-1 Water & sanitation   |                        |                          | X                |                          |                        |                                 |   |
|  | 7-2 Habitation           |                        |                          | X                |                          |                        |                                 |   |
|  | 7-3 Health services      |                        |                          | X                |                          |                        |                                 |   |
|  | 7-4 Nutrition            |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-5 Relocation effect    |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-6 Disease ecology      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-7 Disease hosts        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 7-8 Disease control      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances   | 7-9 Other hazards        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-1 Pests & weeds        |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-2 Animal diseases      |                        |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|  | 8-3 Aquatic weeds        |                        | X                        |                  |                          |                        |                                 |   |
|  | 8-4 Structural damage    |                        |                          | X                |                          |                        |                                 |   |
|  | 8-5 Animal imbalances    |                        |                          | X                |                          |                        |                                 |   |
|  | <b>Number of crosses</b> | <b>0</b>               | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |

Project Name/location: **Rehabilitation of Meghrashen Community Tertiary Irrigation Network**

Assessor's name/position: FS/FD Consultant ("Haygiughshinnakhagits" Ltd.) FS/FD Team

Date(s) of Assessment: August, 2011

|                          |                         | Positive impact likely   | Positive impact possible | No impact likely | Negative impact possible | Negative impact likely | No judgment possible at present | Comments  |
|--------------------------|-------------------------|--|--------------------------|------------------|--------------------------|------------------------|---------------------------------|---|
|                          |                         | For each environmental effect place a cross (X) in one or two of the columns |                          |                  |                          |                        |                                 | N/A = Environmental effect is <b>Not Applicable</b> in this case<br>For detailed explanation refer to the appropriate sections of this EMP                  |
| Hydrology                | 1-1 Low flow regime     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-2 Flood regime        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-3 Operation of dams   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 1-4 Fall of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
|                          | 1-5 Rise of water table |  |                          | X                |                          |                        |                                 | Ground water in this area is 3-5 m deep.  |
| Pollution                | 2-1 Solute dispersion   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-2 Toxic substances    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-3 Organic pollution   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-4 Anaerobic effects   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 2-5 Gas emissions       |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Soils                    | 3-1 Soil salinity       |  |                          | X                |                          |                        |                                 |   |
|                          | 3-2 Soil properties     |  | X                        |                  |                          |                        |                                 |   |
|                          | 3-3 Saline groundwater  |  |                          | X                |                          |                        |                                 |   |
|                          | 3-4 Saline drainage     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 3-5 Saline intrusion    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Sediments                | 4-1 Local erosion       |  |                          |                  |                          | X                      |                                 |   |
|                          | 4-2 Hinterland effect   |  |                          | X                |                          |                        |                                 |   |
|                          | 4-3 River morphology    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 4-4 Channel regime      |  |                          | X                |                          |                        |                                 |   |
|                          | 4-5 Sedimentation       |  | X                        |                  |                          |                        |                                 |   |
|                          | 4-6 Estuary erosion     |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
| Ecology                  | 5-1 Project lands       |  |                          |                  |                          | X                      |                                 |   |
|                          | 5-2 Water bodies        |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-3 Surrounding area    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-4 Valleys & shores    |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-5 Wetlands & plains   |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 5-6 Rare species        |  |                          | X                |                          |                        |                                 | No specially protected areas observed   |
|                          | 5-7 Animal migration    |  |                          |                  |                          | X                      |                                 | Temporarily, caused by civil works  |
|                          | 5-8 Natural industry    |  |                          | X                |                          |                        |                                 |   |
| Socio-economic           | 6-1 Population change   |  |                          | X                |                          |                        |                                 |   |
|                          | 6-2 Income & amenity    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-3 Human migration     |  |                          | X                |                          |                        |                                 |   |
|                          | 6-4 Resettlement        |  |                          | X                |                          |                        |                                 | All the works will be implemented within the alienation zone of the existing infrastructure.  |
|                          | 6-5 Women's role        |  |                          | X                |                          |                        |                                 |   |
|                          | 6-6 Minority groups     |  |                          | X                |                          |                        |                                 | Existing minority groups equally share project benefits.  |
|                          | 6-7 Sites of value      |  |                          | X                |                          |                        |                                 | N/A within the context of this project  |
|                          | 6-8 Regional effects    |  |                          | X                |                          |                        |                                 |   |
|                          | 6-9 User involvement    |  |                          | X                |                          |                        |                                 | The design was prepared in consultation with "Azat" WUA and other stakeholders. Formal and informal public consultations were held during the design phase. |
|                          | 6-10 Recreation         |  |                          | X                |                          |                        |                                 |   |
| Health                   | 7-1 Water & sanitation  |  |                          | X                |                          |                        |                                 |   |
|                          | 7-2 Habitation          |  |                          | X                |                          |                        |                                 |   |
|                          | 7-3 Health services     |  |                          | X                |                          |                        |                                 |   |
|                          | 7-4 Nutrition           |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-5 Relocation effect   |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-6 Disease ecology     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-7 Disease hosts       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-8 Disease control     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 7-9 Other hazards       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
| Imbalances               | 8-1 Pests & weeds       |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-2 Animal diseases     |  |                          | X                |                          |                        |                                 | N/A within the context of tertiary canals   |
|                          | 8-3 Aquatic weeds       |  | X                        |                  |                          |                        |                                 |   |
|                          | 8-4 Structural damage   |  |                          | X                |                          |                        |                                 |   |
|                          | 8-5 Animal imbalances   |  |                          | X                |                          |                        |                                 |   |
| <b>Number of crosses</b> |                         | <b>0</b>   | <b>3</b>                 | <b>47</b>        | <b>0</b>                 | <b>3</b>               | <b>0</b>                        | <b>Total possible = 53 (Unless positive &amp; negative impacts)</b>   |

