

## No.17 Krashen

# Information on Existing Water Sources (Shirak)

Study for Improvement of  
Rural Water Supply and  
Sewage Systems in RA

No.17 Community Krashen  
District Akhuryan  
Marz Shirak

No	Water source	Latitude			Longitude			Altitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	Spring	40	53	18.7	43	58	7.7	1,945	25.0	40.0	10.0
2	Spring	40	53	14.2	43	58	6.3		3.0		
3	Spring	40	53	11.5	43	58	6.8		3.0		
4											
5											
6											
7											
8											
9											
10											

Notes:

Latitude, Longitude, Altitude:	Measured at site
Yield (Min, Max):	Interviewed to the Community
Yield (at site):	Measured / estimated at site in summer of 2007

Users Acceptnce for water quality	Acceptable
Notes	
Alternative sources if any	

No.17 Community Krashen  
District Akhuryan  
Marz Shirak  
Sampling date 24/Jul/2007

	Parameters analysed	Units	No.1	No.2	Guidelines	
					WHO	Armenia
a	pH		7.9	7.9		6.5-8 6.0 - 9.0
b	Temperature	Deg.C	11	12.4		
c	TDS	Mg/L	136	62	1000	1000
1	Al:Aluminum	Mg/L	n.d	n.d	0.10	0.50
2	B:Boron	Mg/L	n.d	n.d	0.70	0.50
3	Cl:Chloride	Mg/L	4	5	250	350
4	Cr:Chrome	Mg/L	n.d	n.d	0.05	0.05
5	Cu:Copper	Mg/L	n.d	n.d	2	1
6	F:Fluoride	Mg/L	0.10	0.10	1.50	
7	Hardness	Mg/L	300	295	500	700
8	Fe:Iron	Mg/L	0.02	n.d	0.30	0.30
9	Mn:Manganese	Mg/L	n.d	n.d	0.40	0.10
10	Mo:Molibdenum	Mg/L	n.d	n.d	0.070	0.250
11	Ni:Nickel	Mg/L	n.d	n.d	0.020	0.100
12	Nitrate(NO3+)	Mg/L	2.7	2.2	50.0	45.0
13	SO4:Sulfate	Mg/L	5.0	5.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d	n.d	3.0	5.0
15	As:Arsenic	Mg/L	n.d	n.d	0.0	0.1
16	Ba:Barium	Mg/L	0.13	0.11	0.70	0.10
17	Be:Berillium	Mg/L	n.d	n.d	NA	0.00020
18	Cd:Cadmium	Mg/L	n.d	n.d	0.0030	0.0010
19	Pb:Lead	Mg/L	0.001	0.001	0.010	0.030
20	Hg:Mercury	Mg/L	<0.0002	<0.0002	0.00100	0.00050
21	Se:Selenium	Mg/L	<0.001	<0.001	0.010	0.010
22	Sr:Strontium	Mg/L	0.3	0.3	NA	7.0
23	CN:Cyanide	Mg/L	n.d	n.d	0.070	0.035
24	Coli form bacteria	bacteria per 100 ml			-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml			0	0
26	Total bacteria	bacteria per 1 ml			-	50

# Information on Existing Water Sources

## Existing Bacteriological Test

## Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.17      Community      Krashen  
                District      Akhuryan  
                Marz          Shirak

No. 17 Marz Shirak Community Krashen**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Possible	Difficult	
	Intake	Possible	Difficult	
	Intake	Possible	Difficult	
2	Transmission pipeline	Possible	Difficult	Pipeline is mostly far from the road
3	Reservoir	Possible	Difficult	

**2. INTAKE STRUCTURE**

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°53'18,7"	43°58'07,7"	1,945	1950	Concrete	10.0	Yes
2	Spring	40°53'14,2"	43°58'06,3"	1,931	1950	Concrete	3.0	Yes
3	Spring	40°53'11,5"	43°58'06,8"	1,926	1999	Concrete	3.0	Yes

**3. TRANSMISSION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	300	200	Steel	5.0	1950	Little	Yes
2	300	150	Steel	2.7	1950	Little	Yes
3	400	100	Steel	3.0	1999	no	No

**4. RESERVOIR**

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m³)	Rehabilitation Necessity (Y/N)
1	40°53'07,3"	43°58'02,3"	1,900	Concrete	Rectangular	2,2×8×4	50	Yes
2	40°53'10,4"	43°58'06,7"	1,922	Concrete	Rectangular	2,2×8×4	50	Yes

**5. CHLORINATION EQUIPMENT**

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

**6. DISTRIBUTION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	800	150	Steel	1950	no	No
2	1,200	100	Steel		no	No
3	400	75	Steel		Little	Yes
4	450	50	Steel		Little	Yes

**7. PUMP STATION**

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m³)	House size (m)	Rehabilitation Necessity (Y/N)
No							

**8. PUBLIC TAPS**

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
3	1950		No	0	Yes

**9. DRAINAGE SYSTEM**

Existence	Rehabilitation	Remarks
Yes	Yes	DN250 for new village

**Questionnaire on Existing Water Supply Conditions  
by Socio-Economic Survey**

Marz	Shirak
Number and Name of Community	No.17 Krashen
District	Akhurian

No.	Question	Answer
<b>A: Baseline Data</b>		
A1	Actual population in 2001	292
A2	Actual population in 2007	296
A3	Number of households	76
A4.1	Elderly people	70
A4.2	Population in labor force (age from 16 to 62)	116
A4.3	Children	110
A5.1	Pensioners	42
A5.2	Unemployed	7
A5.3	Receiving benefits	27
A6	Average monthly income of household (AMD)	15,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	67
<b>B: Budget</b>		
B1	Annual Budget of the community 2004, in thousand AMD	250
	Annual Budget of the community 2005, in thousand AMD	300
	Annual Budget of the community 2006, in thousand AMD	800
	Annual Budget of the community 2007, in thousand AMD	300
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	30
	Amount spent in drinking water sector 2005, in thousand AMD	25
	Amount spent in drinking water sector 2006, in thousand AMD	20
	Amount spent in drinking water sector 2007, in thousand AMD	30
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned
<b>C: Socio-Economic Survey</b>		
C1	Major industries of the community:	dairy, meat, cereals
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no
<b>D: Water Usage and Water Demand Survey</b>		
D1	Does the community hold water use permit? 1-Yes 2-No	yes
D2	Water use permit number	1398
D3	Date of expiry of water use permit	07.05.07-07.05.10
D4	Planned date of obtaining water use permit	-
D5	Present condition of the water supply volume of Domestic use	almost sufficient
D6	Present condition of the water supply volume of Irrigation water	insufficient
D7	Number of house connection to drinking water system	76
D8	How many house connection household set the water meter	0
D9	Number of public taps	3
D10.1	How is the regime of water supply in your community in the dry season?	24 hrs
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	fully pleased
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (liter per day)	200

No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (liter per	200
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	from spring
D20	Are you satisfied with irrigation water supply volume?	insufficient

**E: Present Operation and Maintenance Works**

E1	Name of responsible for water supply	Iskandaryan Dzirayr
E2	Position	administration head
E3	Telephone	(093)497453
E4	Quantity and present condition of the water supply facilities: spring/ intake	3-partially repaired
E5	Quantity and present condition of the water supply facilities:	1 partially repaired
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	1-deteriorated
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	partially repaired
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	community
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	administration head
E14	How you prepare O&M costs?	donation from residents
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	30,000
	Others(AMD)	0
	Total (AMD)	30,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	residents participation

**F: Initial Environmental Examination (IEE)**

F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	yes
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

Shirak  
No.17 Krashen

Pipeline length (m)	Pipe diameter	Material
<b>TRANSMISSION PIPELINE</b>		
(1) 300	200	steel
(2) 300	150	steel
(3) 400	100	steel
<b>DISTRIBUTION PIPELINE</b>		
800	150	steel
1200	100	steel
400	75	steel
450	50	steel

	N	E	H (m)
A	40°53'18.7"	43°58'07.7"	1945
B	40°53'14.2"	43°58'06.3"	1931
C	40°53'11.5"	43°58'06.8"	1926
D	40°53'10.4"	43°58'06.7"	1922
E	40°53'07.3"	43°58'02.3"	1900

