Document of
The World Bank

Report No: ICR00002815

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-77680 IBRD-81060)

ON A

LOAN

IN THE AMOUNT OF US$ 48.0 MILLION

TO THE

REPUBLIC OF ARMENIA

FOR AN

IRRIGATION REHABILITATION EMERGENCY PROJECT

December 17, 2013

Sustainable Development Department
South Caucasus Country Unit
Europe and Central Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective November 2013)

Currency Unit = Armenian Dram (AMD)
1.00 = US$0.0025
US$ 1.00 = 405.7 AMD

FISCAL YEAR
January 1 - December 31

ABBREVIATIONS AND ACRONYMS

AAA	Analytical and Advisory Activity
ADS	Armenia Development Strategy
AF	Additional Financing
AMD	Armenian Dram
CF	Conversion Factor
CFSQC	Consulting Firm for Supervision and Quality Control
CIS	Commonwealth of Independent States
CPS	Country Partnership Strategy
DSP	Dam Safety Project
ERR	Economic Rate of Return
FM	Financial Management
FMR	Financial Management Report
GDP	Gross Domestic Product
GIS	Geographic Information System
GoA	Government of Armenia
Ha	hectare
HVC	Higher Value Crop
I&D	Irrigation and Drainage
ICR	Implementation Completion Report
IDA	International Development Association
IDP	Irrigation Development Project
IDSP II	Irrigation Dam Safety Project II
IFRs	Interim Financial Reports
IREP	Irrigation Rehabilitation Emergency Project
IRP	Irrigation Rehabilitation Project
ISEP	Irrigation System Enhancement Project
ISR	Implementation Status and Results Report
IT	Information Technology
LA	Loan Agreement

Vice President:	Laura Tuck
Country Director:	Henry G. R. Kerali
Sector Manager:	Dina Umali-Deininger
Project Team Leader:	Arusyak Alaverdyan
ICR Team Leader:	Meeta Sehgal

Republic of Armenia
Irrigation Rehabilitation Emergency Project

CONTENTS

A. Basic Information			
Country:	Armenia	Project Name:	IRRIGATION REHABILITATION EMERGENCY PROJECT
Project ID:	P116681	L/C/TF Number(s):	IBRD-77680 IBRD-81060
ICR Date:	10/24/2013	ICR Type:	Core ICR
Lending Instrument:	ERL	Borrower:	REPUBLIC OF ARMENIA
Original Total Commitment:	USD 30.00M	Disbursed Amount:	USD 47.98M
Revised Amount:	USD 48.00M		
Environmental Category: B			
Implementing Agencies: State Committee for Water Management			
Cofinanciers and Other External Partners: None			

B. Key Dates				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	04/28/2009	Effectiveness:	10/06/2009	10/06/2009
Appraisal:	06/08/2009	Restructuring(s):		06/17/2011
Approval:	07/28/2009	Mid-term Review:		04/27/2010
		Closing:	06/30/2011	06/30/2013

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Satisfactory
Risk to Development Outcome:	Low or Negligible
Bank Performance:	Satisfactory
Borrower Performance:	Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry:	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance:	Satisfactory	**Overall Borrower Performance:**	Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	None
DO rating before Closing/Inactive status:	Moderately Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Irrigation and drainage	90	90
Public administration- Agriculture, fishing and forestry	10	10
Theme Code (as % of total Bank financing)		
Rural services and infrastructure	100	100

E. Bank Staff		
Positions	**At ICR**	**At Approval**
Vice President:	Laura Tuck	Shigeo Katsu
Country Director:	Henry G. R. Kerali	Asad Alam
Sector Manager:	Dina Umali-Deininger	Dina Umali-Deininger
Project Team Leader:	Arusyak Alaverdyan	Giuseppe Fantozzi
ICR Team Leader:	Meeta Sehgal	
ICR Primary Author:	Meeta Sehgal	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

The development objectives of the Irrigation Rehabilitation Emergency Project (IREP) were to: (i) improve water use efficiency in two selected irrigation schemes; and (ii) foster immediate rural employment. These objectives were to be achieved by rehabilitating primary irrigation canals to reduce water losses in two selected schemes, and providing some limited assistance for restructuring and strengthening institutions managing the irrigation infrastructure in the project areas.

Revised Project Development Objectives (as approved by original approving authority)

The revised project development objectives were to: (i) improve water use efficiency in selected irrigation schemes; and (ii) foster immediate rural employment. The Additional Financing aimed to scale up and expand the geographic scope of the project by

rehabilitating additional primary and secondary canals as well as selected stretches of tertiary canals.

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Reduction of water losses in the selected primary irrigation schemes			
Value quantitative or Qualitative)	22.5%	3%	7%	7%
Date achieved	07/28/2009	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	100% target achieved. At appraisal, the target was set to reduce water losses by 19.5 percent, so that after project rehabilitation works, seepages would be at 3 percent. During implementation, it was recognized that this target was impossible to achieve even under ideal scenarios. A more feasible target was subsequently set to reduce seepage losses by 15-16 percent so that by end-of-project seepage losses would be 7 percent.			
Indicator 2 :	Number of temporary jobs created (man/month)			
Value quantitative or Qualitative)	0	9,000	16,000	18,410
Date achieved	07/28/2008	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	Target exceeded. Target achieved is 115% of end-of-project target.			
Indicator 3 :	Number of permanent agricultural jobs created			
Value quantitative or Qualitative)	0	2,400	3,250	4,000
Date achieved	07/28/2008	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	Target exceeded. Target achieved is 123% of end-of-project target. These jobs were created in the command areas that were served by the irrigation schemes that received support under the project.			
Indicator 4 :	Value of wages generated (construction workers)			
Value quantitative or Qualitative)	0	US$ 4.58 million	US$ 8.2 million	US$ 8.6 million
Date achieved	07/28/2008	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	Target exceeded. Target achieved is about 105% of end-of-project target.			
Indicator 5 :	Area provided with irrigation and drainage services (ha) –Core Indicator			
Value quantitative or Qualitative)	49,744 ha	53,507 ha		56,295 ha

Date achieved	05/01/2011	11/01//2012		06/30/2013
Comments (incl. % achievement)	Over 100% target achieved. This indicator was added for corporate monitoring purposes. It is the sum of the value of indicators 6 and 7 described below.			
Indicator 6 :	Area provided with irrigation and drainage services - **New** (ha) –Core Indicator			
Value quantitative or Qualitative)	0 ha	4,586 ha		6,551 ha
Date achieved	05/01/2011	11/01/2012		06/30/2013
Comments (incl. % achievement)	142% of target achieved. This indicator was added for corporate monitoring purposes.			
Indicator 7 :	Area provided with irrigation and drainage services - **Improved** (ha) –Core Indicator			
Value quantitative or Qualitative)	49,744 ha	49,744 ha		49,744 ha
Date achieved	05/01/2011	06/30/2013		06/30/2013
Comments (incl. % achievement)	100% target achieved. This indicator was added for corporate monitoring purposes.			
Indicator 8 :	Direct Project Beneficiaries			
Value quantitative or Qualitative)	0	118,000		120,000
Date achieved	10/25/2011	10/25/2011		6/30/2013
Comments (incl. % achievement)	Target exceeded.			
Indicator 9 :	(Of which) Female Beneficiaries			
Value quantitative or Qualitative)	0	7.5%		7.5%
Date achieved	10/25/2011	10/25/2011		6/30/2013
Comments (incl. % achievement)	100% target achieved.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Potential increase of total irrigation area as a result of rehabilitation works on main/secondary canals			
Value (quantitative	28,275 ha	35,570 ha	83,210 ha	83,210 ha

or Qualitative)				
Date achieved	07/28/2009	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	100% target achieved			
Indicator 2 :	Restored irrigation area in communities with rehabilitated tertiary network.			
Value (quantitative or Qualitative)	0 ha	704 ha		704 ha
Date achieved	10/25/2011	10/25/2011		06/30/2013
Comments (incl. % achievement)	Target achieved			
Indicator 3 :	Business Plans of Water User Associations (WUA) developed			
Value (quantitative or Qualitative)	None	44	44	44
Date achieved	07/28/2009	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	100% target achieved. The activity was completed under the original project.			
Indicator 4 :	Subsidy policy study completed			
Value (quantitative or Qualitative)	None		Completed	Completed
Date achieved	07/28/2009	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	100% target achieved. The activity has been completed under the original project.			
Indicator 5 :	GIS WUA information system in place nation wide			
Value (quantitative or Qualitative)	18	44	44	44
Date achieved	07/28/2009	07/29/2009	10/25/2011	06/30/2013
Comments (incl. % achievement)	100% target achieved. The activity was completed under the original project.			

G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	12/02/2009	Satisfactory	Satisfactory	8.27
2	06/15/2010	Satisfactory	Satisfactory	22.90
3	02/16/2011	Satisfactory	Satisfactory	26.98
4	07/09/2011	Satisfactory	Satisfactory	29.42

5	05/08/2012	Satisfactory	Satisfactory	39.68
6	12/24/2012	Satisfactory	Satisfactory	47.05
7	06/25/2013	Moderately Satisfactory*	Satisfactory	47.88

* The rating for DO achievement in the last ISR was Moderately Satisfactory as the target for the indicator related to creation of permanent agricultural jobs was only partially met at the time. However, by the time of ICR preparation/finalization, the target was achieved and in fact exceeded the end-of-project target (see PDO indicator 3 above).

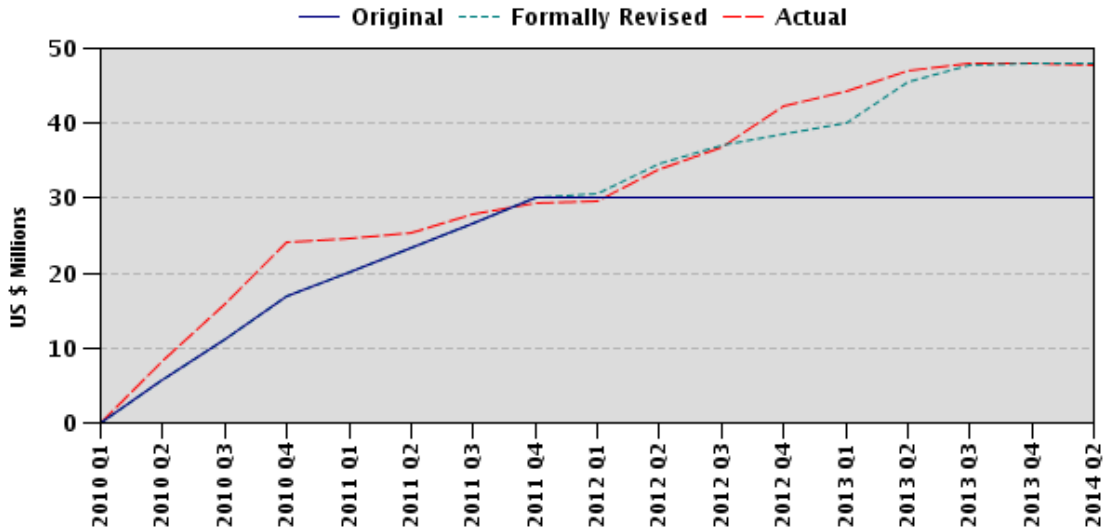
H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
06/17/2011	Y	S	S	29.42	Additional Financing was undertaken to scale up the reach and impact of project activities and help mitigate the ongoing effects of the economic and financial crises and the resulting unemployment. Key changes included: (i) revision of PDO; (ii) revision of outcome indicators; (iii) expansion of geographic coverage; and (iv) extension of closing date.

If PDO and/or Key Outcome Targets were formally revised (approved by the original approving body) enter ratings below:

	Outcome Ratings
Against Original PDO/Targets	Satisfactory
Against Formally Revised PDO/Targets	Satisfactory
Overall (weighted) rating	Satisfactory

I. Disbursement Profile



1. Project Context, Development Objectives and Design

1.1. Context at Appraisal

1. Country Context. Armenia is a land-locked country in the Southern Caucasus region with a population of about three million. Following the post-independence fiscal crises, hyperinflation, and the Nagorno-Karabakh conflict, the Government of Armenia (GOA) initiated a successful program of stabilization and structural reforms in the late 1990s. By the early 2000s, the country was on the path to rapid economic recovery, marked by macroeconomic stability and low inflation. The Gross Domestic Product (GDP) growth averaged above 10 percent per year and poverty fell from 55 percent to 26 percent between 2000 and 2008. Fiscal deficits and public debt remained quite modest in relation to GDP, and were among the lowest in the Commonwealth of Independent States (CIS).

2. Although Armenia entered the 2009 global economic and financial crisis from a relatively robust economic position, achievements in economic reforms and poverty reduction were gradually threatened as the crisis adversely impacted construction activity, trade, and foreign direct investment. GDP contracted in 2009 by 14.2 percent and overall economic growth for 2010 was a mere 2.4 percent. Unemployment rose sharply as numerous mines closed or slowed down production and infrastructure construction dropped by 56 percent in the first five months of 2009 alone.

3. Armenia's domestic economy was also significantly exposed to a sharp decline in remittances which was a key determinant of poverty reduction in Armenia. In 2007, total remittances exceeded US$ 1.5 billion or around 18 percent of GDP. Remittances accounted for over 55 percent of income for those who reported receiving them. However, with the global economic crisis, and loss of job opportunities abroad, the level of remittances declined drastically as migrants working abroad began returning home.

4. These developments put substantial pressure on the economy as a whole, and especially on the rural economy, and the government was hard pressed to provide an adequate social safety net as tax receipts declined. Vulnerable groups were disproportionately affected, with increasing numbers falling below the poverty line as the overall incidence of poverty grew between 2008 and 2010. Thus, Armenia, like many other countries, was severely impacted by the global economic crisis which began to undermine its development agenda and erode the considerable gains in poverty reduction of the past years.

5. Sector Context. Agriculture in Armenia was (and remains) an important economic sector representing about a fifth of GDP and employing some two-fifths of the country's active population. About 36 percent of Armenia's population lives in rural areas and dependent on agriculture for its livelihoods. Most agriculture in Armenia is irrigated agriculture, with more than 80 percent of the agricultural GDP produced on irrigated areas. Thus irrigated agriculture is essential for maintaining rural employment and economic growth in Armenia.

6. Agricultural lands covered about 1.4 million hectares (ha), of which about 35 percent were cultivated lands, and about 20 percent potentially irrigable. The irrigation infrastructure comprised, *inter alia*, about 3,000 km of main and secondary canals, about 18,000 km of tertiary canals, 81reservoirs, and 400 medium and large pumping stations. The demand for irrigation water begins in late April, reaches its peak in early July and drops off in October. Nearly 80

percent of the irrigated area is supplied through open canals and 20 percent is supplied through pipelines.

7. With major sections of the irrigation water delivery system highly deteriorated, in the mid-1990s, the Government launched a long-term national program to support the rehabilitation and restructuring of the Irrigation and Drainage (I&D) system. The first phase of this long-term program consisted of emergency interventions to secure continued operation. The government's efforts in this regard were supported by several IDA-financed operations including the Irrigation Rehabilitation Project (IRP), Dam Safety Project (DSP), and the Irrigation Dam Safety Project II (IDSP II).