## **Annex E: Environmental and Social Clauses for Civil Works' Contracts**

The Environmental Management Plans (EMPs) that are to be provided to the Contractor under this Contract shall be considered as binding. The Mitigation Measures to be included in the EMPs will provide general and specific guidance on protection and mitigation of potential environmental damage. All necessary measures on protection of the environment shall be carried out by the Contractor in accordance with the order of competent authorities, the EMPs, and instructions of the Engineer.

### **Obligations of the Contractor**

The general environmental and social obligations of the Contractor within this Contract, without prejudice to other official provisions in force, include the following:

- The Contractor shall respect the environmental, health, safety and labor regulatory provisions in force in the Republic of Armenia (including those announced during the execution of the works if imposed by the Engineer), the contractual provisions of this Contract as well as the conditions fixed by the various authorizations or approvals required;
- The Contractor shall respect national and international labor codes;
- The Contractor shall assume full responsibility for the consequences of its choices and actions; in particular, and without prejudice to the regulatory provisions in force, it guarantees, if necessary, the repair at its cost and according to the most appropriate technologies and deadlines, notably with regard to the level of sensitivity of the site concerned, of damage caused to the environment and residents by failure to respect regulatory and/or administrative provisions and/or the applicable technical specifications, as well as the payment of fines, damages or other penalties which may be incumbent upon it. All such accidental claims and penalties will be settled before final payment is made;
- For those sections of the Tertiary Canals, which require temporary land use the Contractor is responsible for obtaining the right to access the site, including a written notary verified agreement with the land owner, and for paying the cost for land rental for a season and/or for any tree loss, if any. These costs will be covered under the line “Accidental damage during temporary land use” in Contractor’s budget. However, preference should be given to the technical solutions that do not require taking or demolition of temporary and permanent private properties. Such solutions shall be agreed with the Engineer. Construction activities on such stretches only proceed with approval of the Engineer. Any grievances (such as absence of final agreement between Contractor and land/asset owner, etc.) shall be addressed to Community leader;
- The Contractor shall take all measures to ensure the environmental quality of operations which are the subject of this contract and not disrupt the quality of life of the adjacent villages, in particular by applying the applicable specifications and provisions. The Contractor shall consider the execution of works or the implementation of environmental and social provisions as an integral part of the operations relating to the general construction program of the works;
- Appropriate information and training for Contractor personnel, including management staff, with regard to the security and/or quality of operations;