#### LEGENDS

- Spring intake
- Operating DRR
- Transmission pipeline
- Distribution pipeline

Krashen



Zuygaghbyur A

Zuygaghbyur B

Zuygaghbyur C

D

E

2

3

#### SCALE



Shirak Marz

The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia

No.	Community
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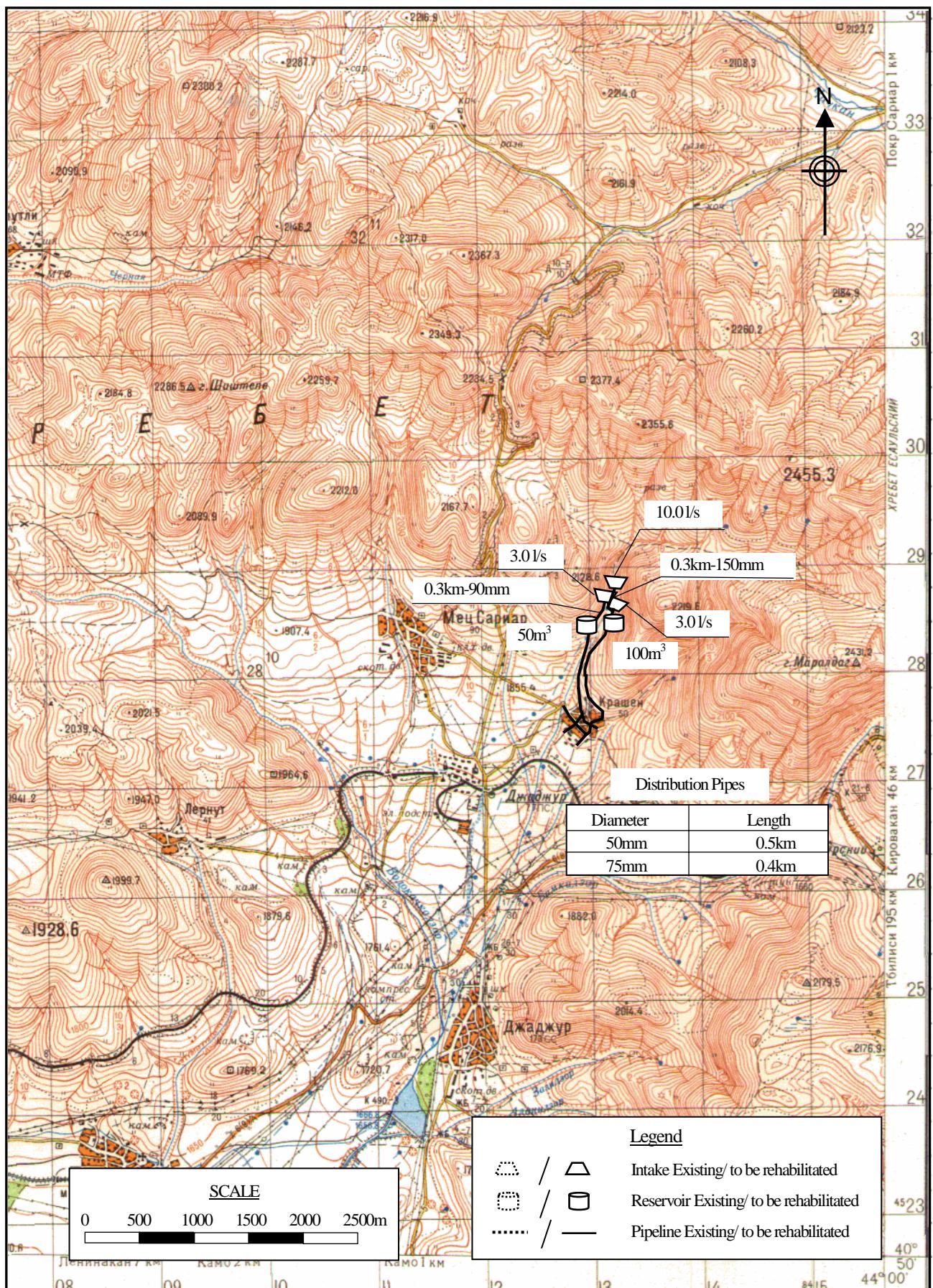
17	Krashen
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JICA STUDY TEAM 2007
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Marz : Shirak  
Name : Krashen

No.17

No.	Item	Quantity	Unit	Water demand (m3/d)
<b>A. WATER DEMAND</b>				
1	Population	296	persons	29.6
2	Factory	-	nos	0.0
3	School (pupils)	67	pupils	0.7
4	Medical Ambulance Station	-	nos	-
5	Policlinic	-	nos	-
6	Livestocks (87lit/household)	76	household	6.6
	Sub-total			36.9
	Unaccounted for water (20%)			7.4
1	Average Daily Water Demand			44.3 m3/day
2	Maximum Daily Water Demand			53.1 m3/day
3	Maximum Hourly Water Demand			11.5 m3/hr
<b>B. WATER SUPPLY PLAN</b>				
	1 Water source type	Nr.	Total vol.	
a	Spring	2	13.0	lit/sec
b	Spring	1	3.0	lit/sec
	Total			1123.2 m3/day
				259.2 m3/day
				1382.4 m3/day
	2 Required reservoir volume			138 m3
<b>C. WATER SUPPLY FACILITIES REHABILITATION PLAN</b>				
No	Item	Quantity	Unit	
1	Intake			
1m3		3	nos	
2m3			nos	
3m3			nos	
4m3			nos	
2	Transmission pipe			
50mm diameter			m	
75mm diameter			m	
90mm diameter		300	m	
110mm diameter			m	
150mm diameter		300	m	
200mm diameter			m	
250mm diameter			m	
3	Reservoir			
50m3 capacity		1	nos	
100m3 capacity		1	nos	
4	Distribution pipe			
50mm diameter		500	m	
75mm diameter		400	m	
90mm diameter			m	
110mm diameter			m	
150mm diameter			m	
200mm diameter			m	
250mm diameter			m	
5	House connection			
6	Water meter installation	76	nos	
7	Public tap	1	nos	
8	Chlorination	2	nos	
9	Pumps	-	nos	



#### Water Supply Facilities Rehabilitation Plan

Marz	Shirak	The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No. 17	Krashen	JICA STUDY TEAM

STUDY FOR IMPROVEMENT OF  
RURAL WATER SUPPLY AND  
SEWAGE SYSTEMS IN RA

Marz : **Shirak**

No. : **17**

Name : **Krashen**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	3	nos	367,700	1,103,100
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					1,103,100
2	Transmission Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm	300	m	8,040	2,412,000
		110mm		m	9,680	
		150mm	300	m	13,140	3,942,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					6,354,000
3	Reservoir					
		50m3	1	nos	8,363,900	8,363,900
		100m3	1	nos	12,968,300	12,968,300
		150m3		nos	18,804,500	
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					21,332,200
4	Distribution Pipe					
		50mm	500	m	5,520	2,760,000
		75mm	400	m	7,160	2,864,000
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					5,624,000
5	House Connection			nos	74,000	
6	Water Meter Installation		76	nos	80,000	6,080,000
7	Public Tap		1	nos	90,000	90,000
8	Chlorilation Equipment		2	nos	500,000	1,000,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa		360	m	3,600	1,296,000
<hr/>					AMD	42,879,300
					Equivalent to USD	140,349
					Equivalent to JPY	14,806,776
<hr/>					AMD	USD
Investment Cost per household					76 HH	564,201
Investment Cost per person					296 persons	144,863
						474