8. The second phase focused on restructuring and development with the overall aim of building a solid basis for system sustainability. This objective was to be achieved through further rehabilitation of critical structures, reduction of energy usage in the system and empowerment of stakeholders in carrying out Operation and Maintenance (O&M) of the system. The second phase was initiated by the Bank-financed Irrigation Development Project (IDP). Some of the key results achieved included introduction of Participatory Irrigation Management (PIMs) principles through establishment of Water Users Associations (WUAs), substantial improvement in the cost-recovery rate of the overall O&M expenses, increase in the number of hectares irrigated, and reduction of the amount of energy and its costs, as well as reduction of water losses. Since 2006, the Millennium Challenge Corporation (MCC) also began supporting the irrigation sector in Armenia through a program of infrastructure rehabilitation and institutional strengthening. Both the Bank and MCC worked closely sharing design plans, studies, and analyses and coordinated their efforts in the I&D sector for synergistic benefits.

9. While Armenia had achieved substantial progress in improving the overall performance of its I&D system and in establishing a basis for sustainable management of the I&D infrastructure, at project appraisal, it was assessed that a substantial amount of work still remained to be done. Despite significant investments since the mid-1990s, major sections of the I&D system remained highly deteriorated. Also, while WUAs were making important gains with irrigation fee collection and cost recovery rates, they were not yet financially sustainable and continued to be dependent on government subsidies for effective operation and management. These challenges had significant implications for establishing and maintaining a productive irrigated agriculture sector in the country and for overall rural development. The government was therefore keen to continue working on its unfinished agenda in the I&D sector and again sought assistance for a Bank-financed project in 2009, not only to improve the I&D infrastructure but also to use it as an instrument for providing short-term employment to rural communities affected by the prevailing economic crisis.

10. Rationale for Bank Assistance. Recognizing the importance for immediate action to address the shocks of the ongoing economic and fiscal crises, the GoA acted swiftly to put in place measures to withstand the adverse impacts of the crisis. Given the limited domestic resources, it sought to leverage donor funding to support a modest fiscal stimulus, boost domestic investments (especially for job creation), and scale up targeted social safety net programs. It specifically requested assistance from the World Bank Group on three fronts: (i) a credit line for small-to-medium sized enterprises (SMEs), to support real sector activity; (ii) budgetary support; and (iii) urgent support for infrastructure that would generate employment. The aim was to facilitate an early spending stimulus to counteract the increases in unemployment arising from job losses in construction, metals and mining, and IT sectors.

11. In response, the Bank provided resources to the government to finance several operations, including the Irrigation Rehabilitation and Emergency Project (IREP), each targeted at small-scale infrastructure interventions aimed at stimulating immediate employment and stemming the rising tide of poverty. These efforts were appropriately designed and processed as emergency operations that provided a rapid response to put in place measures to mitigate or avert the potential effects of crises in countries at high risk (OP/BP 8.0). The importance of irrigation infrastructure in the agricultural sector, and in turn, for rural employment, justified the need for IREP which was designed to foster both temporary (in construction through rehabilitation activities) and permanent (in agriculture through restoration of irrigated lands) employment, while simultaneously tackling some of the country's most serious infrastructure needs. The Project was in a position to get activities off the ground immediately as it could utilize existing designs, produced under the MCC Program[1] for canal rehabilitation works that would provide immediate job opportunities to the large unskilled and unemployed labor force in some of the poorest regions of Armenia.

12. An additional and equally important rationale for Bank assistance through the project was that the crisis posed serious risks to the sustainability of advances made in the irrigation sector. Increased poverty would reduce the capacity of households to pay irrigation water fees, collection rates and revenues would come under pressure, while utility operational costs would rise. Between 2004 and 2008, irrigation fee collection rate had gone up by 55.7 per cent and cost recovery ratio had increased from about 2.7 percent to 42 percent. If rural households faced further constraints to payments, there was a risk that the upward trend in cost recovery, maintenance budgets and planned improvements would be put in jeopardy. Also, as evidenced in previous financial crises, water infrastructure spending bore a disproportionate share of the decline in overall public investments; Bank support would help to address this financing need and contribute to sustaining, and improving, the gains of previous years.

1.2. Original Project Development Objectives (PDO) and Key Indicators (*as approved*)

13. The development objectives of the Irrigation Rehabilitation Emergency Project were to: (i) improve water use efficiency in two selected irrigation schemes; and (ii) foster immediate rural employment. These were to be achieved by rehabilitating primary irrigation canals to reduce water losses in two selected schemes, and providing some limited assistance to the restructuring and strengthening of institutions managing the irrigation infrastructure in the Project areas.

Key Indicators:

- Reduction of water losses on the primary sections of Armavir and Talin schemes (cubic meters) -
- Number of temporary jobs created (man/months) and value of wages generated (based on average pay per day)
- Number of permanent agricultural jobs created

[1]MCC Program had down-scaled the scope of its program in the I&D sector and abandoned implementation of some activities although it had already undertaken studies and prepared designs/plans for primary canals, drainage structures, conversion schemes, etc. in the Ararat valley.

1.3. Revised PDO (as approved by original approving authority) and Key Indicators

14. The revised PDOs were to: (i) improve water use efficiency in the selected irrigation schemes; and (ii) foster immediate rural employment.

15. Although the PDO under the Additional Financing (AF) was modified and a new component (rehabilitation of tertiary canals) was added, the original indicators to measure project impacts were maintained under the AF. This was because the AF simply expanded the geographic scope of canal rehabilitation works. However, the targets to be achieved were revised as follows to reflect the broadened scope of works:

(i) the volume of water savings was increased from 97 to 131 million cubic meters (MCM) (35 percent increase);
(ii) temporary employment was increased from 9,000 to 16,000 person/days (77 percent increase);
(iii) potential permanent employment created was increased from 2,400 to 3,250 jobs (35 percent increase); and
(iv) value of wages paid was increased from US$4.5 million to US$8.2 million (81 percent increase).

1.4. Main Beneficiaries

16. Under the original project, water users in the marzes of Armavir and Aragatsotn were identified as the primary beneficiaries as the Armavir and Talin irrigation schemes were located in these marzes. As the geographic scope of the project was expanded under the Additional Financing, water users in Kotayk, Shirak, Lori, Ararat, and Gegarkunik marzes were brought within the fold of the project and benefited from project interventions. It is estimated that approximately 118,000 water users benefited under the project. However, this number does not include the workers who participated in the rehabilitation activities and worked on the construction sites from neighboring areas and other regions. The team has made a conservative estimate of an additional 2,000 jobs to safeguard against double counting of water user beneficiaries who also participated in the construction works during the winter season.

1.5. Original Components (as approved)

17. The original Project supported the following two components:

18. **Component 1: Rehabilitation of Primary Canals in Talin and Armavir Irrigation Schemes** (US$33.08 million). This component financed rehabilitation of 83.81 km of primary canals (main and branch canals) in the Talin and Armavir schemes: 59.01 km of the Talin Irrigation Scheme located in Aragatsotn and Armavir *Marzes*, as well as 24.80 km of the Armavir Irrigation Scheme located in Armarvir *Marz*. The component included: (i) civil works for the primary canal rehabilitation (US$31.51 million); and (ii) consultancy services for supervision of rehabilitation works (US$1.57 million). The total cost of this component accounted for about 91.0 percent of the total Project costs. The costs of rehabilitation of primary canals in both systems were mainly for concrete lining of the canal sections. Rehabilitation of all canal related structures were financed by MCC under a separate arrangement.

19. **Component 2: Project Management and Institutional Activities** (US$3.25 million). The Component financed two sub-components, namely: (i) Project management and audits (US$1.36 million); and (ii) Institutional strengthening (US$1.89 million). Under the first sub-

component, the project supported project management and monitoring and evaluation (M&E) activities. It also provided resources for financial audits of the Project as well as audits of the Araks-Akhuryan Water Supply Agency (WSA) and the Water User Associations (WUAs). The second sub-component financed selected institutional strengthening activities that were deemed to be particularly relevant for the progress of the ongoing reform based on Participatory Irrigation Management principles. These relevant activities were: (a) sustaining the WUAs' Support Group that would continue to train WUAs and complete drafting of irrigation maps (GIS system) for all WUAs in the country; (b) conducting an institutional strengthening study of the WUAs; (c) piloting a Water Users Federation.

1.6. Revised Components

20. The Additional Financing supported the following three components:

21. **Component 1**: **Rehabilitation of identified stretches of primary canals** (US$15.90 million) in the selected irrigation schemes. Six schemes were identified for support with approximately 50 km of main and secondary canal sections to be rehabilitated. While the original project focused on only two schemes, the AF targeted six schemes for support.

22. **Component 2**: **Rehabilitation of on-farm irrigation network** (US$4.02 million) would rehabilitate selected tertiary canals. Nineteen communities of Lori, Shirak, Gegharkunik and Armavir *marzes* would benefit from improved water conveyance over about 2,500 hectares. Beneficiary farmers would co-finance 15 percent of costs (contributions collected by MCC would be made available before tendering). This was a new component added under the AF.

23. **Component 3**: **Project Management and Institutional Activities** (US$1.68million). It financed three sub-components: (a) Project management, monitoring and evaluation, and WUA support; (b) Audits (PIU, WSAs and WUAs); and (c) Technical Assistance including studies for a gravity scheme construction in the Meghri region. Activity (c) was the new activity introduced under the AF.

1.7. Other significant changes

24. Additional Financing: On May 27, 2011, the Government of Armenia requested an Additional Financing (AF) to IREP. The rationale of this request was to: (i) enhance IREP development impact; (ii) respond to the growing demand from the rural poor for support to rehabilitate irrigation structures; (iii) continue to provide short-term employment opportunities to mitigate the effects of the ongoing economic and fiscal crisis; (iv) secure long-term jobs in the agricultural sector; and (v) capitalize on the already prepared canal rehabilitation designs under the MCC Program before these became obsolete. Although the AF was prepared on a fast-track basis (within about three months), it was not processed as an emergency operation. As under the original project, canals and canal sections selected for rehabilitation were based on the existence of ready or almost-ready designs developed under the soon-to-be-closed MCC program as well as their potential for employment generation and in particular poverty alleviation. The AF helped to scale up the overall project impact and development effectiveness with potentially increased reduction in water losses, a higher number of temporary jobs, increased potential for permanent job creation, an increase in the value of wages and a higher potential for restoring irrigated area in communities with rehabilitated tertiary networks. The AF extended the project closing date to June 30, 2013.

25. Extension of Closing Date of the Original Project. In order to finalize the institutional strengthening study (which had suffered a slight procurement delay) as well as conduct consultations on the findings of the study with key stakeholders, the closing date of the original project was extended by six months-from June 30, 2011 to December 30, 2011. This extension also allowed the Bank and Borrower to prepare and process the AF.

26. Water Users Federation. In consultation with the government, in December 2010, it was agreed to drop the sub-activity on piloting a Water Users Federation under the original project. WUA establishment was still in relative infancy, with associations still being consolidated. At the time of project implementation, water users were gradually becoming aware of the benefits of membership in an association and while there was an upward trend in WUA establishment and increased membership, it was premature to envisage the formation of a federation. Also, the high costs associated with WUF establishment (in particular the heavy machinery needed for O&M of main canals) and the relatively low income of farmers, it became evident that this activity should be postponed to a later stage when the overall WUA system was more firmly established and sustainable.

2. Key Factors Affecting Implementation and Outcomes

2.1. Project Preparation, Design and Quality at Entry

27. The original project was as an emergency operation prepared in response to the prevailing economic crisis. Both the original project as well as the AF were prepared on a fast-track basis, within about three months each. Despite such short duration of project preparation, the proposed interventions were well designed to respond to the prevailing economic and financial situation and quality at entry was sound which allowed the project to hit the ground running.

28. The team was guided by two principles: (i) identify canal rehabilitation works that could be implemented immediately and rapidly; and (ii) maximize the potential for labor employment creation. Thus the canals selected for project support were specifically those whose designs were already prepared under the MCC program and the works could be completed within the two construction seasons spanning the life of the project, without compromising quality or interfering with the irrigation season. Works were kept simple, comprising essentially of re-lining primary canals and replacing tertiary canal sections with pre-cast flumes and/or pipes. The team also ensured that the canals selected were located in some of the poorest regions of the country where unemployment was high. The six marzes selected for project support represented the top 50 percent of the poorest regions in Armenia. About 90 percent of project investments were invested in these six marzes, with the three poorest marzes receiving about 40 percent of total investments. This important design feature was critical to generate employment and in particular, contribute to poverty alleviation in the neediest regions of Armenia where in some instances large segments of the local communities were living substantially below the national poverty line. In Shirak marz, for example, it was estimated that some 47.2 percent of the people were living below the national poverty line.

29. Additionally, the choice to rehabilitate primary canals in the project areas was commensurate with the critical need to enhance the potential for irrigated agriculture. With more than 80 percent of the agricultural production coming from irrigated area (excluding livestock), it was important to provide sustained support to this sub-sector not only to maintain rural employment but also promote economic growth in Armenia. So far the state investment program had focused largely on headwork (dams) and on tertiary networks, and largely ignored the

primary canal systems. Project rehabilitation works, by reducing seepage in the primary and tertiary canals, would improve water availability to beneficiary farmers and increase the potential for irrigated agriculture.

30. While the institutional strengthening program envisaged under the project was relatively modest, the decision to include this component was important to ensure continued stakeholder involvement/empowerment in the irrigation and drainage (I&D) sector. One lesson identified in the Implementation Completion Report (ICR) of IDP was that strengthening Water Users Associations (WUAs) was a long-term undertaking. Although IREP was essentially an emergency project designed primarily to spur immediate employment in the short-term, it was critical to continue to provide support for the institutional reform process initiated and supported under the Irrigation Development Project (IDP) and not to lose the momentum of ongoing reforms. The project appropriately designed this component as a small technical assistance activity to, *inter alia*, support select studies/analyses to improve WUAs' technical, organizational and financial ability to carry out effective O&M of irrigation infrastructure, including options for state assistance and cost recovery. However, project design was ambitious in its efforts of piloting a WUA Federation. As mentioned earlier, this sub-component had to be dropped in keeping with relatively nascent history of WUA development.

31. One shortcoming of project design was the relatively unrealistic target set to measure achievement of one of the main PDO indicators, i.e. reduction in water losses through project-financed rehabilitation works. At appraisal, the target was set to reduce water losses by 19.5 percent, so that after project rehabilitation works, seepages would be at 3 percent down from 22.5 percent. During implementation, it was recognized that this target was impossible to achieve even under ideal scenarios. A more feasible and attainable target was subsequently set to reduce seepage losses by 15-16 percent.

32. It must be acknowledged that given the rapid pace of project preparation due to the emergency nature of the project, the team was operating within an extremely tight timeline which prevented in-depth preparatory work and due diligence on some aspects of project design. This was especially borne out by the technical issues of concern identified during a review of the canal rehabilitation works undertaken in early 2013. The project had used designs prepared by MCC and although these had been reviewed by the technical specialists in the PIU during project preparation, the work was done rapidly. The team discovered, for example during the final stages of project implementation, that there were inadequate energy dissipating structures (such as stilling basins) in canals in the Talin scheme on steep slopes which could lead to high flow velocity, causing difficulties not only with flow regulation, but also result in spill-overs. Also, there were limited numbers of cross regulators along main canals in the scheme which limited the capacity for water control. The MCC designs chosen for project support did not include control structures as these were supposed to have been built by the MCC. However, the MCC program closed before undertaking such works.