- The Contractor shall inform the local authorities (village mayor, council of elders) and the affected population on planned construction activities, sites and schedule at least 2 weeks in advance of any planned construction activities (including signage);
- The Contractor shall hold information meetings at least 2 weeks before entering any village area for planned construction activities, to inform and consult with the villagers regarding the nature of the forthcoming works, their duration and all effects such as dust, smoke, or noise that will be felt in the village, the mitigation measures that will be applied, and provide villagers with opportunities to ask questions and express concerns;
- The Contractor shall refrain from destroying, removing or clearing trees, timber, scrub, crops and other flora to any extent greater than is approved by the Engineer as being necessary for the execution of this Contract and shall take such measures as may be necessary to prevent its employees from hunting, disturbing, capturing or destroying stock, crops and such flora as may be protected by relevant statutes;
- Borrow pits or other similar excavations as well as waste accumulation and disposal sites shall be in locations approved by the Engineer. Disposal sites for waste shall be officially agreed in writing with the head of community in administrative area of which the approved disposal site is located;
- Controlling pollution, noise and nuisances generated by the works;
- The re-use of materials available on the existing site each time the technical and financial conditions allow for this in a satisfactory manner from the point of view of the Engineer. Recycling and reuse of wastes (e.g. lubricants, plastic bottles, paper) is encouraged where appropriate. Strictly banning the use of fire for clearing and grubbing and cleaning sites, except for the treatment of organic waste as approved by the Engineer;
- The maximum preservation of natural resources and the minimization of the use of space, soil and vegetation, in particular by minimizing cleared and stripped surfaces, by the passage of blades at a high level (5 cm above the natural ground level) each time that a simple clearing or a provisional storage of material is required, by controlling logging, including any tree alignments, by the appropriate management of the topsoil, by driving and working the machines perpendicular to the slope, by the maintenance on the sites of naturally grassed areas, and by the control of site erosion;
- As appropriate, the systematic stripping of topsoil of all work sites unless (with prior consent of the Engineer) the soil structure of the surface, predominantly organic matter ("topsoil" or mud), does not exist or has a thickness less than the working height adjustment of the blade of the excavator or machine used, taking into account the state of the terrain (eroded soil, gravel, soil with rocks that prevent the passage of the machine, etc.);
- The Contractor shall respect, for the whole of its site (including borrow sites and disposal areas, quarries and installations) the zones, areas, elements and periods which are environmentally sensitive, including, but not limited to locations and areas identified in the EMP. In the project areas adjacent to specially protected areas, machinery shall not go beyond the alienation zone; there shall be no waste accumulations and waste disposal sites in the same areas; and there shall be no use and storage of explosives and toxic and chemical substances;
- Any discharge or disposal of used water, mud, grout, bituminous products, pollutants of any kind, waste etc. into wells, boreholes, surface water or groundwater, water courses, natural streams, drains, ditches, etc. is strictly forbidden. Waste shall be transported and dumped at the

sites officially designated for disposal and agreed in writing with the head of community in administrative area of which such site is located.