**SHIRAK MARZ  
Gyumri District  
No 17 Krashen**

### **PROJECTED INCOME STATEMENT**

**Unit: million AMD**

Description	Unit	Total	Year																																												
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40					
A Water Sales Revenue																																															
Consumption water volume	1000m <sup>3</sup> /yr		13.5																																												
Unit rate	AMD/m <sup>3</sup>		40.00	40.00	40.00	41.32	70.00	72.31	74.70	77.16	115.65	119.47	123.41	127.48	131.69	136.03	140.52	145.16	149.95	154.90	160.01	165.29	170.75	176.38	182.20	188.21	194.42	200.84	207.47	214.31	221.39	228.69	236.24	244.04	252.09	260.41	269.00	277.88	287.05	296.52							
Sub-total		75.56	0.00	0.00	0.48	0.48	0.48	0.50	0.85	0.88	0.91	0.94	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.76	1.82	1.88	1.94	2.00	2.07	2.14	2.21	2.28	2.36	2.43	2.51	2.60	2.68	2.77	2.86	2.96	3.06	3.16	3.26	3.37	3.48	3.59					
B Operating Costs																																															
1. Staff salary																																															
Inspectors	person																																														
Pump operators	person																																														
Base Salary	AMD/m <sup>3</sup> /p																																														
Sub-total		17.70	20,000	20,660	21,342	22,046	22,774	23,525	24,301	25,103	25,932	26,788	27,672	28,585	29,528	30,502	31,509	32,549	33,623	34,732	35,879	37,063	38,286	39,549	40,854	42,202	43,595	45,034	46,520	48,055	49,641	51,279	52,971	54,719	56,525	58,390	60,317	62,308	64,364	66,488							
0.24	0.25	0.26	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.46	0.47	0.49	0.51	0.52	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.75	0.77	0.80										
2. Chlorine																																															
Pouring volume	kg/yr																																														
Unit rate	AMD/kg																																														
Sub-total		3.59	600	620	640	661	683	706	729	753	778	804	830	858	886	915	945	976	1009	1042	1076	1112	1149	1186	1226	1266	1308	1351	1396	1442	1489	1538	1589	1642	1696	1752	1810	1869	1931	1995							
0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.16										
3. Electricity (for pump)																																															
4. Maintenance cost																																															
Pump repair																																															
Pipe repair																																															
5. Pump replacement																																															
Sub-total		31.65	0.00	0.00	0.43	0.44	0.46	0.46	0.49	0.50	0.52	0.54	0.55	0.58	0.59	0.61	0.63	0.65	0.68	0.70	0.72	0.74	0.77	0.79	0.82	0.85	0.88	0.91	0.94	0.97	1.00	1.04	1.07	1.10	1.14	1.17	1.22	1.25	1.29	1.34	1.38	1.43					
C Gross Income (A-B)		43.91	0.00	0.00	0.05	0.04	0.02	0.04	0.36	0.38	0.39	0.40	0.85	0.87	0.91	0.94	0.97	1.00	1.02	1.06	1.10	1.14	1.17	1.21	1.25	1.29	1.33	1.37	1.42	1.46	1.51	1.56	1.61	1.67	1.72	1.79	1.84	1.91	1.97	2.03	2.10	2.16					
D Depreciation cost		40.60																																													
E Interest paid		14.48	0.02	0.04	0.55	0.58	0.59	0.60	0.60	0.60	0.60	0.60	0.60	0.58	0.56	0.54	0.53	0.51	0.49	0.47	0.45	0.44	0.42	0.40	0.38	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.22	0.20	0.18	0.16	0.13	0.11	0.09	0.07	0.05	0.02					
F Net Income		-11.17	-0.02	-0.04	-0.50	-0.54	-0.57	-1.72	-1.40	-1.38	-1.37	-1.36	-0.91	-0.87	-0.81	-0.76	-0.72	-0.67	-0.63	-0.57	-0.51	-0.46	-0.41	-0.35	-0.29	-0.23	-0.17	-0.11	-0.04	0.02	0.09	0.16	0.23	0.31	0.38	0.47	0.55	0.64	0.72	0.80	0.89	0.98					
G Tax and duties		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H Net Income after deduction of TAX		-11.17	-0.02	-0.04	-0.50	-0.54	-0.57	-1.72	-1.40	-1.38	-1.37	-1.36	-0.91	-0.87	-0.81	-0.76	-0.72	-0.67	-0.63	-0.57	-0.51	-0.46	-0.41	-0.35	-0.29	-0.23	-0.17	-0.11	-0.04	0.02	0.09	0.16	0.23	0.31	0.38	0.47	0.55	0.64	0.72	0.80	0.89	0.98					
OM Cost Recovery Ratio (A/B)		23%	0%	0%	112%	109%	104%	109%	173%	176%	175%	174%	255%	250%	254%	254%	254%	254%	251%	253%	254%	252%	253%	252%	252%	251%	251%	251%	251%	250%	250%	252%	251%	253%	251%	253%	251%	252%	251%	251%							

## PROJECTED CASH FLOW STATEMENT

Unit: million AMD

**SHIRAK MARZ  
Gyumri District  
No 17 Krashen**

## **FINANCIAL ANALYSIS**

## A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
<b>1 Revenue</b>		
Water fee revenue	75.56	71.5%
Subsidy	30.14	28.5%
Total	105.70	100.0%
<b>2 Expenditure</b>		
OM cost	31.65	29.9%
Loan repayment	59.57	56.4%
Interest paid	14.48	13.7%
Surplus cash	0.00	0.0%
Total	105.70	100.0%

## B. FIRR CALCULATION

Description	Total	Year																																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
<b>A COST</b>																																									
1. Investment Cost	54.69	2.30	1.64	47.35	1.93	0.88	0.33	0.26																																	
2. Operation and Maintenance Cost																																									
Salary	9.12																																								
Chlorine	1.90																																								
Electricity	0.00																																								
Maintenance cost	5.52																																								
Pump replacement																																									
Sub-total	16.34																																								
Total Outflow	71.03	2.30	1.64	47.78	2.36	1.31	0.76	0.69	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43						
<b>B BENEFIT</b>																																									
1. Water Tariff	47.52	0.00	0.00	0.48	0.48	0.48	0.50	0.85	0.88	0.91	0.94	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40						
2. Subsidy	17.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.86	0.84	0.82	0.81	0.80	0.80	0.78	0.75	0.73	0.72	0.70	0.68	0.66	0.64	0.62	0.59	0.57	0.54	0.51	0.48	0.44	0.41	0.36	0.33	0.29	0.25	0.21	0.16	0.13
Total Inflow	64.86	0.00	0.00	0.48	0.48	0.48	0.50	0.85	0.88	0.91	0.94	2.26	2.26	2.24	2.22	2.21	2.20	2.20	2.18	2.15	2.13	2.12	2.10	2.08	2.06	2.04	2.02	1.99	1.97	1.94	1.91	1.88	1.84	1.81	1.76	1.73	1.69	1.65	1.61	1.56	1.53
<b>NET BENEFIT</b>	<b>-6.17</b>	<b>-2.30</b>	<b>-1.64</b>	<b>-47.3</b>	<b>-1.9</b>	<b>-0.8</b>	<b>-0.26</b>	<b>0.16</b>	<b>0.45</b>	<b>0.48</b>	<b>0.51</b>	<b>1.83</b>	<b>1.83</b>	<b>1.81</b>	<b>1.79</b>	<b>1.78</b>	<b>1.77</b>	<b>1.77</b>	<b>1.75</b>	<b>1.72</b>	<b>1.70</b>	<b>1.69</b>	<b>1.67</b>	<b>1.65</b>	<b>1.63</b>	<b>1.61</b>	<b>1.59</b>	<b>1.56</b>	<b>1.54</b>	<b>1.51</b>	<b>1.48</b>	<b>1.45</b>	<b>1.41</b>	<b>1.38</b>	<b>1.33</b>	<b>1.30</b>	<b>1.26</b>	<b>1.22</b>	<b>1.18</b>	<b>1.13</b>	<b>1.10</b>

**FIRR = -0.57%**

### **C. SENSITIVITY ANALYSIS**

No.	Description	PV	1.75%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40						
1	1 Capital cost 10% up	-24.52		-2.53	-1.80	-52.0	-2.1	-0.9	-0.29	0.13	0.45	0.48	0.51	1.83	1.83	1.81	1.79	1.78	1.77	1.77	1.75	1.72	1.70	1.69	1.67	1.65	1.63	1.61	1.59	1.56	1.54	1.51	1.48	1.45	1.41	1.38	1.33	1.30	1.26	1.22	1.18	1.13	1.10						
	2 Capital cost 20% up	-29.71		-2.76	-1.97	-56.8	-2.3	-1.0	-0.33	0.11	0.45	0.48	0.51	1.83	1.83	1.81	1.79	1.78	1.77	1.77	1.75	1.72	1.70	1.69	1.67	1.65	1.63	1.61	1.59	1.56	1.54	1.51	1.48	1.45	1.41	1.38	1.33	1.30	1.26	1.22	1.18	1.13	1.10						
2	1 OM cost 10% up	-20.47		-2.30	-1.64	-47.3	-1.9	-0.9	-0.30	0.12	0.41	0.44	0.47	1.79	1.79	1.77	1.75	1.74	1.73	1.73	1.73	1.71	1.71	1.68	1.66	1.65	1.63	1.61	1.59	1.57	1.55	1.52	1.50	1.47	1.44	1.41	1.37	1.34	1.29	1.26	1.22	1.18	1.14	1.09	1.06				
	2 OM cost 20% up	-21.62		-2.30	-1.64	-47.4	-2.0	-0.9	-0.35	0.07	0.36	0.39	0.42	1.74	1.74	1.72	1.70	1.69	1.68	1.66	1.64	1.63	1.61	1.60	1.58	1.56	1.54	1.52	1.50	1.47	1.45	1.42	1.39	1.36	1.32	1.29	1.24	1.21	1.17	1.13	1.09	1.04	1.01						
3	1 Revenue 10% down	-23.73		-2.30	-1.64	-47.3	-1.9	-0.9	-0.31	0.08	0.36	0.39	0.42	1.60	1.60	1.59	1.57	1.56	1.55	1.55	1.53	1.51	1.49	1.48	1.46	1.44	1.42	1.41	1.39	1.36	1.34	1.32	1.29	1.26	1.23	1.20	1.15	1.13	1.10	1.09	1.06	1.02	0.97	0.95	0.92	0.89	0.86	0.82	0.79
	2 Revenue 20% down	-28.14		-2.30	-1.64	-47.4	-2.0	-0.9	-0.36	-0.01	0.27	0.30	0.32	1.38	1.38	1.36	1.35	1.34	1.33	1.33	1.31	1.29	1.27	1.25	1.23	1.22	1.20	1.19	1.16	1.15	1.12	1.10	1.07	1.04	1.02	0.98	0.95	0.92	0.89	0.86	0.82	0.79							