33. The project team has requested the Borrower to address these issues. The PIU has indicated that the energy dissipating structures are not required as the flow velocity in the rehabilitated canals is within Armenian standards and any overtopping has been not due to a design flaw but the volume of water transfer exceeding design capacity. The potential for overtopping is along 150 meters of a 37 km long secondary canal and the Borrower has agreed that the canal walls would be raised once the specific sites are identified. The cost of this is not expected to be more than US$7,000 and will be financed from the state budget. The Borrower has also agreed to carry out field observations at various water depths to collect reliable data to

determine the appropriate locations for control structures on main canals which will subsequently be installed with financing also from the state budget. The Bank will follow up on this during implementation of the new Bank-financed project in the irrigation sector, ISEP, to ensure that these actions are indeed undertaken given the environmental risk of non-action. Additionally, there is a reputational risk for the Bank should these actions not be undertaken in a timely manner.

34. The project's Quality at Entry was satisfactory. All implementation arrangements were in place by project effectiveness. The project was able to capitalize on the IDP that had just closed a few months before (March 2009) as well as the ongoing Dam Safety Project. These Bank-financed projects had helped put an experienced PIU in place that was familiar with Bank safeguard, fiduciary and M&E procedures and requirements. The PIU had the necessary systems/controls already in place which allowed the project to get off the ground rapidly. All contracts for rehabilitation works were tendered before project effectiveness and signed within two weeks of project effectiveness. The Supervision and Quality Control foreign consultant (company) was also selected by project effectiveness and hired after such effectiveness. This allowed the project to launch execution of the civil works soon after the irrigation season was over which was critical to ensuring that employment was generated as soon as possible. The fact that the original project disbursed about 14.3 percent of the total loan amount under the original project (US$30 million) within one month of project effectiveness is testimony to the overall sound preparatory work undertaken by the Borrower and the Bank teams.

2.2. Implementation

35. Overall, project implementation was smooth and the project was never at risk of not achieving its objectives. As project interventions related to civil works could only be carried out during the irrigation off-season, i.e. November to May, procurement activities were completed in advance of project effectiveness, both under the original project and the AF. This allowed civil works contracts to be signed immediately upon effectiveness and project implementation to commence right away. Most of the rehabilitation works moved at a fast pace with several contracts completed earlier than anticipated. By mid-term of the original project (6 months after effectiveness), all planned sections of the Armavir main canal (24.8 km) had been rehabilitated and nearly 45 percent of the Talin main canal (25 km out of 59 km) had been completed. 60 percent of loan proceeds had already been disbursed by mid-term review (MTR). Primary canal works under the AF were also completed considerably ahead of schedule. There were no significant delays with reporting, disbursements were made in a timely manner and all loan proceeds were disbursed by project closing.

36. Regular review/monitoring of activity implementation allowed the implementation team to make adjustments as necessary in a timely manner which strengthened the likelihood of the project achieving its PDO. For example, during field visits soon after project effectiveness, the team discovered the need for rehabilitation works in additional stretches of the canals which were not originally marked for rehabilitation by the 2006 MCC-financed preliminary design report. Visual inspection for verification of the rehabilitation works had not been possible as both primary canals were running full for irrigation purposes. However, the necessary additional work became evident once the canals were empty and could be visually inspected (the canals had deteriorated further between 2006 and 2009). Also, many large sinkholes were discovered and along the canals that needed to be filled in. Appropriate quantity variations were made in the civil works contracts (about 11 percent over the tendered quantity of the project) which was easily possible due to the built-in provision of 5 percent contingencies in each of the contracts as well as the potential savings of approximately US$5 million (discussed below).

37. Similarly, the team revised the design of the concrete lining joints although the unit cost of the new water seal joints was about two and a half times higher than that tendered during project preparation. Most of the water quantity losses in the past were due to leaky joints that washed out the fine soil particles from behind the lining and the foundation underneath resulting in large holes and voids that in turn resulted in substantial water leakage spots and in several cases a total failure of the canal section. With a critical objective of the project being the prevention of high seepage losses, this variation in design was appropriate. The contract unit costs on average were smaller than the estimates by about 16 percent. This was mainly a consequence of the economic crisis in the construction sector that introduced higher competition for the limited number of potential contracts. These savings were sufficient for all the civil works variation orders; after signing all variation orders, there were still savings in the range of almost US$4 million. This allowed the project to finance additional civil works, including a 7.0 km long earth section of the Armavir canal and small additional sections in the Talin canal.

38. Some project interventions were scaled back during implementation. Under the AF, the length of tertiary canals to be rehabilitated was reduced to 50 km from 63 km that was planned at appraisal. A technical review during implementation demonstrated that rehabilitation works on the additional 13 km were not necessary as the lining was in adequate shape. The institutional strengthening component was also reduced in scope under the original project to avoid duplication with ongoing MCC-supported activities. The activity of GIS mapping for WUAs and the Water Supply Agencies (WSAs) as well as most of the topics under the institutional strengthening study were transferred to the MCC for implementation. The project financed only select elements of the WUAs strengthening study, including: (i) development of business plans for each of the 44 operating WUAs; (ii) formulation of alternative mechanisms of state subsidy allocation to WUAs; and (iii) based on analysis of WUAs and their performance, recommendations on how to proceed with Federations of WUAs (which was subsequently dropped). Although overall project progress was good and in some cases activities were completed before their end dates, the institutional strengthening study however suffered a slight procurement delay which resulted in an extension of the project closing date by six months – from June 30, 2011 to December 30, 2011 to allow consultations and finalization of the study. The team was however able to use this extension of closing date for preparation of the AF.

39. During the mid-term mission, the Government requested IREP financing, in addition to the Akhuryan-Araks Water Supply Agency (WSA), audits of the other two WSAs in the country, viz. Sevan Hrazdan and Debed-Aghstev although they were not beneficiaries of the project. Savings under the audit sub-component allowed the inclusion of audits for the two WSAs. This could be undertaken without amending the Loan Agreement (LA) as the LA simply referred to these agencies as “irrigation institutions” without specifically singling them by name for project support.

40. As mentioned earlier, an additional financing to IREP was approved by the Board in October 2011 and became effective in December 2011. The AF was designed to support similar activities as under the original project and scaled up the impact and reach of the project. The AF extended the project closing date to June 30, 2013.

2.3. Monitoring and Evaluation (M&E) Design, Implementation and Utilization

41. The M&E framework under the project was simple and practical. It was designed to measure the impact of the combined PDO and to that end, it measured two indicators related to the rehabilitation works, including percentage of reduced water losses and changes in irrigated

areas and one indicator to capture project impact on incremental temporary construction employment and value of wages generated. Employment was measured simply by obtaining monthly lists of personnel engaged in the civil works from contractors. Permanent agricultural employment was derived from the GIS database of WUAs.

42. The PIU was responsible for project monitoring and updating project monitoring indicators on a regular basis. The Supervision and Quality Control firm closely monitored rehabilitation works at the construction sites, with technical supervisors permanently on site. The PIU was also staffed with a construction supervisor engineer who undertook regular field visits to ensure compliance with design and quality of work. A technical auditing of finished sections of the canals was also performed by the consultants (jointly with the Armenian Design Institute for Water Works) to review the seepage conditions in the rehabilitated sections. The Supervision and Quality Control firm provided the PIU with monthly progress reports, which included lists of the number of personnel engaged in the construction works. This helped to track the number of temporary jobs created under the project.

2.4. Safeguard and Fiduciary Compliance

43. The safeguards triggered under the project included: Environmental Assessment (OP 4.01); Involuntary Resettlement (OP 4.12), Pest Management (OP 4.09) and Projects on International Waterways (OP 7.50).

44. The project was classified as an Environmental Category B (Partial Assessment). This was appropriate given that no new construction was to be financed, no hydraulic structures were to be repaired and any impacts on the environment and human health due to implementation of agreed project interventions would be minor.

45. No major safeguard issues arose during project implementation. Compliance with provisions of the safeguards was satisfactory throughout the life of the project. A review of the civil works undertaken demonstrated that construction works were completed without any negative impacts on the environment. Project sites were predominantly located in areas with little natural vegetation and the works did not pose notable risks to the flora and fauna or cause other disruptions of the local ecosystem. No construction waste was left at the project sites and the clean-up after completion of works was satisfactory. Although some rehabilitated parts of canals passed through villages, in the immediate proximity to private land plots and residential houses, no temporary or permanent restriction of the property use occurred as contractors had sufficient access to canals from the service roads that ran along one side of the canals. Also, no fruit trees or other objects had to be removed during construction as had been anticipated at appraisal. While OP4.09 was triggered, no necessity arose for preparation of a Pest Management Plan. However, a public awareness campaign on good pest and pesticide management was undertaken. Although project interventions were undertaken in trans-boundary river basin and OP7.50 (Projects on International Waters) was triggered, notification of project activities to riparian countries was not made as an exemption for this had been granted by the Regional Vice President.

46. It must be noted, however, that reporting on the environmental supervision of works remained relatively weak throughout the project life. The Supervision consultant provided monthly reports from individual work sites and while some of these provided a realistic overview of compliance with the environmental requirements, some reports consistently indicated perfect compliance which makes their accuracy questionable. Some of the general monthly progress reports from the supervision consultant were not supported by relevant documentation on

environmental monitoring of works and all reports lacked an analytical narrative on the status of safeguards compliance. Additionally, the PIU's filing system for record keeping on environmental supervision of works was inadequate. The Supervisor's reports, while available at the PIU, were not stored in a user-friendly, systemic manner. These shortcomings may have been avoided had the PIU retained a safeguards specialist (even on a part-time basis) over the course of project implementation. To offset this deficiency, the Bank's safeguard specialist undertook frequent and rigorous site visits and diligently assessed and ensured compliance with environmental requirements.

47. Financial Management. The Bank financial management (FM) team regularly conducted FM implementation support and supervision of the project. The FM arrangements in place for the project implementation, including planning and budgeting, accounting, financial reporting, flow of funds, external audits and staffing were satisfactory. Overall, the PIU's internal control system was found to be acceptable to the Bank and was assessed to be capable of providing timely information and reporting on the project as well as safeguarding of the project assets. The FM staff was experienced in implementation of the WB-financed projects. The PIU prepared and submitted quarterly Interim Unaudited Financial Reports (IFRs) for the project that were always received on time and were acceptable to the Bank. The auditors issued unmodified (clean) opinions on the project financial statements which were received on-time. No major issues were raised by the auditors in the management letters for the project audit. Counterpart financing was overall satisfactory during the life of the project.

48. The audit reports on the financial statements of the beneficiary entities (WSAs and the 44 WUAs were usually received on-time. Meanwhile the auditors mostly issued modified opinions on those entities' financial statements due to accountability and internal control issues observed. In these instances, the entities were obligated to prepare time-bound action plans to implement the recommendations of the auditors. The PIU regularly followed up with the entities on the implementation of auditors' recommendations to ensure that these were adequately addressed.

49. Procurement. At appraisal, procurement risk was rated high but with the agreed mitigation measures, it was rated moderate. Overall procurement under the project was satisfactory. Given the large number of contracts under the project, the PIU was staffed with two procurement specialists. Both specialists had served in the PIU for over 10 years and therefore had extensive experience with different types of procurement and were deeply familiar with Bank procurement guidelines. The specialists carried out their responsibilities effectively with technical support from the Plan and Design Department in the PIU. Procurement activities were also well coordinated with accounting departments within the PIU to enable fast-track procurement.

2.5. Post-completion Operation/Next Phase

50. Although significant results were achieved in the I&D sector through implementation of national and donor-supported efforts since the mid-1990s, much remains to be done to exploit the full potential of irrigated agriculture in Armenia. To consolidate the achievements of IREP and past operations, as well as continue the government's agenda of upgrading the irrigation infrastructure and building the institutional capacity among water users, the Bank, at the request of the government, has prepared the Irrigation System Enhancement Project (ISEP), a US$30 million loan designed to: (i) reduce the amount of energy used and to improve the irrigation conveyance efficiency in targeted irrigation schemes; and (ii) improve the availability and reliability of important sector data and information for decision makers and other stakeholders. These objectives are envisaged to be achieved through: (i) conversion of pump-based irrigation to

gravity irrigation; (ii) the rehabilitation of selected outlet canals receiving high-cost water from pumping stations that cannot be converted and that have already been rehabilitated under the MCC program; and (iii) the provision of updated and reliable data that are critical for irrigation water management, such as the amount of financial resources needed for O&M and extraordinary maintenance, performance indicators to measure the operational effectiveness of water institutions, and the amount of water entering the irrigation system and being delivered to the WSAs and WUAs in real time.

51. The project became effective on July 13, 2013, and implementation is now underway. As indicated in the Project Appraisal Document (PAD), it is expected that ISEP will reduce the energy consumption in the irrigation system by about 30 percent, thus enhancing Armenia's self-sufficiency in the energy sector. It will address the need for transparency and accountability in the sector that will help improve the performance and governance of the institutions responsible for the management of irrigation. It will contribute to the implementation of the broader water resources management agenda and to climate change mitigation (through the reduction in energy consumption) and adaptation (through support for increased irrigation conveyance efficiency) in Armenia. Thus the ISEP, like the IREP, will serve as one in a series of ongoing efforts, contributing to the country's ultimate goal of ensuring efficient, cost-effective and sustainable irrigation.

3. Assessment of Outcomes

3.1. Relevance of Objectives, Design and Implementation

52. The project's objectives, design and implementation continue to be highly relevant to Armenia's current development and strategic priorities. The Armenia Development Strategy (ADS) 2013-2025 clearly articulates the need for policies that, *inter alia*, accelerate sustainable economic growth and reduce poverty, including eliminating extreme poverty. The ADS is the country's main socio-economic development strategy that articulates Armenia's long-term development vision and forms the basis for medium-term sectoral and other program documents. During the first five years of ADS, employment growth has been identified as a key priority which is seen as an outcome of the implementation of policies and interventions in vital sectors of the economy, including agriculture. The country's development program specifically articulates that "irrigation systems will continue to remain a priority for public investments". For the entire period of the program, annual capital investments in the irrigation system are expected to amount to 0.3 percent of the GDP. The target of the investment policy is the expansion of irrigated land areas (within the existing irrigation systems) and higher efficiency of the system. On the institutional side, management reforms of the irrigation system are expected to continue and are aimed to further strengthen the already-formed participatory management schemes (WUAs). The Government also intends to continue its program of financial support to WUAs in the form of current grants in accordance with the relevant regulations for provision of public financial support[2]. The tariff policy aims to gradually increase the current cost recovery level of the tariffs from current 47 percent recovery rate to 120 percent recovery rate by 2025.

[2] Order of the government of Armenia No. 398-N dated 10 March 2011 "Regulating the process of provision of state financial support in the form of current grants to water user associations in 2012-2016".

53. Continued project relevance is also demonstrated by the Country Partnership Strategy (CPS) for FY2014-FY2017, which was presented to the Bank's Board on November 7, 2013. The strategy is designed to support the government of Armenia with "boosting shared prosperity and reducing poverty through accelerated economic growth and job creation". Towards this, the strategy has identified several strategic areas of intervention, including sustainably improving the rural economy in a holistic manner. In this context, the CPS acknowledges the importance of implementing rural infrastructure projects, including in the irrigation sub-sector. The CPS specifically states that ongoing irrigation projects will be instrumental in restoring irrigation systems, enhancing their sustainability, and strengthening the participatory management of the networks through Water Users Association, including greater representation of women.