- It is forbidden to create a dam or alter a permanent or temporary watercourse for the requirements of the site (unless otherwise specified in the Design), without authorization of the Engineer;
- All construction vehicles shall travel at low speed (as specified in Armenian legislation) within 100 m on either side of any areas around villages where children are present;
- The control of health risks relating to the works and personnel of the Contractor, in particular the adoption of minimum hygiene rules at the work sites and camps and for the benefit of residents in the affected communities, the control of dust emissions in populated areas and the control of stagnant waters as specified in the EMP;
- The Contractor shall exercise every reasonable precaution to protect persons or property from injury. The Contractor shall erect and maintain all necessary temporary fencing, barricades, barriers, signs and lights and provide fire alarm, fire extinguishing and fire fighting services at strategic points on the Site. The Contractor shall also be responsible for erecting and maintaining structures for storage and containment of hazardous materials or liquids. The Contractor shall adopt and enforce such rules and regulations as may be necessary, desirable or proper to safeguard the public, all persons engaged in the work and its supervision. The Contractor shall be responsible for the flagging and control of traffic and he shall comply with the requirements of the Engineer and competent authority in these matters. The Contractor shall keep clear and in good working order all temporary access road structures, bridges, culverts, drains and other waterways necessary for the execution of the works during the term of the Contract;
- The Contractor shall ensure, so far as is reasonably practicable, the health, safety and welfare at work of its personnel including those of its subcontractors and of all other persons on the Site or crossing the site. The Contractor shall provide protective clothing and equipment to workers that are appropriate to the workers' tasks. The Contractor shall be fully responsible for ensuring necessary first aid services to its staff and workers, including transport for injured personnel to hospital or other appropriate accommodation as and when required;
- The cleaning, restoration and then, if necessary, the appropriate rehabilitation or redevelopment of work sites, camps, quarries and borrow pits released by the Contractor as the work progresses. This obligation, which includes possible drainage of stagnant water and the completion of compensatory tree plantations (if envisaged by the Design), is a condition of the acceptance of the works;
- Taking appropriate sanctions against personnel violating the applicable specifications and provisions on environmental and social matters;
- Checking, by regular inspection, that all stipulated environmental and social provisions are being adhered to;
- Systematically and in a timely manner informing PIU (Engineer and Environmental and Social Impact Officer) of each incident or accident, damage or degradation caused to the environment, workers or residents or their assets, in the course of the works. Contractor shall also take appropriate measures, as approved by the Engineer, to address the incident or accident in timely fashion.

- The Contractor shall be responsible for the safety of its staff and all others who are on the Site when under the Contractor's control. The Contractor shall observe high standards of safety for people and machines at all times. The Contractor shall ensure, inter alia, that staff and labor on Site are issued with personal protection equipment appropriate to their tasks and to the climatic conditions.

## Annex F: Minutes of Public Consultation Meetings

Date: 21.07.2011

Community: Jrashen

Participants:

|              |  |
|--------------|--|
| S.Karapetyan | PIU Irrigation Officer                       |
| N.Atayan     | PIU Environmental and Social Impact Officer, |
| V.Movsisyan  | Institutional Improvements Officer           |
| V.Urusyan    | Head of Jrashen community                    |
| A.Eranosyan  | Director of “Getik” WUA                      |

Representatives of Jrashen community representative zones

### Agenda

To carry out public discussions of environmental and social impacts and other issues related to rehabilitation of tertiary irrigation networks of Jrashen community.

PIU Irrigation Officer S.Karapetyan presented in details the proposed project and the nature of anticipated activities.

V. Movsisyan clarified that proposed rehabilitation works will provide reduction of water losses and reliable water supply.

Leader of Jrashen community: V.Urusyan expressed his gratitude for proposed project, presented to attendants information on irrigated lands, mentioned importance of rehabilitation works for expansion of irrigable land in their community.

N.Atayan presented environmental and social aspects of the anticipated works.

Water users of Jrashen community Lernik Asatryan, Andranik Urusyan, Artyuom Hovhannisyan, Vladidmir Eghiazaryan, Vitaly Hartenyan and others also spoke about importance of rehabilitation of tertiary irrigation network in their community and expressed their willing to involve the local population in rehabilitation works in case of possibility.

PIU specialists clarified that one of the Project’s objectives is to involve in civil works as much local population as possible to increase local employment, and also raise the sense of responsibility of water users in maintaining in future the quality of implemented rehabilitation works.

The list of water users having participated in public consultations is attached.