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	-1.02%	-4.37	-22.87%
	2 Capital cost 20% up	-1.42%		-16.79%
2	1 OM cost 10% up	-0.73%	-2.17	-46.08%
	2 OM cost 20% up	-0.89%		-27.85%
3	1 Revenue 10% down	-1.24%	-5.36	-18.65%
	2 Revenue 20% down	-1.98%		-14.07%

**No.18 Krasar**

# Information on Existing Water Sources (Shirak)

Study for Improvement of  
Rural Water Supply and  
Sewage Systems in RA

No.18 Community Krasar  
District Ashotsk  
Marz Shirak

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	2 Springs	40	59	38.5	43	51	0.6	2,115	1.0	4.0	2.0
2											
3											
4											
5											
6											
7											
8											
9											
10											

Notes:

Latitude, Longitude, Atitude:	Measured at site
Yield (Min, Max):	Interviewed to the Community
Yield (at site):	Measured / estimated at site in summer of 2007

Users Acceptnace for water quality	Not acceptable
Notes	Open air, insanitation, losses in water supply system are 50%. Unacceptable water quality test results is shown by hygiene station.
Alternative sources if any	

No.18 Community Krasar  
District Ashotsk  
Marz Shirak  
Sampling date 08/Aug/2007

	Parameters analysed	Units	No.1	Guidelines	
				WHO	Armenia
a	pH		8.4		6.5-8 6.0 - 9.0
b	Temperature	Deg.C	12.3		
c	TDS	Mg/L	135		1000 1000
1	Al:Aluminum	Mg/L	n.d	0.10	0.50
2	B:Boron	Mg/L	n.d	0.70	0.50
3	Cl:Chloride	Mg/L	4	250	350
4	Cr:Chrome	Mg/L	n.d	0.05	0.05
5	Cu:Copper	Mg/L	n.d	2	1
6	F:Fluoride	Mg/L	0.36	1.50	
7	Hardness	Mg/L	315	500	700
8	Fe:Iron	Mg/L	n.d	0.30	0.30
9	Mn:Manganese	Mg/L	n.d	0.40	0.10
10	Mo:Mobdenium	Mg/L	n.d	0.070	0.250
11	Ni:Nickel	Mg/L	n.d	0.020	0.100
12	Nitrate(NO3+)	Mg/L	1.8	50.0	45.0
13	SO4:Sulfate	Mg/L	2.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d	3.0	5.0
15	As:Arsenic	Mg/L	n.d	0.0	0.1
16	Ba:Barium	Mg/L	0.04	0.70	0.10
17	Be:Berillium	Mg/L	0.00006	NA	0.00020
18	Cd:Cadmium	Mg/L	n.d	0.0030	0.0010
19	Pb:Lead	Mg/L	0.001	0.010	0.030
20	Hg:Mercury	Mg/L	<0.0002	0.00100	0.00050
21	Se:Selenium	Mg/L	<0.001	0.010	0.010
22	Sr:Strontium	Mg/L	0.1	NA	7.0
23	CN:Cyanide	Mg/L	n.d	0.070	0.035
24	Coli form bacteria	bacteria per 100 ml		-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml		0	0
26	Total bacteria	bacteria per 1 ml		-	50

## Information on Existing Water Sources Existing Bacteriological Test

## Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.18      Community      Krasar  
              District         Ashotsk  
              Marz             Shirak

No. 18 Marz Shirak Community Krasar**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Fair	Possible	
2	Transmission pipeline	Possible	Possible	Pipeline is mostly far from the road
3	Reservoir	Possible	Possible	

**2. INTAKE STRUCTURE**

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°59'38,5"	43°51'00,6"	2,115	2000	Concrete	2.0	Yes

**3. TRANSMISSION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	4.000	100	Polyethylene	1.0	1990	Medium	Yes

**4. RESERVOIR**

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m <sup>3</sup> )	Rehabilitation Necessity (Y/N)
1	41°00'53,8"	43°49'39,2"	2,035	Concrete	Rectangular	4x5x4	70	Yes

**5. CHLORINATION EQUIPMENT**

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

**6. DISTRIBUTION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	3.000	100	Steel/PE	1990	no	No
2	1,000	50	Steel	2000	no	No

**7. PUMP STATION**

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m <sup>3</sup> )	House size (m)	Rehabilitation Necessity (Y/N)
No							

**8. PUBLIC TAPS**

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
2	1900	2007	Yes	50	Yes

**9. DRAINAGE SYSTEM**

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
Yes	Yes	DN150-500 asbestos

**Questionnaire on Existing Water Supply Conditions  
by Socio-Economic Survey**

Marz	Shirak
Number and Name of Community	No.18 Krasar
District	Ashotsk

No.	Question	Answer
<b>A: Baseline Data</b>		
A1	Actual population in 2001	500
A2	Actual population in 2007	530
A3	Number of households	120
A4.1	Elderly people	68
A4.2	Population in labor force (age from 16 to 62)	327
A4.3	Children	135
A5.1	Pensioners	68
A5.2	Unemployed	2
A5.3	Receiving benefits	7
A6	Average monthly income of household (AMD)	15,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	95
<b>B: Budget</b>		
B1	Annual Budget of the community 2004, in thousand AMD	2,282
	Annual Budget of the community 2005, in thousand AMD	1,400
	Annual Budget of the community 2006, in thousand AMD	3,100
	Annual Budget of the community 2007, in thousand AMD	2,324
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	0
	Amount spent in drinking water sector 2005, in thousand AMD	0
	Amount spent in drinking water sector 2006, in thousand AMD	0
	Amount spent in drinking water sector 2007, in thousand AMD	0
	Amount spent in drinking water sector 2008, in thousand AMD	0
<b>C: Socio-Economic Survey</b>		
C1	Major industries of the community:	vegetables, dairy, meat
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no
<b>D: Water Usage and Water Demand Survey</b>		
D1	Does the community hold water use permit? 1-Yes 2-No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	is not planned
D5	Present condition of the water supply volume of Domestic use	insufficient
D6	Present condition of the water supply volume of Irrigation water	absent
D7	Number of house connection to drinking water system	120
D8	How many house connection household set the water meter	0
D9	Number of public taps	2
D10.1	How is the regime of water supply in your community in the dry season?	regularly
D10.2	How is the regime of water supply in your community in the wet season?	regularly
D11	What time of day water is given?	9-16, 16-9
D12	Are you pleased with duration of domestic water supply?	mainly displeased
D13	Are hours of water supply convenient?	mainly convenient
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (litter per day)	100

No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (litter per	100
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	absent
D20	Are you satisfied with irrigation water supply volume?	insufficient