3.2. Achievement of Project Development Objectives

54. The impetus of the project was to provide immediate rural employment to assist communities counter the effects of the prevailing economic and fiscal crisis that was plunging an increasing number of people into poverty while simultaneously promoting agricultural productivity by improving water use efficiency. The project achieved these objectives, with several performance indicators exceeding the end-of-project targets.

55. As mentioned earlier, households in the project areas, which comprised some of the poorest regions of Armenia, were hit especially hard during the crisis as remittances declined drastically and jobs were lost as construction and mining activities slowed down. An increasing number of migrants were returning home, and few if any, were leaving for employment opportunities abroad. Those dependent on agriculture for their livelihoods were losing the means to continue farming and invest in agriculture as prices of agricultural inputs rose. The acreage of land cultivated decreased due to reduced cash flows and depressed markets. In some villages more than three-fourths of the livestock herd was slaughtered to generate income from the sale of meat to purchase food and pay utility bills. With poverty projected to increase by about 5.2 percentage points between 2008 and 2010 and GDP growth projected at a mere 1.2 percent in 2010, economic prospects, especially for the rural poor, appeared largely bleak.

56. Against this background, the project served as an urgent and timely intervention in providing rural communities with jobs and wages and stemming their downward spiral into poverty. It enabled the rural labor force to be gainfully employed at a time when there were few opportunities for earning a livelihood. It provided under-employed and seasonally inactive farmers access to alternative sources of income as most of the employment created was during winter months. It thus functioned as an important and productive safety net, allowing families to afford the basic necessities of food and shelter. While households of workers that received wages through employment under the project benefited directly, the infusion of resources (approximately US$8.6 million) within communities had a significant local multiplier effect. By increasing project beneficiaries' purchasing power, it stimulated the overall demand for, and growth of, local goods and services and thereby had a positive impact on the local economy as a whole.

57. Rehabilitation works that were implemented under the project have arrested further deterioration of the targeted infrastructure. Canal rehabilitation has reduced water seepage losses from about 23 percent to about 6-7 percent which not only resulted in restoring/improving irrigation water supply to nearly 50,000 ha of land but also brought about 6,551 ha of new land under irrigation. About 118,000 water users now have access to reliable and secure irrigation water. The improvements in conveyance efficiency have substantially reduced the time taken to provide irrigation water to farmers. During a field visit to the Armavir irrigation scheme, farmers

indicated that on a particular 26 km canal stretch, before project rehabilitation works, it took 40 hours for the water to travel from the canal head to the tail end; after canal re-lining, this time was reduced to 12 hours.

58. The improvement in irrigation service, in terms of quantity, reliability and timely delivery, is gradually leading to improvements in overall agricultural production/productivity in the project areas. Farmers are benefiting not only from increases in crop yields, but are also now more confident about investing in their farms and expanding their operations. The project was instrumental in creating permanent agricultural jobs and in fact, permanent agricultural jobs generated under the project exceeded the target set at appraisal - 4,000 by project-end vis-à-vis 3,250 estimated at appraisal. This is remarkable given that the rehabilitation activities were implemented in some of the poorest regions of the country where farmers had limited resources for capital investments. Also, these estimates are conservative as they do not factor in the non-farm jobs potentially created upstream and downstream due to increased production.

59. Farmers are moving to cultivating higher value crops and there is a rising trend especially towards planting orchards. During field visits, several farmers indicated that they are now planting vineyards as there is a greater reliability of irrigation water. As costs associated with vineyards are high, the government is assisting these farmers with subsidized inputs. A larger number of project farmers are also now looking to establish greenhouses to grow horticultural products. Green house tomatoes, although still in limited quantities, are being sold during winter months when open-soil tomatoes are not available. This provides farmers with improved incomes as greenhouse products fetch higher prices than those grown traditionally. For example, the sale price of tomatoes grown in greenhouses is 1,500 AMD/kilo while those grown in the open field sell for 35 AMD/kilo.

60. Farmers are also benefiting economically due to the reduced overall cost of irrigation as a result of project interventions. With improved volume of water flow, there is now a less dependence on pumped irrigation and a greater reliance on gravity to supply irrigation water, especially to the tail-end farmers. This has significant implications for reduced energy consumption and cost savings to farmers. The Khoy WUA in the lower Hrazdan irrigation scheme in Armavir marz, for example reported that electricity use has gone down by 3 million kilowatts annually mainly due to IREP-supported canal rehabilitation works. The WUAs are thus seeing lower overall O&M costs and are in a position to reduce the amount of subsidies requested from the government to meet O&M expenditures.

61. The project also largely achieved its objectives on the institutional side. The WUA Support group was successfully institutionalized within the State Committee of Water Management (SCWM) which mainstreamed WUA-support efforts within the overall mandate of the SCWM. This underscored the government's commitment to continue to provide technical, organizational and financial assistance to WUAs until such time that they matured and became self-sustaining. The WUA subsidy policy study was completed and provided the government with options for future state assistance to the WUAs. The study involved an assessment of each WUA's needs in carrying out its O&M. Its overall recommendations also drew from the experiences and lessons learned in other countries and their applicability to the Armenian situation and needs. Thus while the project did not enact policy changes, it undertook critical preparatory work for such policy discussions and decision-making in the future.

62. The project supported the WUAs with the development of 3-year business plans based on the detailed needs assessment undertaken during the subsidy policy study. Additionally, training

was provided to a broad spectrum of WUA members, including the WUA executive body, members of the Administrative Council, Dispute Settlement Committee, Supervising Committee and farmer representatives. Training modules included inter alia, participatory training methods, WUA governance and management, dispute resolution, planning and budgeting for O&M, and accounting. It is expected that such training will strengthen WUA capacity to function effectively which will also help attract a larger membership, improved fee collection rates, as well as build trust and confidence among water users for WUAs.

63. Thus the project achieved its overall objectives and successfully responded to the critical needs of the time. It served as an effective emergency operation by getting off the ground swiftly and yielding positive results rapidly. It provided communities with immediate employment, urgently-needed incomes and a source of livelihood in the short-term to help ride out the economic crisis. Project rehabilitation works contributed to slowing down the incidence and depth of poverty in the poorest regions of the country. It also contributed to improving irrigated agriculture, one of the main drivers of economic growth and rural employment in Armenia.

3.3. Efficiency

64. Rehabilitation of irrigation infrastructure was expected to have the following benefits: (i) reduced water losses; (ii) areas returning to irrigation as more water reaches more farm land; and (iii) increased productivity as a result of improved availability of water (in quantity and opportunity). Reduced water losses would also reduce cost of irrigation as less water needs to be pumped, and also an increase in the availability of water in the tail end of the irrigation systems, introducing more equity among farmers. For this assessment, the financial effect on farmers' income and the economic impact on the overall economy were estimated based on the following benefits: (i) the incremental value of production from the lands where irrigation water was restored; (ii) the increased yields on those irrigated areas where water provision was improved (mainly on the tail-end sections) and (iii) the increased production value due to changes in cropping patterns on the irrigated lands, as water became more reliable and failure crop risks are reduced.

65. Fourteen crop models and two farm models were constructed to estimate the financial impact of the project at the beneficiaries' livelihood level. Models used conservative assumptions regarding yield increases and costs involved. With the project, benefited farmers' annual net income was estimated to be growing from an average of AMD 542,000 to AMD 1.2 million in the Armavir area (US$ 1,320 to US$ 2,970); and from AMD 1.45 million to AMD 2.5 million Net income increases result from the expansion of the farms activities due to more reliable water being made available in a timely manner, allowing for more frequent watering of crops, improved productivity and also farmers disposition to invest in higher value crops (HVCs) as risk of water shortage is reduced. The area under irrigation in the Talin and Armavir canal command area has increased from 32,761 ha to 33,535 ha between 2008 and 2012. Wheat and alfalfa have reduced their area from 41 to 30 percent, while the HVCs increased their share from 59 to 70 percent. This evolution confirms a tendency already observed in the previous IDP areas.

66. Project economic results were estimated from the aggregate cropping patterns evolution and the crop's financial budgets, using few adjustments to the existing market prices. Most values express adequately their shadow (or economic) values given that Armenia presents a fairly open economy. Adjustments were introduced only for rural labor and irrigation water costs. Unskilled labor was adjusted with a 0.7 conversion factor (CF) given the relatively high level of under-employment in rural areas in Armenia. Additionally, as the market (or financial) cost of water (AMD 11 per cubic meter) constitutes a value fixed administratively by the GOA its economic

price was adjusted with a CF of 1.7 resulting in an economic price of AMD 18.7 per cubic meter. The difference between the financial and economic prices is covered by subsidies directly delivered by the GoA to the WUAs.

67. The overall Economic Rate of Return (ERR) of the IREP was estimated at 21.2%. Using a discount rate of 12 percent, the project economic NPV is AMD 34.2 billion (US$82.4 million). The analysis also showed that the results are different for each of the three project areas, and in all areas the economic NPV is positive: (i) in the Armavir area the ERR is 22 percent; (ii) in the Talin area the ERR is 12.9 percent; and (iii) in the other areas where tertiary canals were rehabilitated the ERR is 65.4 percent. The reason making these different results is the amount invested per benefitted area: in Talin the cost was almost three times the amount invested per ha in Armavir, while in the other areas the investment cost per ha was only about one fourth of the cost in Armavir. Results from the Talin irrigation investments might seem to be marginal, but if other non-quantified benefits were to be added to the assessment, the ERR would be improve significantly. Electricity consumption for pumping irrigation water in Armenian systems was reduced from 235,700 KWH on average per year for 2004 – 2006, to 125,100 KWH per year for 2010 – 2012 due to the infrastructure improvements introduced by the IDP and the IREP reducing the electricity used per cubic meter of water delivered to farmers from 0.39 KWH to 0.29 KWH. The cost reductions not only improve profitability of irrigation in the systems but also, create more competitive conditions for further investments and expansion of the irrigation.

68. Sustainability of project benefits is expected to be high, given that the increase in availability and water use efficiencies, together with the consolidation and continuous improvement of the adopted PIM, enhances the competitiveness of the irrigated agriculture in Armenia. The dynamic and professional attitude shown by WUAs improving the O&M of the systems is having a significant effect on the quality of the water service delivery and on farmers' incomes. The persistent tendency of the rehabilitated systems towards changing cropping patterns towards HVCs is the best evidence that the IREP improvements are to be sustainable.

69. Sensitivity analysis of the expected results shows that the project impact is solid even if adverse factors affect the irrigated agricultural production business in Armenia. If farm gate prices of all main agricultural products considered in the assessment would drop by 20 percent, the ERR would then still be 16.2 percent. If production costs for all crops considered would increase by 20 percent, the ERR would become 18.4 percent. Finally, if both adverse events would occur jointly (farm gate prices dropping by 20 percent and costs of production increasing by 20 percent), then the resulting ERR of the project would then drop to 12.9 percent. These results show that the IREP would have a positive result even in the most adverse unlikely situation.

3.4. Justification of Overall Outcome Rating

Rating: Satisfactory

70. The overall outcome rating of the project is satisfactory given that project relevance, efficacy and efficiency are rated satisfactory. The project achieved its objectives of reducing irrigation water losses and providing immediate rural employment. These outcomes remain highly relevant to Armenia's overall development program of sustainable economic growth and reduced poverty. Through implementation of simple rehabilitation works, the project achieved a strong impact on the ground providing much-needed employment to large swaths of the rural population in some of the poorest regions of the country. With poverty still widespread, the activities supported by the project lend themselves to replication for a larger impact.

71.

3.5. Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

72. The project had a considerable impact on addressing poverty in Armenia, albeit largely in the short-term. By creating much-need employment opportunities for large swaths of unskilled (and some skilled) labor force in the six marzes, it provided water users and households in some of the poorest communities of the country with a critical source of livelihood. While the project did create about 4,000 permanent agricultural jobs, however, it must be pointed out that most of the jobs (18,410 man/months) were temporary in nature and therefore project benefits in terms of longer-term poverty alleviation were limited. The project served more as a stop-gap measure to help poor rural communities ride out the economic and fiscal crisis.

(b) Institutional Change/Strengthening

73. The project financed select institutional strengthening activities, primarily in the form of technical assistance, to continue reforms initiated under the IDP towards participatory management principles in the irrigation sector. Resources allocated for this this activity were limited, yet significant. It allowed the WUA Support Group to continue functioning and subsequently be absorbed into the State Committee for Water Management (SCWM). This was a critical achievement as its location within the PIU jeopardized its future existence given the temporary nature of the PIU. Mainstreaming the Support Group into the SCWM also signaled the government's continuing support for technical, organizational and financial support to WUAs in the longer-term and enabled seamless coordination of work in the area of irrigation water supply and management.

74. While the project was unable to pilot a Water Users Federation (as discussed above), it supported interventions to help the government with ensuring future sustainability of the irrigation system. The ultimate goal of the government is to develop WUAs into self-governed and self-financed entities. However, currently, most WUAs have low fee collection capacity (estimated at 45 percent) and inadequate budgets for effective O&M. The state funding of WUAs is primarily directed to cover the financial gap between WUA costs and fees collected from water users. It is important for the government to provide sufficient budget allocation for adequate irrigation system maintenance until full cost-recovery for the whole irrigation system is achieved by the WUAs. In this context, the project financed a study to analyze options for providing financial assistance to WUAs from the state budget. Currently the subsidies are based on the traditional expenditure method which takes into account the WUAs' planned budgets, planned electricity consumption and the technical state of the infrastructure under their management. There is a need to move from the current traditional approach to an alternative results-based approach. The study looked at experiences in other countries for providing subsidies / grants to WUAs and based on these experiences and their applicability to Armenia, made several recommendations. However, these yet need to be reviewed for their viability. While the project did not undertake this exercise, ISEP is focusing, in part, on several aspects of institutional strengthening, including the issue of cost recovery and WUA subsidies. Thus while IREP did not enact policy changes, it financed the preparatory work for such policy discussions and decision-making.

75. The project contributed to strengthening WUA performance by financing two specially-developed software applications: (i) GIS-based water management software designed to enable analysis of lands, electricity consumed, actual irrigation water losses, fee collection rate and

debts, water intake from the source by each irrigation system, water distribution within inter-communal and on-farm irrigation systems, water users, signed water delivery agreements, irrigated areas, crops, volume of water delivered to water users, payments by water users and arrears, water usage plans, and envisaged electricity quotas; and (ii) accounting software that helped with fiduciary aspects of the WUAs. The information and data available from these applications helped all 44 WUAs with preparation of their 3-year business plans (2011-2014) designed to help with increasing irrigation efficiency and lowering O&M costs.

(c) Other Unintended Outcomes and Impacts (positive or negative)

76. Canal rehabilitation works also resulted in a positive impact on households living close to the project-supported canals. Due to deteriorated canal linings, water would seep into houses, compromising their structural integrity as well as increasing indoor humidity that resulted in strong odors and mold formation. About 20-30 residences adjacent to the canal in Kosh and Aragats villages had been subjected to these dangerous and unhygienic conditions in the past. With repaired linings and a significant reduction in water seepage, these houses were no longer affected by water damage. Residents in these affected villages expressed their deep appreciation for the project and the impact it had on improving their living conditions.