Head of Jrashen community      [SIGNATURE]      V.Urusyan

Secretary      [SIGNATURE]      A.Hovhannisyan

[SEAL]



List of participants of the Public Consultations

NALBAND IRRIGATION SCHEME / “Getik” WUA

Date 21.07.2011

Community Jrashen

| No. | Participant's Name    | Participant's occupation | Signature |
|-----|-----------------------|--------------------------|-----------|
| 1.  | Hovhannesian Artem    | Water User               | Signature |
| 2.  | Safaryan Hmayak       | Water User               |           |
| 3.  | Safaryan Nina         | Water User               |           |
| 4.  | Hakobyan Anastas      | Water User               |           |
| 5.  | Meloyan Laura         | Water User               |           |
| 6.  | Hakobyan Harutun      | Water User               |           |
| 7.  | Manukyan Surik        | Water User               |           |
| 8.  | Karapetyan Samvel     | Water User               |           |
| 9.  | Asoyan Ashot          | Water User               |           |
| 10. | Asoyan Hovhannes      | Water User               |           |
| 11. | Asoyan Mkhitar        | Water User               |           |
| 12. | Alaverdyan Levon      | Water User               |           |
| 13. | Ayvazyan Volodya      | Water User               |           |
| 14. | Baghdasaryan Anahit   | Water User               |           |
| 15. | Baghdasaryan Andreas  | Water User               |           |
| 16. | Torosyan Gohar        | Water User               |           |
| 17. | Baghdasaryan Ashot    | Water User               |           |
| 18. | Tovmasyan Nazik       | Water User               |           |
| 19. | Baghdasaryan Aleksan  | Water User               |           |
| 20. | Baghdasaryan Burastan | Water User               |           |
| 21. | Badikyan Seryoja      | Water User               |           |
| 22. | Tatosyan Amalya       | Water User               |           |
| 23. | Badikyan Edik         | Water User               |           |
| 24. | Badikyan Robert       | Water User               |           |
| 25. | Vardanyan Nazani      | Water User               |           |

head of Jrashen community

(Signature)

/V.Urusyan/

Date: 20.07.2011

Community: Dzoragiugh

Participants:

|              |  |
|--------------|--|
| S.Karapetyan | PIU Irrigation Officer                       |
| N.Atayan     | PIU Environmental and Social Impact Officer, |
| V.Movsisyan  | Institutional Improvements Officer           |
| L.Grigoryan  | Head of Dzoragiugh community                 |
| T.Karapetyan | Executive Director of “Martouni” WUA         |

Representatives of Dzoragiugh community representative zones

### **Agenda**

To carry out public discussions of environmental and social impacts and other issues related to rehabilitation of tertiary irrigation networks of Dzoragiugh community being under command of Sevan Irrigation Scheme..

PIU Irrigation Officer S.Karapetyan presented in details the proposed project and the nature of anticipated activities.

N.Atayan presented environmental and social aspects of the anticipated works.

Leader of Dzoragiugh community L.Grigoryan expressed his gratitude for proposed project, presented to attendants information on irrigated lands, mentioned importance of rehabilitation works for expansion of irrigable land in their community.

V. Movsisyan clarified that proposed rehabilitation works will provide reduction of water losses and reliable water supply

Water users of Dzoragiugh community: N.Asatryan, N.Movsisyan, S.Minasyan also spoke about importance of rehabilitation of tertiary irrigation network in their community and expressed their willing to involve the local population in rehabilitation works in case of possibility.

PIU specialists clarified that one of the Project’s objectives is to involve in civil works as much local population as possible to increase local employment, and also raise the sense of responsibility of water users in maintaining in future the quality of implemented rehabilitation works.

The list of water users having participated in public consultations is attached.

Head of Dzoragiugh community                      [SIGNATURE]                      L.Grigoryan

Secretary    [SIGNATURE]                      N.Asatryan

[SEAL]

List of participants of the Public Consultations  
SEVAN IRRIGATION SCHEME / “Martounit” WUA