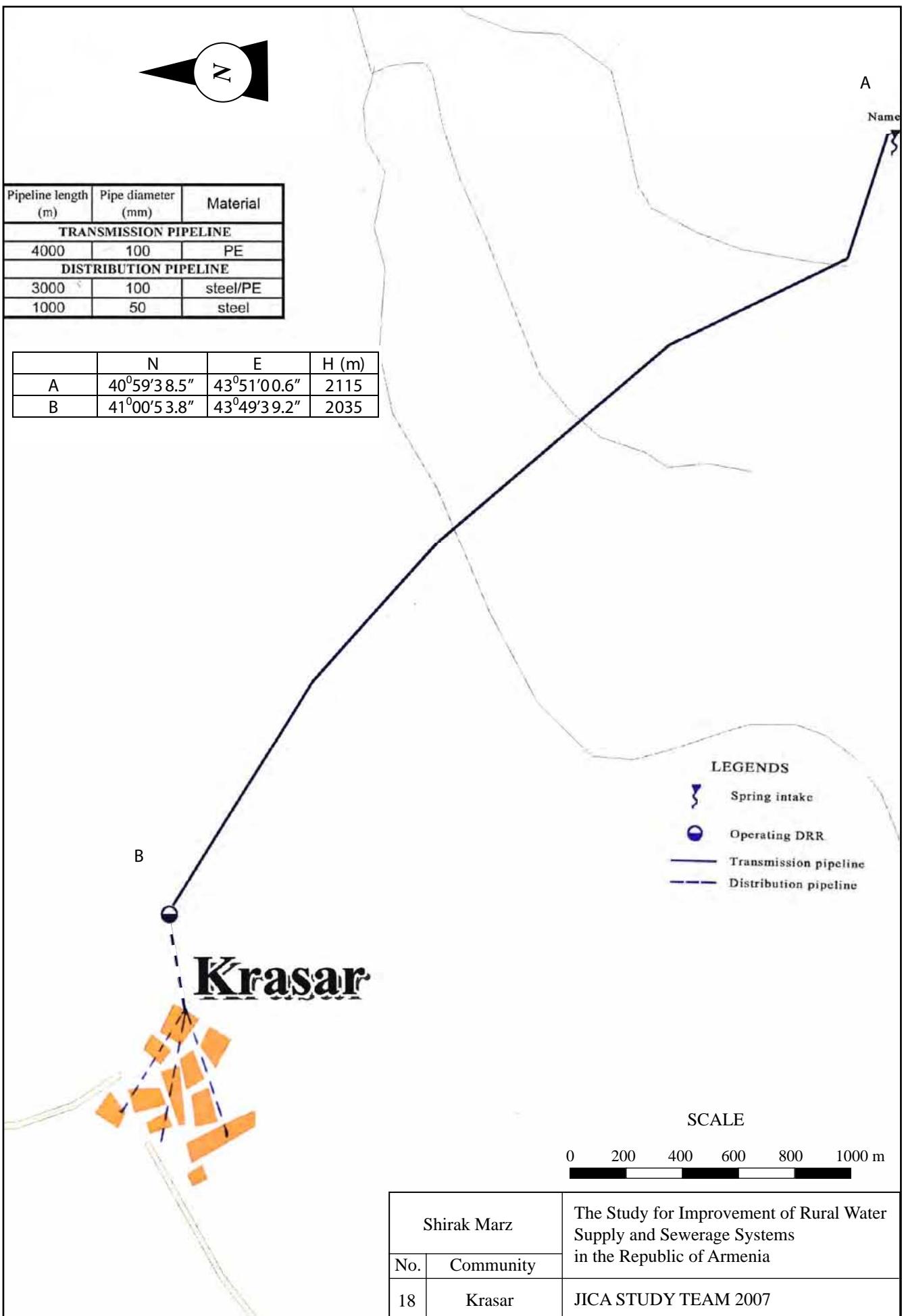
**E: Present Operation and Maintenance Works**

E1	Name of responsible for water supply	Grigoryan Davit
E2	Position	water distributor
E3	Telephone	with the help of administration head
E4	Quantity and present condition of the water supply facilities: spring/ intake	3-deteriorated
E5	Quantity and present condition of the water supply facilities:	1-partially repaired
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	absent
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	deteriorated
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	residents
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	administration head
E14	How you prepare O&M costs?	donation from residents
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	120,000
	Repair cost(AMD)	30,000
	Others(AMD)	0
	Total (AMD)	150,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	water fee

**F: Initial Environmental Examination (IEE)**

F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

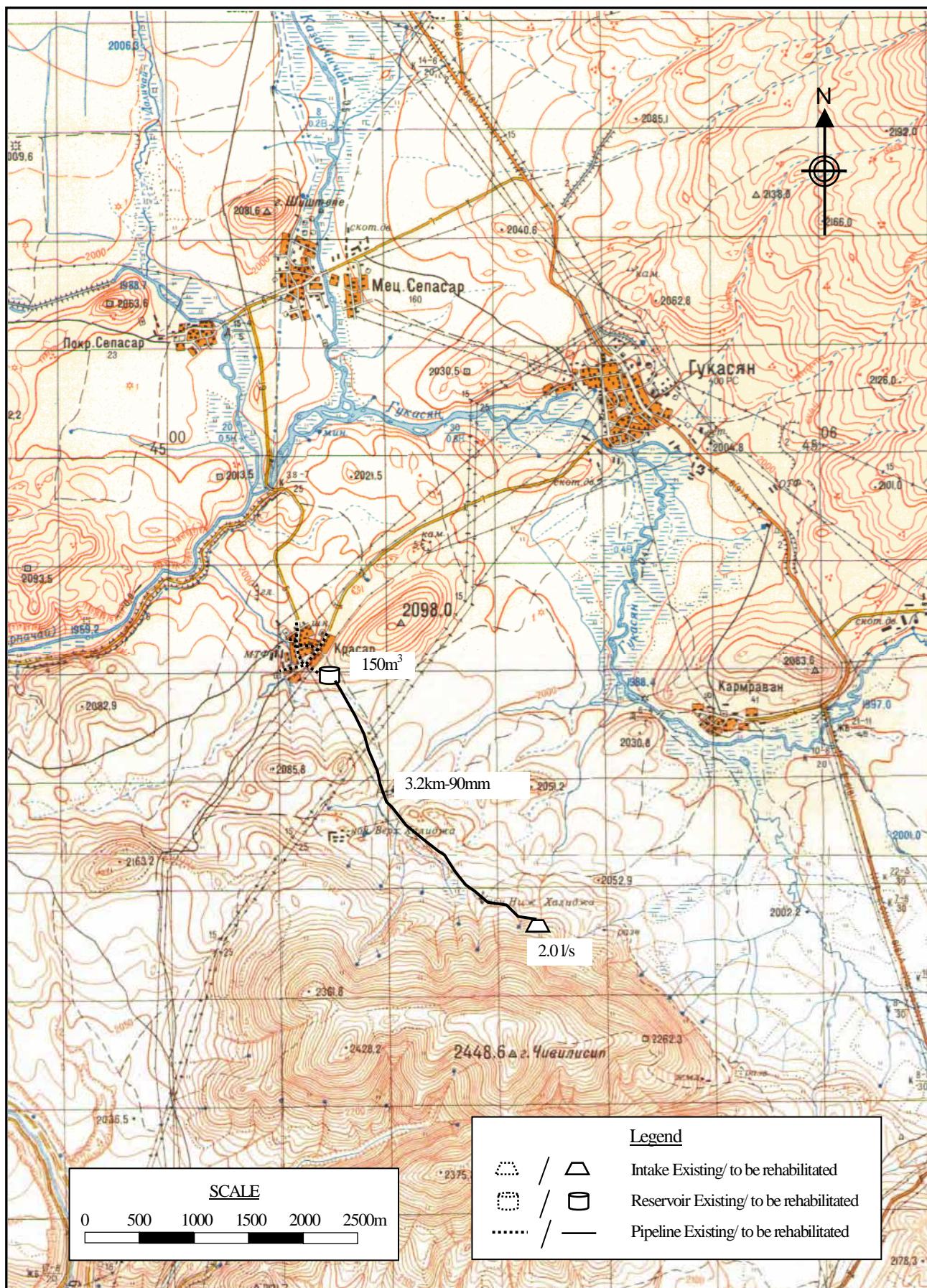
Shirak  
No.18 Krasar



Marz : Shirak  
Name : Krasar

No.18

No.	Item	Quantity	Unit	Water demand (m3/d)
<b>A. WATER DEMAND</b>				
1	Population	530	persons	53.0
2	Factory	-	nos	0.0
3	School (pupils)	95	pupils	1.0
4	Medical Ambulance Station	-	nos	-
5	Policlinic	-	nos	-
6	Livestocks (87lit/household)	120	household	10.4
	Sub-total			64.4
	Unaccounted for water (20%)			12.9
1	Average Daily Water Demand			77.3 m3/day
2	Maximum Daily Water Demand			92.7 m3/day
3	Maximum Hourly Water Demand			12.6 m3/hr
<b>B. WATER SUPPLY PLAN</b>				
	1 Water source type	Nr.	Total vol.	
	a Spring		2.0	lit/sec
				172.8 m3/day
	^ Total			172.8 m3/day
	2 Required reservoir volume			151 m3
<b>C. WATER SUPPLY FACILITIES REHABILITATION PLAN</b>				
No	Item	Quantity	Unit	
1	Intake			
	1m3	1	nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter	3,200	m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	150m3 capacity	1	nos	
4	Distribution pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	-	nos	
6	Water meter installation	120	nos	
7	Public tap	2	nos	
8	Chlorination	1	nos	
9	Pumps	-	nos	



Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Shirak	JICA STUDY TEAM
No. 18	Krasar	

STUDY FOR IMPROVEMENT OF  
RURAL WATER SUPPLY AND  
SEWAGE SYSTEMS IN RA

Marz : **Shirak**

No. : **18**

Name : **Krasar**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3		1 nos	367,700	367,700
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					367,700
2	Transmission Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm	3,200	m	8,040	25,728,000
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					25,728,000
3	Reservoir					
		50m3		nos	8,363,900	
		100m3		nos	12,968,300	
		150m3		1 nos	18,804,500	18,804,500
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					18,804,500
4	Distribution Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					
5	House Connection			nos	74,000	
6	Water Meter Installation		120	nos	80,000	9,600,000
7	Public Tap		2	nos	90,000	180,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa			m	3,600	
	Total				AMD	55,180,200
					Equivalent to USD	180,611
					Equivalent to JPY	19,054,435
					AMD	USD
	Investment Cost per household		120	HH	459,835	1,505
	Investment Cost per person		530	persons	104,114	341