3.6. Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

74. Not applicable

4. Assessment of Risk to Development Outcome
Rating: Low

75. At the time of project completion, the risk that development outcomes will not be sustained is low. There is a continuous commitment to appropriate economic, financial and sector policies on the part of the Government as evidenced in its development strategy: *Armenia Development Strategy 2013-2025*. The ADS clearly articulates the long-term development vision for Armenia: creating jobs, building human capital, strengthening the social protection system and modernizing public administration and governance.

76. Agriculture continues to play a key role in the country's overall efforts towards economic development, job creation, and poverty reduction. Irrigated agriculture is crucial to the agricultural sector's performance, given that it accounts for about 80 percent of the sector contribution to GDP. Acknowledging the place of agriculture in developing a sustainable growth path for the economy after the setback of 2009, the government of Armenia has reinforced its support for the irrigation sector and taken steps to sustain and broaden the results and outcomes of IREP. In this context, the new Bank-financed ISEP will also contribute to maintaining and enhancing the gains achieved under IREP. The institutionalization of the WUA Support Group within the State Committee for Water Resources (achieved under IREP) has provided an effective mechanism for the government to work closely with the WUAs to build their capacity for efficient O&M of the irrigation system, maintenance of the irrigation infrastructure and building overall sustainability. The WUA Support Group is already undertaking a detailed assessment of the current needs and concerns of water users in the country which will inform the design of training and communication activities to be provided under ISEP to strengthen overall WUA functioning and performance.

5. Assessment of Bank and Borrower Performance

5.1. Bank Performance

(a) Bank Performance in Ensuring Quality at Entry
Rating: Satisfactory

77. The Bank team's performance during project preparation was satisfactory. Overall project design was kept simple with a clear emphasis on the imperative of immediate rural employment generation. The PDO was clearly articulated and the indicators were simple and easy to measure. For project implementation, the team hired the staff of the PIU that had worked on Bank-supported irrigation projects in the past who had extensive experience with Bank procedures and guidelines. Thus from the very start the project had a well-staffed PIU that was competent to manage and coordinate project activities. This was instrumental in ensuring successful implementation of project activities which was critical given the emergency nature of the project. To allow project activities to be launched immediately after effectiveness, all procurement, including tendering of contracts, was initiated during preparation. The team ensured that the necessary fiduciary, safeguard, and M&E requirements were also adequately addressed up front as going forward these were important for maintain a smooth pace of implementation. It must also be noted that the team received strong support from Bank management all through project preparation which helped facilitate rapid preparation of the project.

(b) Quality of Supervision
Rating: Satisfactory

78. The Bank team closely supervised project implementation. Implementation support missions were conducted on average twice a year, which allowed for fairly regular face-to-face interaction on project issues. Implementation support reporting on technical, fiduciary and safeguard issues was thorough and progress towards achievement of the key performance indicators was regularly updated to reflect project status. Next steps and follow up action were agreed upon in detail with counterparts. These were included in the mission Aide Memoires and Implementation Status and Results Reports (ISRs) and closely tracked.

79. Throughout the duration of the project, the team maintained a regular and constructive dialogue with the PIU, government, as well as communities. Its pro-active approach in managing and resolving issues that arose during implementation helped to keep project activities on track.

(c) Justification of Rating for Overall Bank Performance
Rating: Satisfactory

80. Overall Bank performance is rated satisfactory. The team worked closely with counterparts all through preparation and supervision of the project. Its pragmatic and flexible approach to quickly deliver results on the ground contributed to successful project implementation.

5.2. Borrower Performance

(a) Government Performance
Rating: Satisfactory

81. Overall government performance was satisfactory. It was deeply supportive of the project, both through preparation and implementation as it recognized the importance of the project in providing a social safety net to its citizens who were reeling under the effects of the prevailing economic and fiscal crisis. Counterpart financing was made available on time and in the agreed amounts which contributed to satisfactory disbursement performance.

(b) Implementing Agency or Agencies Performance
Rating: Satisfactory

82. The State Committee for Water Management (SCWM) had overall responsibility for project implementation. The Project Implementation Unit (PIU) housed within the SCWM, was responsible for project management, coordination and monitoring. It had vast experience with implementing Bank-financed projects and brought this experience to bear in the implementation of IREP. It diligently followed Bank requirements as necessary. The PIU's performance was highly satisfactory on procurement issues under the project, especially as related to contracts for civil works. All necessary contracts for canal rehabilitation works were tendered before the project became effective which enabled immediate implementation of civil works and thereby job generation. The PIU closely monitored the implementation of contracts along with the supervision consulting firm and was proactive in addressing issues as they arose. The PIU worked cooperatively with the WUAs as well. Detailed progress reports were made available to the Bank in a timely manner.

(c) Justification of Rating for Overall Borrower Performance
Rating: Satisfactory

83. The Borrower's overall performance is rated satisfactory as all through preparation and implementation, it demonstrated a high level of ownership and commitment for the project. It took timely and effective steps as necessary to address any issues that may have arisen and worked closely with the intended beneficiaries to ensure that the project's intended benefits reached the target beneficiaries.

6. Lessons Learned

84. *Projects that are simple in design and singularly focused perform well and have a high likelihood of achieving their objectives*. IREP design was guided by the fundamental principle of rapidly commencing project activities and generating rural employment to the maximum extent possible to address the growing threat of poverty from the prevailing economic and fiscal crisis. The project comprised two straight-forward, well targeted components that lent themselves to swift and efficient implementation. Also, the benefits of simple projects are relatively easy to disseminate among the local populations which stimulates a high degree of buy-in and support.

85. *Addressing priority needs of local populations is critical for the successful implementation of rural development projects.* By targeting the most pressing needs of the local communities, IREP generated much support and good will among the local populations which ensured its success right from the start. In this context, placing local people at the center of the whole implementation process has the added benefit of encouraging and enhancing beneficiary

participation in decision making in rural development assistance efforts. This results in better designed projects that have a higher likelihood of implementation success.

86. *Irrigation Projects can provide an important safety net for rural populations, especially during times of economic downturn.* The project demonstrated that irrigation projects can serve as a significant source of public employment. Irrigation projects do not necessarily need to be designed as capital-intensive efforts. A labor-intensive design is in fact preferable under certain circumstances, such as times of economic downturn, when rural populations are facing rising unemployment and loss of incomes.

87. *Projects prepared rapidly must have in-built flexibility to respond to emerging needs and situations.* Projects prepared on a fast track basis often have limited time for detailed preparatory work and adequate due diligence. This opens the door to encountering issues during project implementation that the team might not have faced had there been sufficient time for thorough preparatory work. It is therefore critical that a strong element of flexibility is built into project design so that project activities can be adjusted and issues that may arise during implementation can be addressed rapidly and appropriately.

88. *Establishing and strengthening WUAs is a long-term undertaking.* While organized user groups are essential for solving irrigation management problems and sustaining the physical infrastructure of the system, there is no 'blue-print,' one-size fits all institutional model for setting up a WUA. Given the complex and diverse management problems of irrigation systems, establishing and strengthening WUAs is a time intensive effort that requires several years of sustained support by the government.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

The Borrower has indicated that it has no comments on the ICR.

(b) Cofinanciers

Not Applicable

(c) Other partners and stakeholders

(e.g. NGOs/private sector/civil society)

Not Applicable

Annex 1. Project Costs and Financing

7.1.1 (a) Project Cost by Component (in USD Million equivalent)

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Rehabilitation of Primary Canals	48.98	50.09	102.26
Rehabilitation of On-farm Irrigation Network	4.02	3.93	97.76
Project Management and Institutional Activities	4.93	3.74	75.86
Total Baseline Cost	57.93	57.76	99.70
Physical and Price Contingencies	0.00	0.00	0.00
Total Project Costs	57.93	57.76	99.70
Front-end fee PPF	0.00	0.00	0.00
Front-end fee IBRD	0.75	0.75	0.00
Total Financing Required	58.68	58.51	99.71

7.1.2 (b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		9.73	10.00	102.77
International Bank for Reconstruction and Development		48.00	47.99	99.97
Beneficiaries		0.20	0.24	120.00

Annex 2. Outputs by Component

Component 1: Rehabilitation of Primary Canals in Selected Schemes.

1. This component financed rehabilitation of 89.5 km of primary canals (main and branch canals) in six marzes. The component included: (i) civil works for the primary canal rehabilitation; and (ii) consultancy services for supervision of rehabilitation works. The costs of rehabilitation of primary canals mainly included concrete lining of the canal sections. Canal lining works were carried out on the existing alignment and lined sections so that there was no land acquisition. The works paid particular attention to concrete quality and construction quality control so as to ensure that the final linings were of appropriate quality. The thickness of lined concrete on top of existing concrete lining (after roughening) was a minimum 12 cm. In case of new lined sections, a 10 cm blind concrete was underlain.

2. An international *Consulting Firm for Supervision and Quality Control (CFSQC)* of works was hired for the day-to-day supervision of construction works and monitoring of its quality. The CFSQC monitored compliance with the design and quality of the work as necessary. Technical auditing of the finished sections of the canals in the schemes was performed by the consultants (jointly with the Armenian Design Institute for Water Works) to independently review the seepage conditions in the rehabilitated sections.

Table 1. Rehabilitation of Primary Canals under the Original Project

Contract	Marz	WUA	Implemented in total		Per Communities	
			Thousand USD	Canal length (m)	Communities	Canal length (m)
Rehabilitation of Talin main canal DM 0+10 DM 70+28	Aragatsotn	Talin	**2,672.708460**	**4,887**		
Lot 1 - Rehabilitation of Talin main canal DM 0+10 DM 30+00			1281.594010	2,177	Aragatsavan	2,177
Lot 2 - Rehabilitation of Talin main canal DM 30+00 DM 70+28			1391.114450	2,710	Aragatsavan	2,710
Rehabilitation of Talin main canal DM 70+28 DM 160+00	Aragatsotn	Talin	**2,433.799260**	**4,685**		
Lot 1 - Rehabilitation of Talin main canal DM 70+28 DM 115+36			1252.453260	2,588	Arteni	2,588
Lot 2 - Rehabilitation of Talin main canal DM 115+36 DM 160+00			1181.346000	2,097	Arteni	2,097
Rehabilitation of Talin main canal DM 160+00 DM 258+00			**2,994.852350**	**5,323**		
Lot 1 - Rehabilitation of Talin main canal DM 160+00 DM 181+73	Aragatsotn	Talin	1394.770010	2,157	Arteni	2,157
Lot 2 - Rehabilitation of Talin main canal DM 181+73 DM 258+00	Armavir	Shenik	1600.082340	3,166	Shenik	3,166

Rehabilitation of Talin main canal DM 258+00 DM 455+13	Armavir	Shenik	**3,471.033260**	**11,062**		
Lot 1 - Rehabilitation of Talin main canal DM 258+00 DM 330+00			1816.607770	4,439	Shenik	4,439
Lot 2 - Rehabilitation of Talin main canal DM 330+00 DM 455+13			1654.425490	6,623	Vanand	6,623
Rehabilitation of left branch of Talin main canal DM 0+00 DM 170+00	Aragatsotn	Talin	**3,169.082080**	**16,250**		
Lot 1 - Rehabilitation of left branch of Talin main canal DM 0+00 DM 54+00			1460.466110	4,931	Aragatsavan	4,931
Lot 2 - Rehabilitation of left branch of Talin main canal DM 54+00 DM 170+00			1708.615970	11,319	Aragatsavan	2,557
					Arteni	5,943
					Lusakn	2,819
Rehabilitation of left branch of Talin main canal DM 170+00 DM 247+27 and right branch of Talin main canal DM 0+00 DM 102+46			**3,279.738970**	**15,583**		
Lot 1 - Rehabilitation of left branch of Talin main canal DM 170+00 DM 247+27	Aragatsotn	Talin	1655.246490	7,451	Lusakn	7,451
Lot 2 - Rehabilitation of right branch of Talin main canal DM 0+00 DM 102+46	Armavir	Qarakert	1624.492480	8,132	Qarakert	5,038
					Dalarik	3,094
7Rehabilitation of Armavir main canal DM 48+13 DM 87+57	Armavir	Araks	**2,831.942210**	**3,833**		
Lot 1 - Rehabilitation of Armavir main canal DM 48+13 DM 70+00			1420.239050	2,076	Berqashat	2,076
Lot 2 - Rehabilitation of Armavir main canal DM 70+00 DM 87+57			1411.703160	1,757	Nor Kesaria	1,757
Rehabilitation of Armavir main canal DM 87+57 DM 399+00	Armavir	Araks	**2,911.624630**	**5,639**		
Lot 1 - Rehabilitation of Armavir main canal DM 87+57 DM 111+28			1226.58429	2,316	Nor Kesaria	1,243
					Hushakert	1,073
Lot 2 - Rehabilitation of Armavir main canal DM 111+28 DM 399+00			1685.04034	3,323	Hushakert	878
					Noravan	2,445
Rehabilitation of Armavir main canal DM 399+00 DM 444+00	Armavir	Armavir	**2,326.043650**	**4,137**		
Lot 1 - Rehabilitation of Armavir main canal DM 399+00 DM 425+00			1264.050270	2281	Noravan	2281
Lot 2 - Rehabilitation of Armavir main canal DM 425+00 DM 444+00			1061.993380	1856	Noravan	1292
					Armavir	564

Rehabilitation of Mrgashat canal DM 17+15 DM 84+91 and diverting canal of Metsamor pump station DM 0+00 DM 130+15			**2,371.337980**	**11,181**		
Lot 1 - Rehabilitation of Mrgashat canal DM 17+15 DM 84+91	Armavir	Merdznapnya	794.21488	5,204	Alashkert	204
					Armavir, Haykavan	2047
					Nor Artagers	2325
					Janfida	628
Lot 2 - Rehabilitation of diverting canal of Metsamor pump station DM 0+00 DM 130+15		Armavir	1577.1231	5,977	Aknalich	4474
					Mayisyan	1101
					Mrgashat	402
Total 10 contracts			**28,462.162850**	**82,580**		

Table 2. Rehabilitation of Additional 7 km of Earthen Canal

Contract	Marz	WUA	Implemented, in total		Per Communities	
			Thousand USD	Canal length (m)	Communities	Canal length (m)
Rehabilitation of Armavir main canal DM 120+06 DM152+73	Armavir	Araks	1970.60531	3247	Hushakert	416
					Nor Amasia	2078
					Araks	753
Rehabilitation of Armavir main canal *DM 152+73 DM 189+82*		Armavir	2052.24628	3,686	Araks	2,345
					Lenughi	1,341
Sub-total under two contracts			4,022.851590	**6,933**		
Total under all 11 contracts			**32,485.014440**	**89,513**		

Table 3. Rehabilitation of Primary Canals under Additional Financing

Contract/Canal name	Marz name	Total length of canal(m)	Rehabilitation of canals (m)	Amount (million USD)	Community