Date 20.07.2011 Community Dzoragiugh

| No. | Participant's Name   | Participant's occupation | Signature |
|-----|----------------------|--------------------------|-----------|
| 1.  | Grigoryan Lyova      | Water User               | Signature |
| 2.  | Umrshatyan Hovik     | Water User               |           |
| 3.  | Grigoryan Samvel     | Water User               |           |
| 4.  | Khakhakyan Eduard    | Water User               |           |
| 5.  | Movsisyan Never      | Water User               |           |
| 6.  | Aghekyan Hamlet      | Water User               |           |
| 7.  | Soghoyan Liparit     | Water User               |           |
| 8.  | Minasyan Surik       | Water User               |           |
| 9.  | Baghdasaryan Khachik | Water User               |           |
| 10. | Mheryan Mamikon      | Water User               |           |
| 11. | Abrahamyan Khachik   | Water User               |           |
| 12. | Khrshoyan Hayk       | Water User               |           |
| 13. | Melkonyan Oksen      | Water User               |           |
| 14. | Ayvazyan Melik       | Water User               |           |
| 15. | Hakobyan Sevak       | Water User               |           |
| 16. | Grigoryan Araik      | Water User               |           |
| 17. | Asoyan Jurik         | Water User               |           |
| 18. | Mkrtchyan Avetik     | Water User               |           |
| 19. | Galstyan Sergry      | Water User               |           |
| 20. | Harutunyan Jora      | Water User               |           |
| 21. | Kharoyan Hovsep      | Water User               |           |
| 22. | Aghekyan Haykaz      | Water User               |           |
| 23. | Asatryan Norik       | Water User               |           |
| 24. | Khachatryan Jora     | Water User               |           |
| 25. | Minasyan Vanik       | Water User               |           |

Head of Dzoragiugh community

/L.Grigoryan/

Date: 15.07.2011

Community: Meghrashen

Participants:

|              |  |
|--------------|--|
| S.Karapetyan | PIU Irrigation Officer                       |
| N.Atayan     | PIU Environmental and Social Impact Officer, |
| V.Movsisyan  | Institutional Improvements Officer           |
| L.Grigoryan  | Head of Dzoragiugh community                 |
| M.Ghazaryan  | Executive Director of “Shirak” WUA           |

Representatives of Meghrashen community representative zones

### **Agenda**

To carry out public discussions of environmental and social impacts and other issues related to rehabilitation of tertiary irrigation networks of Meghrashen community being under command of Shirak Irrigation Scheme..

PIU Irrigation Officer S.Karapetyan presented in details the proposed project and the nature of anticipated activities.

N.Atayan presented environmental and social aspects of the anticipated works.

Leader of Meghrashen community L.Grigoryan expressed his gratitude for proposed project, presented to attendants information on irrigated lands, mentioned importance of rehabilitation works for expansion of irrigable land in their community.

V. Movsisyan clarified that proposed rehabilitation works will provide reduction of water losses and reliable water supply.

Water users of Meghrashen community: Z.Galstyan, G.Avetisyan, K.Kirakosyan also speaked about importance of rehabilitation of tertiary irrigation network in their community and expressed their willing to involve the local population in rehabilitation works in case of possibility.

PIU specialists clarified that one of the Project’s objectives is to involve in civil works as much local population as possible to increase local employment, and also raise the sense of responsibility of water users in maintaining in future the quality of implemented rehabilitation works.

The list of water users having participated in public consultations is attached.

Head of Mrgashat community                      [SIGNATURE]                      H.Petrosyan

Secretary    [SIGNATURE]                      G.Avetisyan

[SEAL]

List of participants of the Public Consultations  
SEVAN IRRIGATION SCHEME / “Shirak” WUA