**SHIRAK MARZ  
Amasia District  
No 18 Krasar**

### **PROJECTED INCOME STATEMENT**

**Unit: million AMD**

Description	Unit	Total	Year																																												
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40					
A Water Sales Revenue																																															
Consumption water volume	1000m3/yr	23.5																																													
Unit rate	AMD/m3	40.00	40.00	40.00	41.32	70.00	72.31	74.70	77.16	115.65	119.47	123.41	127.48	131.69	136.03	140.52	145.16	149.95	154.90	160.01	165.29	170.75	176.38	182.20	188.21	194.42	200.84	207.47	214.31	221.39	228.69	236.24	244.04	252.09	260.41	269.00	277.88	287.05	296.52								
Sub-total		131.01	0.00	0.00	0.85	0.85	0.87	1.48	1.53	1.58	1.63	2.45	2.53	2.61	2.70	2.79	2.88	2.97	3.07	3.17	3.28	3.39	3.50	3.61	3.73	3.85	3.98	4.11	4.25	4.39	4.53	4.68	4.84	5.00	5.16	5.33	5.51	5.69	5.88	6.07	6.27						
B Operating Costs																																															
1. Staff salary																																															
Inspectors	person	1																																													
Pump operators	person	0																																													
Base Salary	AMD/m/p	20,000	20,660	21,342	22,046	22,774	23,525	24,301	25,103	25,932	26,788	27,672	28,585	29,528	30,502	31,509	32,549	33,623	34,732	35,879	37,063	38,286	39,549	40,854	42,202	43,595	45,034	46,520	48,055	49,641	51,279	52,971	54,719	56,525	58,390	60,317	62,308	64,364	66,488								
Sub-total		0.24	0.25	0.26	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.46	0.47	0.49	0.51	0.52	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.75	0.77	0.80								
2. Chlorine																																															
Pouring volume	kg/yr	142																																													
Unit rate	AMD/kg	600	620	640	661	683	706	729	753	778	804	830	858	886	915	945	976	1009	1042	1076	1112	1149	1186	1226	1266	1308	1351	1396	1442	1489	1538	1589	1642	1696	1752	1810	1869	1931	1995								
Sub-total		0.00	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26	0.27	0.28										
3. Electricity (for pump)		6.19																																													
4. Maintenance cost		0.00																																													
Pump repair		0.00	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.38	0.39	0.40	0.41	0.43	0.44	0.46	0.47	0.49	0.50	0.52	0.54	0.55	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.72	0.74	0.77	0.79	0.82	0.84	0.87	0.90	0.93								
Pipe repair		0	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.38	0.39	0.40	0.41	0.43	0.44	0.46	0.47	0.49	0.50	0.52	0.54	0.55	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.72	0.74	0.77	0.79	0.82	0.84	0.87	0.90	0.93								
5. Pump replacement		0.00																																													
Sub-total		44.26	0.00	0.00	0.24	0.63	0.65	0.66	0.69	0.71	0.73	0.76	0.78	0.81	0.84	0.86	0.89	0.93	0.95	0.99	1.01	1.06	1.08	1.12	1.16	1.19	1.23	1.28	1.32	1.36	1.41	1.45	1.50	1.56	1.61	1.66	1.71	1.77	1.82	1.89	1.94	2.01					
C Gross Income (A-B)		86.75	0.00	0.00	-0.24	0.22	0.20	0.21	0.79	0.82	0.85	0.87	1.67	1.72	1.77	1.84	1.90	1.95	2.02	2.08	2.16	2.22	2.31	2.38	2.45	2.54	2.62	2.70	2.79	2.89	2.98	3.08	3.18	3.28	3.39	3.50	3.62	3.74	3.87	3.99	4.13	4.26					
D Depreciation cost		52.50																																													
E Interest paid		17.72	0.02	0.04	0.06	0.74	0.75	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76								
F Net Income		16.53	-0.02	-0.04	-0.30	-0.52	-0.55	-2.05	-1.47	-1.44	-1.41	-1.39	-0.59	-0.52	-0.44	-0.35	-0.27	-0.20	-0.10	-0.02	0.08	0.17	0.28	0.37	0.47	0.58	0.69	0.79	0.91	1.03	1.15	1.28	1.40	1.53	1.67	1.80	1.95	2.10	2.26	2.40	2.57	2.73					
G Tax and duties		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H Net Income after deduction of TAX		16.53	-0.02	-0.04	-0.30	-0.52	-0.55	-2.05	-1.47	-1.44	-1.41	-1.39	-0.59	-0.52	-0.44	-0.35	-0.27	-0.20	-0.10	-0.02	0.08	0.17	0.28	0.37	0.47	0.58	0.69	0.79	0.91	1.03	1.15	1.28	1.40	1.53	1.67	1.80	1.95	2.10	2.26	2.40	2.57	2.73					
OM Cost Recovery Ratio (A/B)		79.6%	0%	0%	0%	135%	131%	132%	214%	215%	216%	214%	314%	312%	311%	314%	313%	310%	313%	310%	314%	309%	314%	313%	311%	313%	311%	313%	311%	312%	312%	310%	311%	311%	312%	312%	310%	311%	311%	313%	313%	312%					

#### PROJECTED CASH FLOW STATEMENT

Unit: million AMD

**SHIRAK MARZ**  
Amasia District  
No 18 Krasar

FINANCIAL ANALYSIS

## A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
<b>1 Revenue</b>		
Water fee revenue	131.01	89.8%
Subsidy	14.86	10.2%
Total	145.87	100.0%
<b>2 Expenditure</b>		
OM cost	44.26	30.3%
Loan repayment	75.83	52.0%
Interest paid	17.72	12.1%
Surplus cash	8.06	5.5%
Total	145.87	100.0%

## B. FIRR CALCULATION

**FIRR = -0.33%**

### **C. SENSITIVITY ANALYSIS**

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	-0.79%	-5.88	-17.01%
	2 Capital cost 20% up	-1.21%		-13.71%
2	1 OM cost 10% up	-0.51%	-3.54	-28.25%
	2 OM cost 20% up	-0.69%		-19.03%
3	1 Revenue 10% down	-1.04%	-6.84	-14.62%
	2 Revenue 20% down	-1.83%		-12.18%

**No.19 Mayisan Kayaran**

# Information on Existing Water Sources (Shirak)

Study for Improvement of  
Rural Water Supply and  
Sewage Systems in RA

No.19 Community Mayisyan+Kayarani  
District Akhuryan  
Marz Shirak

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	Water Main	40	51	4.6	43	51	43.2	1,662	0.1	2.0	0.2
2											
3											
4											
5											
6											
7											
8											
9											
10											

Notes:

Latitude, Longitude, Atitude:	Measured at site
Yield (Min, Max):	Interviewed to the Community
Yield (at site):	Measured / estimated at site in summer of 2007

Users Acceptnace for water quality	Acceptable
Notes	Water is taken from the pipeline to Akhouryan and the community has only one public tap.
Alternative sources if any	

No.19 Community Mayisyan+Kayarani  
District Akhuryan  
Marz Shirak  
Sampling date 19/Jul/2007

	Parameters analysed	Units	No.1	Guidelines	
				WHO	Armenia
a	pH		7.6		6.5-8 6.0 - 9.0
b	Temperature	Deg.C	11.5		
c	TDS	Mg/L	45		1000 1000
1	Al:Aluminum	Mg/L	0.05		0.10 0.50
2	B:Boron	Mg/L	n.d		0.70 0.50
3	Cl:Chloride	Mg/L	6		250 350
4	Cr:Chrome	Mg/L	n.d		0.05 0.05
5	Cu:Copper	Mg/L	n.d		2 1
6	F:Fluoride	Mg/L	0.12		1.50
7	Hardness	Mg/L	205		500 700
8	Fe:Iron	Mg/L	0.01		0.30 0.30
9	Mn:Manganese	Mg/L	n.d		0.40 0.10
10	Mo:Mobdenium	Mg/L	n.d		0.070 0.250
11	Ni:Nickel	Mg/L	0.009		0.020 0.100
12	Nitrate(NO3+)	Mg/L	2.2		50.0 45.0
13	SO4:Sulfate	Mg/L	3.0		250.0 500.0
14	Zn:Zink	Mg/L	n.d		3.0 5.0
15	As:Arsenic	Mg/L	n.d		0.0 0.1
16	Ba:Barium	Mg/L	0.01		0.70 0.10
17	Be:Berillium	Mg/L	n.d	NA	0.00020
18	Cd:Cadmium	Mg/L	n.d		0.0030 0.0010
19	Pb:Lead	Mg/L	0.002		0.010 0.030
20	Hg:Mercury	Mg/L	<0.0002		0.00100 0.00050
21	Se:Selenium	Mg/L	<0.001		0.010 0.010
22	Sr:Strontium	Mg/L	<0.7	NA	7.0
23	CN:Cyanide	Mg/L	n.d		0.070 0.035
24	Coli form bacteria	bacteria per 100 ml		-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml		0	0
26	Total bacteria	bacteria per 1 ml		-	50