IREP/AF/NCB/CW-11/001 Rehabilitation of Mkchyan Canal DM35+20-DM74+43 and Dvin Canal DM7+69-DM38+08	Ararat	**32,628.0**	**6,020.0**	**0.922**	
Mkchyan Canal		17,360.0	1,007	0.131	Byuravan
			1,003	0.237	Aygestan
Dvin Canal		15,268.0	4,010	0.554	Getazat
Rehabilitation of Arzni Shamiram canal DM105+35-DM281+50 (1st stage canal)	Kotayk	**35,095.0**	**8,145**	**2.890**	
			1,895	0.78	Mrgashen
			5,750	1.94	Yegvard
			500	0.17	Nor Yerznka
Rehabilitation of Arzni-Shamiram Canal DM179+60 - DM447+91 (2nd stage)	Aragatsotn	**44,791.0**	**4,931**	**2.020**	
			440	0.175	Ghazaravan
			3,746	1.495	Kosh
			745	0.350	Agtsk
Rehabilitation of Arzni Canal Branch DM27+57- DM124+00	Kotayk	**15,000.0**	**9,876.0**	**2.949**	-
			1,119.0	0.308	Yegvard
			1,195.0	0.328	Zovuni
			5,662.0	1.791	Proshyan
			1,900.0	0.523	Kassakh
Rehabilitation of Right Branch of Kassakh Canal DM9+14 - DM41+42 and Left Branch of Kassakh Canal DM34+09 - DM65+00	Aragatsotn and Kotayk	**11,900.0**	**5,995.0**	**1.110**	
Rehabilitation of right branch of Kassakh canal		5,400.0	925.0	0.178	Sagmosavan
			2,338.0	0.452	Artashavan
Rehabilitation of left branch of Kassakh canal		6,500.0	1,764.0	0.295	Karbi
			968.0	0.19	Yegvard
IREP/AF/NCB/CW-11/006 Rehabilitation of Lower Hrazdan Canals DM112+00-DM160+40 (1st stage) and DM24+22-DM86+60 (2nd stage) and Shah-Aru Canal DM30+74-DM47+86		**58,988.0**	**6,312.0**	**2.630**	

Rehabilitation of Lower Hrazdan Canals (1st stage) DM112+00-DM160+40	Armavir	28,300.0	1,212	0.706	Aygek
Rehabilitation of Lower Hrazdan canal (2nd stage) DM24+22-DM86+60		21,900.0	2,995	1.223	Aragats
			393	0.147	Agavnatun
Rehabilitation of Shah-Aru canal DM30+74-DM47+86		8,788.0	1,712	0.555	Mrgashat
IREP/AF/NCB/CW-11/007 Rehabilitation of Shirak Main Canal DM13+40 - DM24+04; Distributor 26 Canal DM91+64 - DM169+84 and Nalband Canal DM141+22 - DM183+73		**87,460.0**	**9,015.0**	**1.783**	
Shirak Main Canal	Shirak	18,620.0	150.0	0.061	Kamo
			1,064.0	0.402	Hatsik
Distributor 26 Canal		25,840.0	3,550.0	0.601	Arevik
Nalband Canal	Lori	43,000.0	1,600.0	0.273	Parni
			2,373.0	0.397	Lusaghbyur
			278.0	0.048	Saralanj
IREP/AF/NCB/CW-11/008 Rehabilitation of Right Branch of Talin Main Canal DM102+46-DM165+07 and Myasnikyan "Mayr Aru" Canal DM0+00-DM31+86		**15,575.0**	**7,738.0**	**1.057**	**-**
Right Branch of Talin Main Canal	Armavir	10,300.0	1,187	0.214	Dalarik
			3,425	0.428	Bagramyan
Myasnikyan "Mayr Aru"		5,275.0	3,126.0	0.415	Myasnikyan
Total		**301,437.0**	**58,032**	**15.36105**	

C**omponent 2: Rehabilitation of On-farm irrigation network.**

3. This component, introduced under the Additional Financing, financed the rehabilitation of 50 km of tertiary canals. Nineteen communities grouped in eight Water Users' Associations of six irrigation schemes benefited from project interventions. These activities were co-financed 15 percent by farmers. Activities under this component included: (i) civil works for tertiary canal rehabilitation (ii) consultancy services for supervision of rehabilitation works.

Table 4. Rehabilitation of On-farm Canal Network

Communities	Marz	Irrigation System	WUA	Total length of canals (m)	Length of rehabilitated stretches (m)	Cost (M USD)
Bagramyan	Armavir	Talin system	Qarakert	500	370	0.035
Myasnikyan				8000	2972	0.279
Dalarik				5000	4414	0.258
Qarakert				9200	1124	0.197
Bagaran			Shenik	700	770	0.048
Vanand				6800	5935	0.400
Yervandashat				3200	610	0.063
Lernagog			Talin	4000	940	0.115
Arevadasht		Armavir system	Armavir	5300	2000	0.179
Hatsik				2500	2016	0.113
Noravan				1700	806	0.048
Agavnatun		Lower Hrazdan	Khoy	7500	5700	0.368
Contract IREP/AF/NCB/CW-11/009				**54400**	**27657**	**2.102**
Jrashen	Lori	Nalband system	Getik	2400	1630	0.110
Upper Getashen	Gegarkunik	Sevan system	Martuni	14400	4256	0.363
Martuni				10800	6941	0.518
Dzoragyug				7600	3399	0.232
Asthadzor				5300	4122	0.205
Vagashen				4500	1680	0.111
Megrashen	Shirak	Shirak	Shirak	2800	1600	0.081
Contract IREP/AF/NCB/CW-11/010				**47800**	**23628**	**1.619**
Total				**102200**	**51285**	**3.721**

Component 3: Project Management and Institutional Activities

4. This Component financed two sub-components, namely: (i) Project management and audits; and (ii) Institutional strengthening.

Project Management and Audits

5. Under the first sub-component, the project financed project management, monitoring and evaluation (M&E) activities as well as annual financial audits of the Project.

6. Financial audits for 2009 and 2010 were also undertaken for the three Water Supply Agencies (WSAs): Akhuryan-Araks, Sevan Hrazdan and Debed-Aghstev

7. Financial audits for all WUAs for the years 2009 and 2010 were also undertaken. These audits served as a complementary institutional strengthening activity (discussed below).

Institutional Strengthening

8. Outputs under this component included:

(a) Operational support for the WUAs' Support Group. The WUAs' Support Group was established under IDP financing within PIU in 2003 with the main aim of supporting establishment and training of WUAs. It worked to inform rural communities about the concept of WUA's, facilitated formation of initiative groups, provided technical expertise to these initiative groups, developed complete databases for all WUAs, developed training material and implemented WUAs' training modules. Under the IREP, the WUAs' Support Group was successfully institutionalized within the State Committee for Water Management (SCWM).

(b) Institutional Strengthening.
(i) Two studies were completed:

- *Arrangements for Providing State Assistance Funds to Water Users Associations* that reviewed the current system of subsidies to WUAs and analyzed options for alternative funding arrangements by drawing on the experiences of other countries and their applicability to the Armenian situation; and
- *Institutional Strengthening Study* that analyzed the financial and economic performance of each WUA over the past three years that would feed into the development of preparation of business plans for each WUA for the period 2011-2016.

(ii) The aforementioned business plans were developed for all operating WUAs
(iii) GIS-based software was installed in all WUAs and made operational. During project implementation it was agreed to transfer this activity to the MCC so while project resources were not used for this activity, it was nevertheless successfully completed and contributed to the achievement of IREP objectives.

(c) Feasibility study for the Meghri Gravity Scheme. The government was interested in financing a gravity scheme in the Meghri region of the country and a preliminary study had been undertaken through the MCC Program. The project provided technical assistance to verify the environmental, economic, and technical feasibility of the gravity scheme; support for the construction of such a scheme has been included under ISEP.

Annex 3. Economic and Financial Analysis

I. Summary

1. Rehabilitation of irrigation infrastructure in Armavir and Talin irrigation canals was expected to have the following benefits: (i) reduced water losses; (ii) rain fed areas returning to irrigation as more water reaches more farm land; and (iii) increased productivity as a result of improved availability of water (in quantity and opportunity). Reduced water losses would also reduce cost of irrigation as less water needs to be pumped, and an increase in the availability of water in the tail end of the irrigation systems, would introduce more equity among farmers. The Additional Financing included new and scaled-up activities allowing the inclusion of areas other than the two originally foreseen in Armavir and Talin canal areas. This Annex estimates: (i) the financial impact on farmers' income, and (ii) the economic impact on the overall economy. Detailed crop and farm models representing typical farming situations for benefited areas showing the "with" and "without project" scenarios were developed using FARMOD software.

2. The financial and economic ex ante analysis for the IREP based its assessment only on quantified benefits from the incremental lands to be returned to irrigation after water losses would be reduced and water availability restored through the rehabilitation works. Values per ha were based on the calculation of the five crop budgets of the most frequent cultivated crops in the project areas, previously prepared under the Millennium Challenge Account Armenia Program in 2008. The estimated Economic Rate of Return (ERR) at appraisal was 19.5 percent, and the Net Present Value (NPV) was US$48.5 million using a discount rate of 12 percent.

3. This ICR ex post analysis estimated the following benefits: (i) the incremental production from the lands where irrigation water supply was restored; (ii) the increased yields on those irrigated areas where water provision was improved (mainly on the tail-end sections) and (iii) the increased production value due to changes in cropping patterns on the irrigated lands, as water became more reliable and failure crop risks are being reduced. Energy savings in pumping water in the improved irrigation schemes although significant were not quantified. Additional benefits likely to appear after project closing (due to further yield increases and cropping pattern shifts) were also considered based on actual changes observed after closing of the IDP in rehabilitated areas, occurring between 2009 and 2012. Estimations were based on the project's GIS based M&E system that continued to monitor the IDP rehabilitated areas. Changes in cropping areas in IDP irrigation systems were taken as proxy estimates of what might also happen in the project areas. The ICR estimated economic impact shows that the project would be attaining an ERR of 21.2 percent and a NPV of AMD 34.2 billion (US$82.4 million) when using 12 percent as discount rate.

II. Methodology and Assumptions

4. **Crop models** were prepared for estimating the representative production budgets involved in the major crop in the irrigated project area. Models included: (i) average crop yields and quantities of inputs used per cropped ha, both in the pre-project situation (representing "without the project" scenario) and in the current situation with the rehabilitation works completed (the "with the project" scenario) as observed in the field; and (ii) the financial budgets resulting from the physical quantities of production and inputs used, and the market prices received by farmers for their production or paid for the inputs and services used for the activity.

5. **Land use.** Due to the long deferred maintenance of the irrigation systems in Armenia, most of the structures are not operating well and water rarely reaches the farms at the tail of the irrigation systems. It is estimated that irrigated area in Armenia has dropped to half the area that

was under irrigation due to lack of proper O&M. With the rehabilitation of some of the main irrigation structures and the participatory irrigation management (PIM) practices introduced by the 2009 closed IDP, together with the follow-up strengthening and roll out activities developed under the IREP, the irrigation systems in Armenia are saving up to 25 percent of the water that was previously lost, allowing to serve again some of the previously irrigated abandoned land.

6. **Aggregation of Costs and Benefits** The agricultural production costs and benefits at the project rehabilitated areas (in Armavir canal, Tallin canal and other areas where tertiary canal systems were rehabilitated), were aggregated in both scenarios: "with" and "without" project, following the cropping pattern as it really happened with the changing importance of each production activity during implementation. The analysis was done for a 20 year period assuming that the cropping pattern would continue to evolve until 2016 - when it would stabilize – in a similar tendency as the one shown by the area rehabilitated under the preceding IDP. As conservative assumption, it was assumed that no further significant changes in yields, planted areas and/or cropping patterns would occur after 2016 in which the new cropping pattern was assumed to stabilize. The aggregation of the agricultural incremental production and related farm costs, provide an overall estimate of the project net benefits which were compared with the IREP overall investment costs (US$63.3 million in five years) for estimating the impact indicators.

III. Financial and Economic Results.

7. Fourteen crop models and 2 farm models were constructed to estimate the financial impact of the project at the beneficiaries' livelihood level. Models represent average crop budgets for the dominant crops in the project areas showing the "with" and "without" project financial results per ha (details in Tables 1 - 14 in the project files). Budgets were based on conservative assumptions regarding yield increases and costs involved as can be seen in the following Table 1 where the main parameters and results indicators for the most important seven crops in the rehabilitated Armavir canal command area are presented.

Table 1. Crop Main Indicators for Expected Results in Armavir Canal (000' drams/ha)

Crop	Average Yields (kg/ha)		Gross Revenue		Input & Labor Costs		Net Income	
	without	with	Without	with	without	with	without	with
Grains (Wheat)	3,500	3,850	525.7	577.5	403.8	409.3	121.2	168.2
Fodder Crops (Alfalfa)	10,000	11,000	400.0	440.0	341.3	353.3	58.7	86.7
Vegetables (Tomato)	35,000	40,000	1,750.0	2,000.0	1,392.8	1,478.8	357.3	521.2
Existing Orchards (Apricots)	3,500	4,000	630.0	720.0	366.0	371.5	264.0	348.5
New Orchards (Apricots)	0	9,000	0	1,620.0	0	747.4	0	872.6
Existing Grapes	5,000	5,500	900.0	990.0	452.5	460.2	447.5	529.8
New Grapes	O	16,000	0	2,880.0	0	1,072.9	0	1,807.1

8. **Financial Results** of the project at the farm level were analyzed considering average cropping patterns in both scenarios. This analysis intended to measure the average impact that the project is having in the livelihood of beneficiaries. According to the GIS based M&E project data, there are still limited changes in cropping patterns for the typical farm on the project areas. However these changes were assumed to continue evolving as occurred during the operational phase of the IDP. The cropping pattern for the Armavir canal typical farm of 1.3 ha is shown in Table 2 (figures in ha):

Table 2 Average Cropping Pattern of a typical Farm in Armavir Canal Area

In Hectars per farm	Without Project	With Project					
Cropping Pattern	**1 to 15**	**1**	**2**	**3**	**4**	**5**	**6 - 15**
Wheat (Armavir Canal Area)	0.21	0.21	0.21	0.17	0.12	0.1	0.08
Alfalfa (Armavir Canal Area)	0.13	0.13	0.13	0.115	0.1	0.09	0.09
Tomato (Armavir Canal Area)	0.171	0.171	0.171	0.171	0.171	0.171	0.171
Cabbage (Talin Canal Area)	0.17	0.17	0.17	0.23	0.28	0.42	0.42
Grapes Existing Orchards (Armavir Canal Area)	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Apricots Existing Orchards (Armavir Canal Area)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Grapes - New Orchards (Armavir Canal Area)	-	-	-	0.01	0.04	0.09	0.17
Apricots New (Armavir Canal Area)	-	-	-	0.01	0.02	0.025	0.025
Rainfed Pastures	0.309	0.309	0.309	0.284	0.259	0.094	0.034
Total Area	1.3	1.3	1.3	1.3	1.3	1.3	1.3

9. This process towards higher value crops will probably continue beyond 2016 but is kept unchanged from that year onwards as a conservative approach for this assessment. Table 3 and 4 show the expected results on typical farms located on the Armavir and Talin canal project areas.