Date 15.07.2011

Community Meghrashen

| No. | Participant's Name   | Participant's occupation | Signature |
|-----|----------------------|--------------------------|-----------|
| 1.  | Asatryan Hakob       |                          | Signature |
| 2.  | Balasyan Azat        | Water User               |           |
| 3.  | Barseghyan Mher      | Water User               |           |
| 4.  | Grigoryan Andranik   | Water User               |           |
| 5.  | Zakaryan Aramais     | Water User               |           |
| 6.  | Tevanyan Hamlet      | Water User               |           |
| 7.  | Avetisyan galust     | Water User               |           |
| 8.  | Ishichyan Misha      | Water User               |           |
| 9.  | Khachatryan Vaghinak | Water User               |           |
| 10. | Kirakosyan Karapet   | Water User               |           |
| 11. | Ghazaryan Norik      | Water User               |           |
| 12. | Mardoyan Koriun      | Water User               |           |
| 13. | Margaryan Grisha     | Water User               |           |
| 14. | Margaryan Smbat      | Water User               |           |
| 15. | Marzecyan Garush     | Water User               |           |
| 16. | Minasyan Albert      | Water User               |           |
| 17. | Charchyan Rita       | Water User               |           |
| 18. | Petrosyan Aleksan    | Water User               |           |
| 19. | Rafaelyan Vasil      | Water User               |           |
| 20. | Sahakyan Anastasia   | Water User               |           |
| 21. | Abgaryan Arhestak    | Water User               |           |
| 22. | Balasyan Sargis      | Water User               |           |
| 23. | Barseghyan Ashot     | Water User               |           |
| 24. | Khachatryan Flora    | Water User               |           |
| 25. | Mikaelyan Hrach      | Water User               |           |

Meghrashen community leader

/H.Petrosyan/

Date: 19.07.2011

Community: Meghrashen

Participants:

|               |  |
|---------------|--|
| S.Karapetyan  | PIU Irrigation Officer                       |
| N.Atayan      | PIU Environmental and Social Impact Officer, |
| V.Movsisyan   | Institutional Improvements Officer           |
| L.Grigoryan   | Head of Dzoragiugh community                 |
| R.Ghukasyan   | Head of Verin Getashen community             |
| R.Khachatryan | Head of Astghadzor community                 |
| A.Movsisyan   | Head of Vaghashen community                  |
| B.Harutunyan  | Head of Martouni community                   |
| T.Karapetyan  | Executive Director of “Martuoni” WUA         |

### **Agenda**

To carry out public discussions of environmental and social impacts and other issues related to rehabilitation of tertiary irrigation networks of Martouni, Dzoragiugh, Verin Getashen, Astghadzor and Vaghashen communities being under command of Sevan Irrigation Scheme.

PIU Irrigation Officer S.Karapetyan presented in details the proposed project and the nature of anticipated activities.

N.Atayan presented environmental and social aspects of the anticipated works.

Director of “Martouni” WUA T.Karapetyan expressed his gratitude for proposed project, presented to attendants information on irrigated lands, mentioned importance of rehabilitation works for expansion of irrigable land in Martouni, Dzoragiugh, Verin Getashen, Astghadzor and Vaghashen communities.

V. Movsisyan clarified that proposed rehabilitation works will provide reduction of water losses and reliable water supply

Leaders of Martouni, Dzoragiugh, Verin Getashen, Astghadzor and Vaghashen communities also spoke about importance of rehabilitation of tertiary irrigation network in their community and expressed their willing to involve population of their communities in rehabilitation works in case of possibility.

PIU specialists clarified that one of the Project’s objectives is to involve in civil works as much local population as possible to increase local employment, and also raise the sense of responsibility of water users in maintaining in future the quality of implemented rehabilitation works.

The list of water users having participated in public consultations is attached.

Executive Director of “Martouni” WUA [SIGNATURE] T.Karapetyan

Secretary [SIGNATURE] L.Grigoryan

[SEAL]

List of participants of the Public Consultations

SEVAN IRRIGATION SCHEME / “Martuni” WUA

Date 19.07.2011

| No | Name of community | Community leader's name | Signature             | Comments                         |
|----|-------------------|-------------------------|-----------------------|----------------------------------|
| 1. | Martuni           | Bagrat Harutunyan       | (Signature)<br>[SEAL] | Head of Martunit community       |
| 2. | Verin Getashen    | Rubik Ghukasyan         |                       | Head of Verin Getashen community |
| 3. | Dzoragiugh        | Lyova Grigoryan         |                       | Head of Dzoragiugh community     |
| 4. | Astghadzor        | Robert Khachatryan      |                       | Head of Astghadzor community     |
| 5. | Vaghashen         | Artur Suvaryan          |                       | Head of Vaghashen community      |

Executive Director of “Martuni” WUA

/T.Karapetyan/