# Information on Existing Water Sources

## Existing Bacteriological Test

## Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.19 Community Mayisan Kayaran  
District Akhuryan  
Marz Shirak

No. 19 Marz Shirak Community Mayisyan Kayaran**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Possible	Possible	
2	Transmission pipeline	Possible	Possible	Pipeline is mostly far from the road
3	Reservoir			No reservoir

**2. INTAKE STRUCTURE**

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	fed from main	40°51'04,6"	43°51'43,2"	1,662	1976	iron	0.2	Yes

**3. TRANSMISSION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	100	100	Ductile Iron	0.2	1970	no	No

**4. RESERVOIR**

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	No							

**5. CHLORINATION EQUIPMENT**

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

**6. DISTRIBUTION PIPELINE**

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	250	50	Ductile Iron	1976	Little	No

**7. PUMP STATION**

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m3)	House size (m)	Rehabilitation Necessity (Y/N)
No							

**8. PUBLIC TAPS**

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
3	1950	1990	Yes	100	Yes

**9. DRAINAGE SYSTEM**

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
No	Yes	

**Questionnaire on Existing Water Supply Conditions  
by Socio-Economic Survey**

Marz	Shirak
Number and Name of Community	No.19 Mayisyan Kayaran
District	Akhurian

No.	Question	Answer
<b>A: Baseline Data</b>		
A1	Actual population in 2001	49
A2	Actual population in 2007	49
A3	Number of households	20
A4.1	Elderly people	10
A4.2	Population in labor force (age from 16 to 62)	24
A4.3	Children	15
A5.1	Pensioners	11
A5.2	Unemployed	25
A5.3	Receiving benefits	3
A6	Average monthly income of household (AMD)	10,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	10
<b>B: Budget</b>		
B1	Annual Budget of the community 2004, in thousand AMD	6,600
	Annual Budget of the community 2005, in thousand AMD	5,154
	Annual Budget of the community 2006, in thousand AMD	2,245
	Annual Budget of the community 2007, in thousand AMD	3,523
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	0
	Amount spent in drinking water sector 2005, in thousand AMD	0
	Amount spent in drinking water sector 2006, in thousand AMD	0
	Amount spent in drinking water sector 2007, in thousand AMD	0
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned
<b>C: Socio-Economic Survey</b>		
C1	Major industries of the community:	dairy, meat, vegetables
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no
<b>D: Water Usage and Water Demand Survey</b>		
D1	Does the community hold water use permit? 1-Yes 2-No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	is not planned
D5	Present condition of the water supply volume of Domestic use	almost sufficient
D6	Present condition of the water supply volume of Irrigation water	sufficient
D7	Number of house connection to drinking water system	20
D8	How many house connection household set the water meter	0
D9	Number of public taps	5
D10.1	How is the regime of water supply in your community in the dry season?	24 hrs
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	fully pleased
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (liter per day)	200

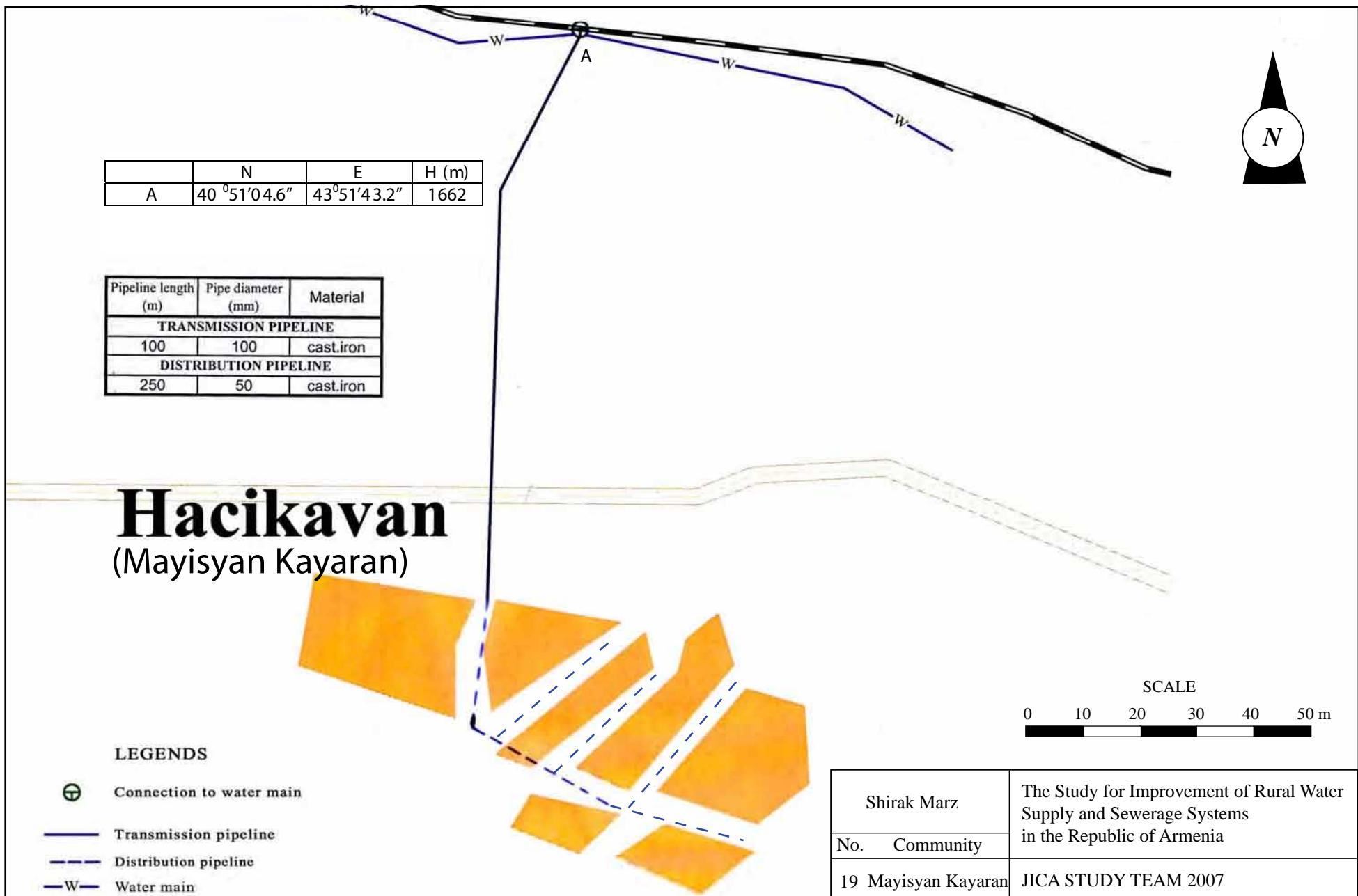
No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (liter per	200
D16	Drinking water monthly water fee per household	400AMD per capita/ month
D17	How often do you usually pay water fees?	monthly
D18	Water fee structure 1Flat rate, 2 Having water tariff	flat rate
D19	Where do you acquire the irrigation water?	WUA
D20	Are you satisfied with irrigation water supply volume?	sufficient

**E: Present Operation and Maintenance Works**

E1	Name of responsible for water supply	Serikyan Nune
E2	Position	water distributor
E3	Telephone	with the help of administration head
E4	Quantity and present condition of the water supply facilities: spring/ intake	absent
E5	Quantity and present condition of the water supply facilities:	2-deteriorated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	absent
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	deteriorated
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	nobody
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	administration head
E14	How you prepare O&M costs?	community budget
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	according to collections
	Repair cost(AMD)	0
	Others(AMD)	0
	Total (AMD)	0
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	difficult to answer

**F: Initial Environmental Examination (IEE)**

F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent



Marz : Shirak  
Name : Mayisyan Kayaran

No.19

No.	Item	Quantity	Unit	Water demand (m3/d)
<b>A. WATER DEMAND</b>				
1	Population	49	persons	4.9
2	Factory	-	nos	0.0
3	School (pupils)	10	pupils	0.1
4	Medical Ambulance Station	-	nos	-
5	Policlinic	-	nos	-
6	Livestocks (87lit/household)	20	household	1.7
	Sub-total			6.7
	Unaccounted for water (20%)			1.3
1	Average Daily Water Demand			8.0 m3/day
2	Maximum Daily Water Demand			9.6 m3/day
3	Maximum Hourly Water Demand			2.4 m3/hr
<b>B. WATER SUPPLY PLAN</b>				
	1 Water source type	Nr.	Total vol.	
	a Existing pipeline	1	0.2 lit/sec	17.3 m3/day
	^ Total			17.3 m3/day
	2 Required reservoir volume			28 m3
<b>C. WATER SUPPLY FACILITIES REHABILITATION PLAN</b>				
No	Item	Quantity	Unit	
1	Intake			
	1m3	1	nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	50m3 capacity	1	nos	
			nos	
4	Distribution pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	-	nos	
6	Water meter installation	20	nos	
7	Public tap	1	nos	
8	Chlorination	1	nos	
9	Pumps	-	nos	