Table 3 Armavir Canal Typical Farm

FINANCIAL BUDGET (AGGREGATED) (In dram '000)	Without Project	With Project								
	1 to 15	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**11 to 15**
Main Production										
Grains	110	110	94	69	58	46	46	46	46	46
Vegetables	452	452	541	628	770	770	770	770	770	770
Fruits	225	225	240	253	253	264	300	375	504	783
Fodder	52	52	48	44	40	40	40	40	40	40
Sub-total Main Production	840	840	923	994	1,121	1,120	1,156	1,232	1,360	1,639
Production Cost										
Agricultural Imputs	-	-	24	70	117	186	12	4	3	-
Services	-	-	5	15	31	52	41	25	-	-
Water	-	-	1	5	9	16	14	11	7	-
Sub-total Investment Costs	-	-	31	95	168	270	83	52	17	-
Agricultural Imputs	109	109	109	107	114	112	113	115	117	120
Services	102	102	102	99	108	109	118	134	157	159
Water	61	61	64	65	70	69	70	73	77	84
Sub-total Operating Costs	298	298	303	303	331	330	344	367	401	421
Sub-Total Production Cost	298	298	335	398	499	601	427	419	418	421
OUTFLOWS	298	298	335	398	499	601	427	419	418	421
Cash Flow Before Financing	542	542	589	596	622	519	729	813	942	1,218
Net Financing	-	197	-19	-30	-31	52	2	0	-0	-
Cash Flow After Financing	542	739	570	566	591	571	732	813	942	1,218
Sub-Total Change in Net Worth	-	-209	-	-	-	-	-	-	-	-
Farm Family Benefits After Financing	542	531	570	566	591	571	732	813	942	1,218

10. IREP benefited farmers' annual net incomes are estimated to grow from an average of AMD 542,000 to AMD 1.2 million in the Armavir canal area (US$ 1,320 to US$ 2,970); and from AMD 1.45 million to AMD 2.5 million (Table 4) in the Talin canal area (US$3.536 to US$6,260).

Table 4 Talin Canal Typical Farm (2.5 ha) FM

FINANCIAL BUDGET (AGGREGATED) (In dram '000)	Without Project	With Project								
	1 to 15	1	2	3	4	5	6	7	8	12 to 15
Main Production										
Grains	147	147	121	92	69	58	58	58	58	58
Vegetables	180	180	173	143	133	122	122	122	122	122
Other Crops	1,075	1,075	1,219	1,372	1,568	1,764	1,764	1,764	1,764	1,764
Fruits	465	465	472	506	540	554	598	686	818	1,278
Fodder	304	304	302	299	282	264	264	264	264	264
Sub-total Main Production	2,172	2,172	2,288	2,412	2,592	2,763	2,806	2,894	3,027	3,486
Production Cost										
Agricultural Imputs	-	-	57	63	62	65	56	8	4	-
Services	-	-	15	28	38	42	34	21	11	-
Water	-	-	5	9	13	17	14	9	6	-
Sub-total Investment Costs	-	-	82	110	127	142	118	48	26	-
Agricultural Imputs	92	92	86	79	77	78	83	88	92	97
Services	215	215	206	195	191	196	208	222	234	250
Water	124	124	124	124	121	117	121	125	128	133
Sub-total Operating Costs	722	722	727	729	763	809	835	863	887	918
Sub-Total Production Cost	722	722	809	839	890	951	954	911	912	918
OUTFLOWS	722	722	809	839	890	951	954	911	912	918
Cash Flow Before Financing	1,450	1,450	1,479	1,574	1,702	1,812	1,852	1,982	2,114	2,568
Net Financing	-	479	-9	-15	-18	-1	13	-0	-1	-
Cash Flow After Financing	1,450	1,929	1,470	1,558	1,684	1,811	1,865	1,982	2,114	2,568
Sub-Total Change in Net Worth	-	-505	-	-	-	-	-	-	-	-
Farm Family Benefits After Financing	1,450	1,423	1,470	1,558	1,684	1,811	1,865	1,982	2,114	2,568

11. The increase in beneficiaries' income is resulting from a combination of vertical and horizontal expansion of their small farms, due to water being made available in a timely manner allowing for more frequent watering of crops, which improves productivity and also induces farmers to invest in higher value crops (HVCs) as risks of water shortage is reduced. However, changes are expected to be slow because most farmers have limited access to technical assistance and credit. Table 5 shows that the area under irrigation in the Talin and Armavir canal command area increased from 32,761 ha to 33,535 ha. Wheat and alfalfa reduced their area from 41 to 30 percent between 2008 and 2012, while the HVCs increased their share in the total irrigated area from 59 to 70 percent, confirming a clear tendency. The bulk of irrigated area increase is likely to be incorporated in the following years as rehabilitation works have just being finished.

Table 5 Cropping Pattern in the Armavir and Talin areas (including Additional Financing)

YEAR	CONTRACTUAL AREA	including by crops					
		Winter wheat	Vegetables and gourds	Vineyards	Alfalfa	Orchards	Others
	%	%	%	%	%	%	%
2012	100.0	10.8	12.9	12.5	19.2	23.1	21.6
2011	100.0	15.1	11.2	12.1	18.7	22.4	20.4
2010	100.0	18.1	11.4	11.1	18.9	21.0	19.5
2009	100.0	19.3	12.2	10.4	20.1	19.7	18.3
2008	100.0	18.3	14.3	10.7	22.9	19.7	14.0

YEAR	CONTRACTUAL AREA	including by crops					
		Winter wheat	Vegetables and gourds	Vineyards	Alfalfa	Orchards	Others
	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]	[ha]
		1	2	3	4	5	6
2012	33535	3612	4327	4179	6437	7730	7250
2011	33690	5101	3788	4069	6294	7563	6875
2010	33296	6036	3781	3704	6303	6977	6495
2009	33416	6448	4090	3482	6721	6576	6099
2008	32761	6005	4686	3502	7512	6469	4587

12. Similar behavior is expected in the rehabilitated tertiary canal command areas where irrigated areas still remains almost the same but the areas under wheat and alfalfa already show an

incipient tendency towards reductions in their share in the cropping pattern. As in IDP areas, vineyards and orchards are also beginning to increase their share in response to the improved access and reliability to water for irrigation.

13. **Economic Results Indicators** of the IREP (including the Additional Financing) provide a good estimate of the project's impact at the country's economy level. Results were estimated from the aggregate crop patterns evolution and the crop's financial budgets, using a few adjustments to the existing market prices. Most of these values express adequately their shadow (or economic) values given that Armenia presents a fairly open economy to the international markets and trade. Adjustments were introduced only for rural labor and irrigation water costs. Unskilled labor was adjusted with a 0.7 conversion factor (CF) given the relatively high level of underemployment in rural areas in Armenia. Additionally, the market (or financial) cost of water (AMD 11 per cubic meter) constitutes a value fixed administratively by the GOA and as such was adjusted with a CF of 1.7. The estimation of the economic cost involved in delivering water to the irrigation systems in Armenia was estimated at AMD 18.7 per cubic meter. The difference between these two levels is covered by subsidies directly delivered to the GOA to the WUAs.

14. As shown in Table 6 the overall ERR of the IREP was estimated at 21.2%. Using a discount rate of 12 percent, the project economic NPV is AMD 34.2 billion (US$82.4 million).

Table 6 Project Summary

ECONOMIC BUDGET (AGGREGATED) (In dram Million)	Without Project	With Project								
	1 to 20	1	2	3	4	5	6	10	15	20
Main Production										
Grains	6,280	6,280	6,280	6,198	5,975	5,874	6,247	6,682	6,682	6,682
Vegetables	21,345	21,345	21,345	21,606	22,180	23,406	25,433	32,082	32,082	32,082
Other Crops	6,451	6,451	6,451	6,595	6,964	7,606	8,541	10,584	10,584	10,584
Fruits	10,957	10,957	10,957	11,008	11,151	11,373	11,713	16,881	28,605	28,983
Fodder	3,686	3,686	3,686	3,673	3,640	3,570	3,473	3,298	3,298	3,298
Livestock Products	8	8	8	8	7	6	5	0	-	-
Sub-total Main Production	48,726	48,726	48,726	49,088	49,917	51,835	55,411	69,526	81,251	81,628
Production Cost										
Investment										
Purchased Inputs										
Agricultural Imputs	-	-	-	128	452	1,013	1,953	975	-	-
Services	-	-	-	29	115	285	574	668	-	-
Water	-	-	-	15	60	150	307	487	-	-
Sub-Total Purchased Inputs	-	-	-	183	669	1,550	3,038	2,438	-	-
Labor										
Labor	-	-	-	59	190	390	689	495	-	-
Sub-total Investment Costs	-	-	-	241	859	1,941	3,728	2,933	-	-
Operating										
Purchased Inputs										
Agricultural Imputs	5,938	5,938	5,938	5,931	5,907	5,947	6,137	6,867	7,035	7,035
Services	5,581	5,581	5,581	5,570	5,536	5,592	5,870	7,368	8,087	8,090
Water	5,526	5,526	5,526	5,541	5,569	5,664	5,893	6,851	7,312	7,312
Sub-Total Purchased Inputs	19,738	19,738	19,738	19,765	19,807	20,152	21,098	25,150	26,806	26,810
Labor										
Labor	10,242	10,242	10,242	10,286	10,359	10,581	11,062	13,457	14,848	14,876
Sub-total Operating Costs	29,980	29,980	29,980	30,051	30,166	30,733	32,161	38,607	41,655	41,686
Sub-Total Production Cost	29,980	29,980	29,980	30,292	31,025	32,674	35,888	41,540	41,655	41,686
Other Costs										
Project Investments	-	1,282	11,131	2,591	9,190	971	310	310	310	310
OUTFLOWS	29,980	31,262	41,111	32,883	40,215	33,645	36,198	41,850	41,965	41,996
Cash Flow	18,747	17,465	7,616	16,205	9,702	18,190	19,213	27,676	39,286	39,632

IRR = 21.2%, NPV = 34,195.52

15. The analysis shows that the results are different for each of the three project areas, and in all areas the economic NPV is positive: (i) in the Armavir canal command area the ERR is 22 percent; (ii) in the Talin canal command area the ERR is 12.9 percent; and (iii) in the other areas

where tertiary canals were rehabilitated the ERR is 65.4 percent. The main reason making these different results is the amount invested per benefitted area: in Talin the cost was almost three times the amount invested per ha in Armavir, while in the other areas where tertiary canals were improved the investment cost per ha was only about one fourth of the cost in Armavir.

16. Results achieved from the Talin irrigation investments might seem to be marginal. However, if other non-quantified benefits were to be added to the assessment, the ERR would be improve significantly. The most important direct non-quantified benefit is the reduction in electricity consumption by the WUAs and Water Supply Agencies enabled by the project. Electricity consumption for pumping irrigation water in Armenian systems was reduced from 235,700 KWH on average per year for 2004 – 2006, to 125,100 KWH per year for 2010 – 2012. The reduced consumption was due to the infrastructure improvements introduced by the IDP and the IREP reducing the electricity used per cubic meter of water delivered to farmers from 0.39 KWH to 0.29 KWH. Therefore, the economic price of water is being reduced significantly as losses decreased and as the pumping proportion is reduced in favor of gravity water. The cost reductions not only improve profitability of irrigation in the systems but also, create more competitive conditions for further investments and expansion of the irrigation. These benefits have not been taken into account for the ERR and NPV estimations because they are difficult to quantify. Since pumping costs are still a significant part of the economic cost of water (more than 30 percent in spite of its recent reduction), there is still a significant margin for a continued decrease in the average economic cost of providing water for the irrigation systems which can contribute further to the development of the sector.

17. **Sustainability** of project benefits is expected to be high, given that the increase in availability and water use efficiencies, together with the consolidation and continuous improvement of the adopted PIM, enhances the competitiveness of the irrigated agriculture in Armenia. The dynamic and professional attitude shown by WUAs improving the O&M of the systems is having a significant effect on the quality of the water service delivery and on farmers' incomes. The persistent tendency of the rehabilitated systems towards changing cropping patterns towards HVCs is the best evidence that the IREP improvements are to be sustainable.

18. **Sensitivity analysis** of the expected results shows that the project impact is solid even if adverse factors affect the irrigated agricultural production business in Armenia. If farm gate prices of all main agricultural products considered in the assessment would drop by 20 percent, the ERR would then still be 16.2 percent. If production costs for all crops considered would increase by 20 percent, the ERR would become 18.4 percent. Finally, if both adverse events would occur jointly (farm gate prices dropping by 20 percent and costs of production increasing by 20 percent), then the resulting ERR of the project would than drop to 12.9 percent. These results show that the IREP would have a positive result even in the most adverse unlikely situation.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Giuseppe Fantozzi	Senior Rural Development Specialist	ECSAR	Team Leader
Arusyak Alaverdyan	Operations Officer	ECSAR	Operations
Daniel Gerber	Operations Analyst	ECSAR	Operations
Darejan Kapanadze	Senior Environmental Specialist	ECSEN	Environment
Martin Henry Lenihan	Social Development Specialist	LCSSO	Social
Arman Vatyan	Sr Financial Management Specialist	ECSO3	Financial Management
Garik Sregeyan	Consultant	ECSO3	Financial Management
Yingwei Wu	Senior Procurement Specialist	LCSPT	Procurement
Anarkan Akerova	Counsel	LEGLE	Legal
Ohn Myint	Consultant		Irrigation Engineer
Anna O'Donnell	Consultant		Editor
Supervision/ICR			
Arusyak Alaverdyan	Operations Officer	ECSAR	Team Leader
Giuseppe Fantozzi	Senior Rural Development Specialist	AES	Technical
Alexander Astvatsatryan	Senior Procurement Specialist	ECSO2	Procurement
Armine Aydinyan	Consultant	ECSO2	Procurement
Daniel P. Gerber	Rural Development Specialist	ECSAR	Operations
Darejan Kapanadze	Senior Environmental Specialist	ECSEN	Environment
Ohn Myint	Consultant	SASDA	Engineer
Robert Rout	Consultant	FAO	Engineer
Giovanni Munoz	Consultant	FAO	Engineer
Arman Vatyan	Sr Financial Management Specialist	ECSO3	Financial Management
Garik Sergeyan	Consultant	ECSO3	Financial Management
Yingwei Wu	Senior Procurement Specialist	LCSPT	Procurement
Meeta Sehgal	Rural Development Specialist	ECSAR	Lead ICR Author

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD
Lending		
Total:	35.79	144,387.65
Supervision/ICR		
Total:	121.18	372,953.11

Annex 5. Beneficiary Survey Results

Not applicable

Annex 6. Stakeholder Workshop Report and Results

Not applicable

Annex 7. Summary of Borrower's ICR

1. Introduction

1. Agriculture in Armenia remains an important sector representing around a fifth of GDP and employing some of two fifth of the country's active population. About 36 percent of Armenia's population lives in rural areas, and rural poverty, at 36 percent, remains higher on average than in urban areas. In rural areas, agriculture remains the main occupation, also for rural poor. More than 80% of the agricultural Gross Domestic Product (GDP) is produced on irrigated areas[3]. Should the irrigation infrastructure deteriorate further, agricultural production in Armenia would decrease significantly, considerably affecting rural employment. Thus, irrigated agriculture is essential for maintaining rural employment and economic growth in Armenia.

2. In 2006 the Millennium Challenge Corporation (MCC) started to support the irrigation sector in Armenia. MCC signed a USD 235 million agreement with the Government of Armenia, including a USD 109 mln. Irrigation Component. In spite of these resources, and recognizing that much has been achieved, the needs for irrigation rehabilitation investments in Armenia remain important. Consequently, the World Bank's support to rehabilitation of irrigation and drainage system is very meaningful for the Government of Armenia. In addition to this, 2009 economic and financial crises and the need for short-term employment stimulation have contributed to emphasize attention to the irrigation and drainage sector again. In addition, extensive preparatory work had already been completed with MCC financing for new investments and the projects helps to capitalize on resources used by the MCC Program to investigate the sites and prepare designs before these become obsolete in the medium term.

3. So, the primary objective of the Irrigation Rehabilitation Emergency Project was to mitigate the impact from the global financial crisis through extending an IBRD loan in the amount of USD 30.0 million.

2. Irrigation Rehabilitation Emergency Project Objectives

4. The objectives of IREP were as follows: (a) improve water use efficiency in two selected irrigation systems; and (b) foster immediate rural employment. This was achieved by rehabilitating primary irrigation canals to reduce water losses in two selected schemes, and providing some limited assistance to the restructuring and strengthening of institutions managing irrigation infrastructure in the Project areas.

3. Description of Irrigation Rehabilitation Emergency Project.

5. Implementation of this Project lasted two construction seasons, starting from October 2009 through June 2011. The Project consisted of the following two components and subcomponents:

Component 1. Rehabilitation of Primary Canals in Talin and Armavir Irrigation Schemes.

a) civil works for the primary canal rehabilitation ;

b) services of the Consultancy Firm for Supervision and Quality Control of rehabilitation works.

[3] Excluding livestock

Component 2. Project Management and Institutional Strengthening Activities

2.1. Project Management and Audits

2.1.1. Project Management

2.1.2. Audits (WUAs. WSA, and PIU)

2.2. Institutional Strengthening

2.2.1. The WUAs' Support Group

2.2.2. The Institutional Strengthening Study and Technical Audit of WUAs

6. The first component financed rehabilitation of 89.5 km of primary canals in total, of which 57.8 km in Tallin Irrigation Scheme (out of the total length of 81.0 km) and 31.7 km in Armavir Irrigation Scheme (out of the total length of 70.3 km). The component financed also consultant services for supervision and quality control of rehabilitation works.

7. The second component financed the Project management, monitoring and evaluation, as well as financial audits of the Project, WSAs, and WUAs, and selected activities targeted to institutional strengthening. These activities were as follows: (a) to sustain the WUAs' Support Team, which continued training of WUAs ; (b) to conduct an institutional strengthening study of WUAs.

4. Achievement of Project Objectives and Results

4.1 Irrigation Rehabilitation Emergency Project

Component 1. Rehabilitation of Primary Canals of Talin and Armavir Irrigation Schemes

Name	Length of the Canal to Be Rehabilitated (m)		Annual Water Saved	Increase in Irrigated Area
	Planned	Actually Rehabilitated		
	m	m	000 m^3	ha
Tallin Irrigation Scheme	**58,972**	**57,790**	**58,595.4**	**4,968**
Talin main canal	25,122	25,957	37,072.0	3,020
Talin main canal right branch	10,113	8,132	14,144.7	1,280
Talin main canal left branch	23,737	23,701	7,378.8	668
Armavir Scheme	**24,767**	**31,723**	**38,325.3**	**3,075**
Armavir main canal	13,971	13,609	20,921.6	1,550
		6,933	9,860.0	775
Mrgashat canal	4,231	5,204	3,683.6	360
Outlet canal of Metsamor PS	6,565	5,977	3,860.0	390
TOTAL	**83,739**	**89,513**	**96,920.7**	**8,043**

9. As you can see from the above table, the original project design provided for rehabilitation of about 83.7 km of canals, of which 59.0 km in Talin Irrigation Scheme, and 24.8 km in Armavir Irrigation Scheme. However, due to project savings it became possible to rehabilitate an additional 7 km long section of Armavir main canal, thus resulting in total 89.5 km of rehabilitated canals, of which 57.8 km in Talin Scheme and 31.7 km in Armavir.

9. This in its turn allowed to exceed also other important indicators, i.e. the annual saved water came up to 96.9 m3 instead of the originally estimated 87.1 m3; additional potential increase in irrigated area amounted to 8,043 ha instead of the originally estimated 7,300 ha.

The expectations were that 8,922 person/month of employment would be created under the project. This important indicator was also exceeded, and the number of created temporary jobs was 11,379 person / month.

Component 2. Project Management and Institutional Strengthening Measures

10. *Sub-component 2.1.* financed all the incremental operational costs necessary for the PIU to properly implement the Project; audits of the Project, Sevan-Hrazdan Water Jrar JCSC (WSA), and Akhuryan-Araks Jrar CJSC (WSA). Besides, financial audits of all WUAs were also financed by this sub-component.

11. *Sub-component 2.2.* provided funds for operation of the WUAs' Support Team. The Support Team assisted in establishment and training of WUAs. The Support Team was the core group dedicated to inform rural communities about the concept of WUAs, develop training material and implement WUAs' training modules.

12. The same sub-component financed the Institutional Strengthening Study on WUAs. It assessed technical, organizational, and financial needs of WUAs in carrying out O&M and reflected it in the preparation of specific business plans for each WUA for the next three years period.

4.2 Irrigation Rehabilitation Emergency Project Additional Financing (AF)

13. Similar to the original Project, the Additional Financing (AF) addressed problems arising from the economic crisis, while creating longer-term benefits for irrigation users through the improved quality of irrigation infrastructure in other regions of the country as well: Aragatsotn, Kotajk, Shirak, Lori, Ararat, Gegharkounik, and Armavir Regions (Marzes).

14. The objectives of IREP AF are as follows: i) to improve water use efficiency in selected irrigation systems; and (ii) foster immediate rual employment.

15. In contrast with the original Project, which was concentrated on rehabilitation of main and secondary canals only in two selected irrigation systems - Armavir and Talin, AF activities enlarged their impact from the territorial point of view, covering new marzes. Besides, unlike the original project, AF included rehabilitation of on-farm network canals, which was not targeted under the first project.

16. AF consisted of the following components:

Component 1. Rehabilitation of the Main and Secondary Canals

(i) Civil works for rehabilitation of the primary canals, and

(ii) Consultancy services for supervision of rehabilitation works.

Component 2. Rehabilitation of On-farm Irrigation Network

(i) Civil works for rehabilitation of on-farm canals (USD 3, 86 million);

(ii) Consultancy services for supervision of civil works.

Component 3. Project Management and Institutional Activities

3.1 Additional Project Management

3.1.1. PIU staff and operation costs;

3.1.2. WUAs' Support Team

3.2 Consultancy services

3.2.1 Audits of PIU, WSAs, and WUAs; and

3.2.2 Feasibility study of Meghri Gravity Irrigation Scheme.

17. **Component 1** financed rehabilitation of a total 58,032 m of main and secondary canals, of which in Ararat Marz - 6,020 m, in Kotajk Marz - 18,989 m, in Aragatsotn Marz - 9,958 m, in Armavir - 14,050 m, in Shirak - 4,764 m, and in Lori - 4,251 m. The same component financed also consultancy services for supervision of rehabilitation works. The lengths of rehabilitated canals were longer than originally planned, coming to some 50.0 km, since the project implementation generated savings, which were used for rehabilitation of new stretches in Ararat Marz - 1,379 m, in Kotajk Marz - 4,585 m, in Aragatsotn Marz- 325 m, in Armavir Marz - 1,763 m, and in Shirak - 150 m. Reduction of water losses due to rehabilitation works amounted to around 34.4 million m^3 in the main and secondary canals.

18. **Component 2** rehabilitated in total 51,285 m of on-farm canals in 19 communities, of which 12 were in Armavir Marz, five – in Gegharkonik Marz, one in Lori Marz, and one in Shirak.

19. The Project design initially provided for rehabilitation of canals in the same 19 communities with total length of around 60 km. Selection of canal stretches for rehabilitation was based on the list of ready designs with major data prepared by MCA-Armenia.

20. However, during implementation of the project it became clear that the design solutions were not complying with reality and community demands. After review of the ready designs, verifications and adjustments of technical solutions the total rehabilitation length amounted to 51,285 m. At the same time, the size of the area under command of these canals did not change. As a result of rehabilitation works water losses in tertiary canals were redfuced by 9.9 million m^3. The second component financed also consultancy services for supervision of rehabilitation of on-farm network canals.

21. **Component 3** financed (a) the Project management (PIU and WUAs' Support Team), (b) audits (of the PIU, three WUAs: Sevan-Hrazdan Jrar CJSC, Akhuryan-Araks Jrar CJSC, Debet-Aghstev Jrar CJSC, and 44 WUAs); and (c) Feasibility Study of Meghry Gravity Iirgation Scheme.

5. Project Results Monitoring

5.1 Irrigation Rehabilitation Emergency Project

Project Outcomes Indicators	Baseline Data 2008	Target Value	Actual at Project Completion
Number of new person- months created	0	9,000	11,379
Amount of wages generated	0	USD 4.58 million	…
Intermediate Outcome Indicator			
Increase in irrigated area as a result of rehabilitation works	28,275 ha	35,570 ha	36,318 ha
Component 2 WUA business plans Subsidy policy study GIS WUA information system in place nation-wide	 None None 15	 Complete Complete 46	 Complete Complete 44[4]

5.2 Irrigation Rehabilitation Emergency Project Additional Financing

22. The table below reflects indicators and targets of the original IREP and IREP AF and corresponding actual data.

PDO	Original Target	Changes in AF	Revised Target	Actual at AF Completion
Reduction of water losses in the selected schemes. (% /amount)	97 mln. m^3	34,4 mln. m^3	131.4 mln. m^3	131.4 mln. m^3
Number of temporary person/months created.	9,000	7,000	16,000	18,410[5]
Potential increase of total irrigation area as a result of rehabilitation (IREP/AF).	35,570	52,050	87,600	87,600
Restored irrigation area in communities with rehabilitated tertiary network.	-	1,760	1,760	1,760
- Developed WUA business plans;	100%	100%	100%	

[4] At the Project completion the total number of WUAs became 44 due to merger of some WUAs.

[5] The actual number of temporary jobs created under IREP was 11379 person-months ; and 7031 man-months – under AF.

PDO	Original Target	Changes in AF	Revised Target	Actual at AF Completion
- GIS WUA information system in place nationwide; - Improved subsidy policy defined; - A pilot WUAs' Federation established.	100% Completed Completed	100% In progress Canceled	100% Completed Canceled	100% 100% Completed Canceled

6. Major Factors Influencing on the Implementation and Outcomes of the Project

23. Similar to IREP, the Additional Financing (AF) addressed problems arising from the economic crisis, while creating longer-term benefits for irrigation users through the improved quality of irrigation infrastructure. Activities implemented were similar to activities under IREP by their nature and methods. However, since the rehabilitation of canals was mostly implemented in those marzes, which were not included under the first project and were the poorest marzes of the country (Shirak, Kotajk, Lori, Gegharkounik, Ararat), the Project has significantly contributed to poverty reduction.

The Project achieved or exceeded all its main indicators. The total length of rehabilitated main canals is 58.0 km, and that of on-farm network canals - 51.3 km.

7. Project Costs and Financing

7.1 Irrigation Rehabilitation Emergency Project

(a) Project Cost by Component (in USD million equivalent)

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage at Appraisal
Rehabilitation of On-Farm Irrigation Network	33.08	34.13	103.17%
Project Management and Institutional Activities	3.25	2.35	72.31%
Total Baseline Cost	36.33	36.48	
Physical Contingencies	0.00	0.00	0.00
Price Contingencies	0.00	0.00	0.00
Total Project Costs	0.00	0.00	
Front-end fee PPF	0.00	0.00	0.00
Front-end fee IBRD	0.75	0.75	
Total Financing Required	37.08	37.23	

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		6.33	6.62	104.58%
International Bank for Reconstruction and Development		30.00	29.99	99.97%
Co-financing (beneficiaries)				

7.2 Irrigation Rehabilitation Emergency Project Additional Financing

(a) Project Cost by Component (in USD Million equivalent)

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Rehabilitation of Identified Stretches o Canals in the Selected Irrigation Schemes	15.90	16.06	101.01%
Rehabilitation of Tertiary Irrigation Networks	4.02	3.93	97.76%
Project Management and Institutional Activities	1.68	1.39	82.74%
Total Baseline Cost	21.60	21.38	
Physical Contingencies	0.00	0.00	0.00
Price Contingencies	0.00	0.00	0.00
Total Project Costs	0.00	0.00	
Front-end fee PPF	0.00	0.00	0.00
Front-end fee IBRD	0.45	0.45	
Total Financing Required	22.05	21.83	

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		3.40	3.38	99.41%
International Bank for Reconstruction and Development		18.00	17.99	99.94%
Co-financing (beneficiaries)		0.20	0.24	120.00%

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

Not applicable

Annex 9. List of Supporting Documents

Project Paper for the Irrigation Rehabilitation Emergency Project (IREP), July 9, 2009
Project Paper for Additional Financing to the IREP, September 27, 2011
Aide Memoires: May-June 2009 through June 2013
Implementation Status and Results Reports: November 2009 through June 2013
Project Appraisal Document for the Irrigation Systems Enhancement Project, April 25, 2013
Loan Agreement of Original Project
Loan Agreement of Additional Financing

Consultant Reports: Institutional Strengthening Study, June 15, 2011
Arrangements for Providing State Assistance Funds to Water Users Associations, June 15, 2011

MAP

IBRD 36939

ARMENIA
ARMENIA 2009 EMERGENCY PROJECTS LOCATION

- PRIMARY IRRIGATION CANALS TO BE REHABILITATED UNDER THE PROJECT
- PRIMARY ROADS (DUAL CARRIAGEWAYS)
- PRIMARY ROADS (OTHER)
- RAILROADS
- RESERVOIRS
- NATIONAL CAPITAL
- MARZ (PROVINCE) CAPITALS
- MAIN TOWNS/VILLAGES
- RIVERS
- INTERNATIONAL BOUNDARIES
- MARZ (PROVINCE) BOUNDARIES

GEORGIA
AZERBAIJAN
TURKEY
ISLAMIC REPUBLIC OF IRAN
LAKE SEVAN
SHIRAK
LORI
TAVUSH
ARAGATSOTN
KOTAYK
GEGHARKUNIK
YEREVAN
ARARAT
ARMAVIR
VAYOTS-DZOR
SYUNIK
Bagrateshen
Noyemberian
Dzoramut
Bavra
Tashir
Zorakert
Tavshut
Ashotsk
Alaverdi
Step'anavan
Amasiya
Verdaghbiur
Toumanian
Ijevan
Berd
Gyumri
Spitak
Vanadzor
Akhurit
Dilijan
Artik
Tsakhkahovit
Maralik
Aparan
Krasnosel'sk
Artsvashen
Sevan
Tsakhkadzor
Aragats
Hrazdan
Verin Talin
Gavar
Yegvard
Ashtarak
Abovian
Mets Mazra
Echmiadzin
YEREVAN
Oktemberjan
Garni
Vardenis
Bagaran
Martuni
Armavir
Dzhrarat
Markara
Massis
Artashat
Vedi
Ararat
Yeraskh
Jermuk
Yegegnadzor
Getap
Vaik
Angekhakot
Sisian
Goris
Zabukh
Tatev
Kapan
Kadzh
Kajaran
Megri
To Bagdanovka
To Dmanisi
To Shulaveri
To Nyzakh
To Kars
To Shakhtakhty
To Nakhichevan
To Shusha
To Zangelan
To Ordubad
Akhuryan R.
Araks R.
Vorotan R.

ARMENIA

0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS

44° 45° 46° 47° 48°
41° 40° 39°

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