#### Water Supply Facilities Rehabilitation Plan

The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia

Marz Shirak

No. 19 Mayisan Kayaran

JICA STUDY TEAM

STUDY FOR IMPROVEMENT OF  
RURAL WATER SUPPLY AND  
SEWAGE SYSTEMS IN RA

Marz : **Shirak**

No. : **19**

Name : **Mayisyan Kayaran**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	1	nos	367,700	367,700
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					367,700
2	Transmission Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					
3	Reservoir					
		50m3	1	nos	8,363,900	8,363,900
		100m3		nos	12,968,300	
		150m3		nos	18,804,500	
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					8,363,900
4	Distribution Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					
5	House Connection			nos	74,000	
6	Water Meter Installation		20	nos	80,000	1,600,000
7	Public Tap		1	nos	90,000	90,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa			m	3,600	
<b>Total</b>					<b>AMD</b>	<b>10,921,600</b>
					Equivalent to USD	35,748
					Equivalent to JPY	3,771,369
					<b>AMD</b>	<b>USD</b>
	Investment Cost per household		20	HH	546,080	1,787
	Investment Cost per person		49	persons	222,890	730

**SHIRAK MARZ  
Gyumri District  
No 19 Mayisyan Kayaran**

## PROJECTED INCOME STATEMENT

**Unit: million AMD**

### **PROJECTED CASH FLOW STATEMENT**

**Unit: million AMD**

SHIRAK MARZ  
Gyumri District  
No 19 Mayisan Kayaran

#### FINANCIAL ANALYSIS

##### A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
<b>1 Revenue</b>		
Water fee revenue	13.69	29.0%
Subsidy	33.52	71.0%
<b>Total</b>	<b>47.21</b>	<b>100.0%</b>
<b>2 Expenditure</b>		
OM cost	19.08	40.4%
Loan repayment	22.62	47.9%
Interest paid	5.51	11.7%
Surplus cash	0.00	0.0%
<b>Total</b>	<b>47.21</b>	<b>100.0%</b>

##### B FIRR CALCULATION

Description	Total	Year																																					Unit: million AMD																								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40																						
<b>A COST</b>																																																															
1. Investment Cost	20.97	2.30	1.64	13.63	1.93	0.88	0.33	0.26																																																							
2. Operation and Maintenance Cost																																																															
Salary	9.12																																																														
Chlorine	0.38																																																														
Electricity	0.00																																																														
Maintenance cost	0.38																																																														
Pump replacement																																																															
Pump replacement																																																															
Sub-total	9.88																																																														
Total Outflow	30.85	2.30	1.64	13.89	2.19	1.14	0.59	0.52	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26																	
<b>B BENEFIT</b>																																																															
1. Water Tariff	8.50	0.00	0.00	0.09	0.09	0.09	0.09	0.09	0.15	0.16	0.16	0.17	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25							
2. Subsidy	28.01	0.00	0.00	0.17	0.18	0.19	0.19	0.14	0.14	0.15	0.15	0.15	0.73	0.74	0.74	0.75	0.76	0.78	0.79	0.80	0.81	0.83	0.84	0.85	0.85	0.86	0.88	0.89	0.89	0.91	0.92	0.94	0.94	0.97	0.98	0.99	1.02	1.02	1.03	1.05	1.06	1.08	1.08	1.09	1.10	1.10	1.11	1.13	1.14	1.14	1.16	1.17	1.19	1.19	1.22	1.23	1.24	1.27	1.27	1.28	1.30	1.31	1.33
Total Inflow	36.51	0.00	0.00	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.98	0.99	0.99	1.00	1.01	1.03	1.04	1.05	1.06	1.08	1.09	1.10	1.10	1.11	1.13	1.14	1.14	1.16	1.17	1.19	1.19	1.22	1.23	1.24	1.27	1.27	1.28	1.30	1.31	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.39	1.40														
<b>NET BENEFIT</b>	<b>5.66</b>	<b>-2.30</b>	<b>-1.64</b>	<b>-13.6</b>	<b>-1.9</b>	<b>-0.9</b>	<b>-0.31</b>	<b>-0.23</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.72</b>	<b>0.73</b>	<b>0.73</b>	<b>0.74</b>	<b>0.75</b>	<b>0.77</b>	<b>0.78</b>	<b>0.79</b>	<b>0.80</b>	<b>0.82</b>	<b>0.83</b>	<b>0.84</b>	<b>0.84</b>	<b>0.85</b>	<b>0.87</b>	<b>0.88</b>	<b>0.88</b>	<b>0.90</b>	<b>0.91</b>	<b>0.93</b>	<b>0.93</b>	<b>0.96</b>	<b>0.97</b>	<b>0.98</b>	<b>1.01</b>	<b>1.01</b>	<b>1.02</b>	<b>1.04</b>	<b>1.05</b>	<b>1.07</b>																						

FIRR = **1.04%**

##### C SENSITIVITY ANALYSIS

No.	Description	PV 1.75%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40																			
1	1 Capital cost 10% up	-4.86	-2.53	-1.80	-15.0	-2.1	-0.9	-0.34	-0.26	0.04	0.05	0.06	0.72	0.73	0.73	0.74	0.75	0.77	0.78	0.79	0.80	0.82	0.83	0.84	0.84	0.85	0.87	0.88	0.88	0.90	0.91	0.93	0.93	0.96	0.97	0.98	1.01	1.01	1.02	1.04	1.05	1.07																			
	2 Capital cost 20% up	-6.85	-2.76	-1.97	-16.4	-2.3	-1.0	-0.38	-0.28	0.04	0.05	0.06	0.72	0.73	0.73	0.74	0.75	0.77	0.78	0.79	0.80	0.82	0.83	0.84	0.84	0.85	0.87	0.88	0.88	0.90	0.91	0.93	0.93	0.96	0.97	0.98	1.01	1.01	1.02	1.04	1.05	1.07																			
2	1 OM cost 10% up	-3.56	-2.30	-1.64	-13.7	-1.9	-0.9	-0.34	-0.26	0.01	0.02	0.03	0.69	0.70	0.70	0.71	0.72	0.74	0.75	0.76	0.77	0.79	0.80	0.81	0.81	0.82	0.84	0.85	0.85	0.87	0.88	0.90	0.90	0.93	0.94	0.95	0.98	0.98	0.99	1.01	1.02	1.04	1.05	1.06	1.08																
	2 OM cost 20% up	-4.25	-2.30	-1.64	-13.7	-2.0	-0.9	-0.36	-0.28	-0.01	0.00	0.01	0.67	0.68	0.68	0.69	0.70	0.72	0.73	0.74	0.75	0.77	0.78	0.79	0.80	0.82	0.83	0.83	0.85	0.86	0.88	0.88	0.91	0.92	0.93	0.96	0.96	0.97	0.99	1.00	1.02	1.04	1.05	1.06	1.08																
3	1 Revenue 10% down	-5.26	-2.30	-1.64	-13.7	-1.9	-0.9	-0.34	-0.26	0.01	0.02	0.03	0.62	0.63	0.63	0.64	0.65	0.67	0.68	0.69	0.71	0.72	0.73	0.73	0.74	0.76	0.77	0.77	0.78	0.79	0.81	0.81	0.84	0.85	0.86	0.88	0.88	0.91	0.92	0.94	0.94	0.96	0.97	0.98	0.99	1.02	1.04	1.05	1.06	1.08											
	2 Revenue 20% down	-7.66	-2.30	-1.64	-13.7	-2.0	-0.9	-0.37	-0.29	-0.02	-0.01	0.00	0.52	0.53	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.65	0.67	0.68	0.69	0.69	0.72	0.72	0.73	0.76	0.76	0.78	0.79	0.80	0.80	0.82	0.83	0.84	0.85	0.86	0.88	0.89	0.91	0.92	0.94	0.94	0.96	0.97	0.98	0.99	1.02	1.04	1.05	1.06	1.08

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	0.62%	6.79	14.74%
	2 Capital cost 20% up	0.24%	32.92	3.04%
2	1 OM cost 10% up	0.87%	2.03	49.33%
	2 OM cost 20% up	0.69%	5.14	19.46%
3	1 Revenue 10% down	0.39%	16.73	5.98%
	2 Revenue 20% down	-0.34%	-40.80	-2.45%