<Explanation of the Draft Outline Design Report>

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY (PHASE II)
ON
THE PROJECT FOR REHABILITATION AND IMPROVEMENT
OF WATER FACILITIES
IN TAFIELEH GOVERNORATE
IN THE HASHEMITE KINGDOM OF JORDAN
(EXPLANATION ON DRAFT OUTLINE DESIGN REPORT)

In April 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") conducted the Preparatory Survey (Phase II) for the Outline Design on the Project for Rehabilitation and Expansion of the Water Facilities in Southern Governorates of Tafieleh and Ma'an to Jordan and through discussion, field survey and technical examination of the results in Japan, JICA prepared a draft outline design report (hereinafter referred to as "the Draft Report").

In order to explain and to consult with the Government of Jordan on the components of the Draft Report, JICA sent to Jordan the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Fumihiko Okiura, Director, Water Resources Management Division I, Water Resources and Disaster Management Group, Global Environment Department, JICA, and is scheduled to stay in the country from October 24th to 28th, 2010.

The Team held discussions with the officials concerned of the Government of Jordan. In the course of discussions, both sides confirmed the main items described in the attached sheets.

Amman, 28 October, 2010

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ATTACHMENT

1. Component of the Draft Report

The Jordanian side agreed and accepted in principle the components of the Draft Report explained by the Team. The components of the Project are shown in **Annex-1**.

2. Japan's Grant Aid Scheme

The Jordanian side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Jordan as explained by the Team and described in Annex-5 and Annex-6 of the Minutes of Discussions signed by both sides on 14 April, 2010.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed item and send it to the Government of Jordan by January 2011.

4. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

4-1) Project Title

The Jordanian side agreed to modify the Project Title as "the Project for Rehabilitation and Improvement of the Water Facilities in Tafieleh Governorate" (hereinafter referred to as "the Project") proposed by the Team according to the final components of the Project.

4-2) Components of the Project

The Jordanian side agreed the components of the Project described in **Annex-1** and **Annex-2**.

4-3) Project Cost Estimate

The Team explained to the Jordanian side the Project Cost Estimate as described in **Annex-3**. It is provisional estimate and would be further examined by the Government of Japan for the approval of the Grant. The Jordanian side understood that the Project Cost Estimate is not final and subject to be modified. Both sides agreed that the Project Cost Estimate should never be duplicated or released to any outside parties until signing of all the contract(s) for the Project.

4-4) Undertakings and Obligations of Jordanian Side

1) In case the Project would be approved by the Government of Japan, Jordanian side would execute the obligations with the progress of the construction and procurement in additional to major undertakings described in **Annex-4**.

2) The Jordanian side agreed and committed to allocate enough budgets and implement necessary works as described in **Annex-5**.

4-5) "Soft Component" of the Project

1) The Project would implement the technology transfer and capacity building on distribution management as a portion of Soft Component, so that the Jordanian side would be able to monitor and manage water flow and pressure in the overall water supply system effectively.

2) The Jordanian side agreed and committed to assign the responsible personnel in charge of the distribution management in WAJ Tafieleh Governorate as counterpart for technical assistance, and to promote continuous efforts to reduce non revenue water.

3) USAID will conduct training on GIS data management and hydraulic modeling for existing systems from February 2011 under Water / Wastewater Infrastructure Project, including Tafieleh Governorate. Both sides confirmed that the Soft Component will be conducted for effective management of water distribution and non revenue water reduction utilizing the new distribution system constructed by the Project, based on the skills and knowledge acquired through the USAID project.

4-6) Overlapping with other projects

Both sides confirmed that the Project would not be overlapped with any other project supported by other donor agencies, NGOs, and Jordanian official organizations.

4-7) Environmental Impact Assessment (EIA)

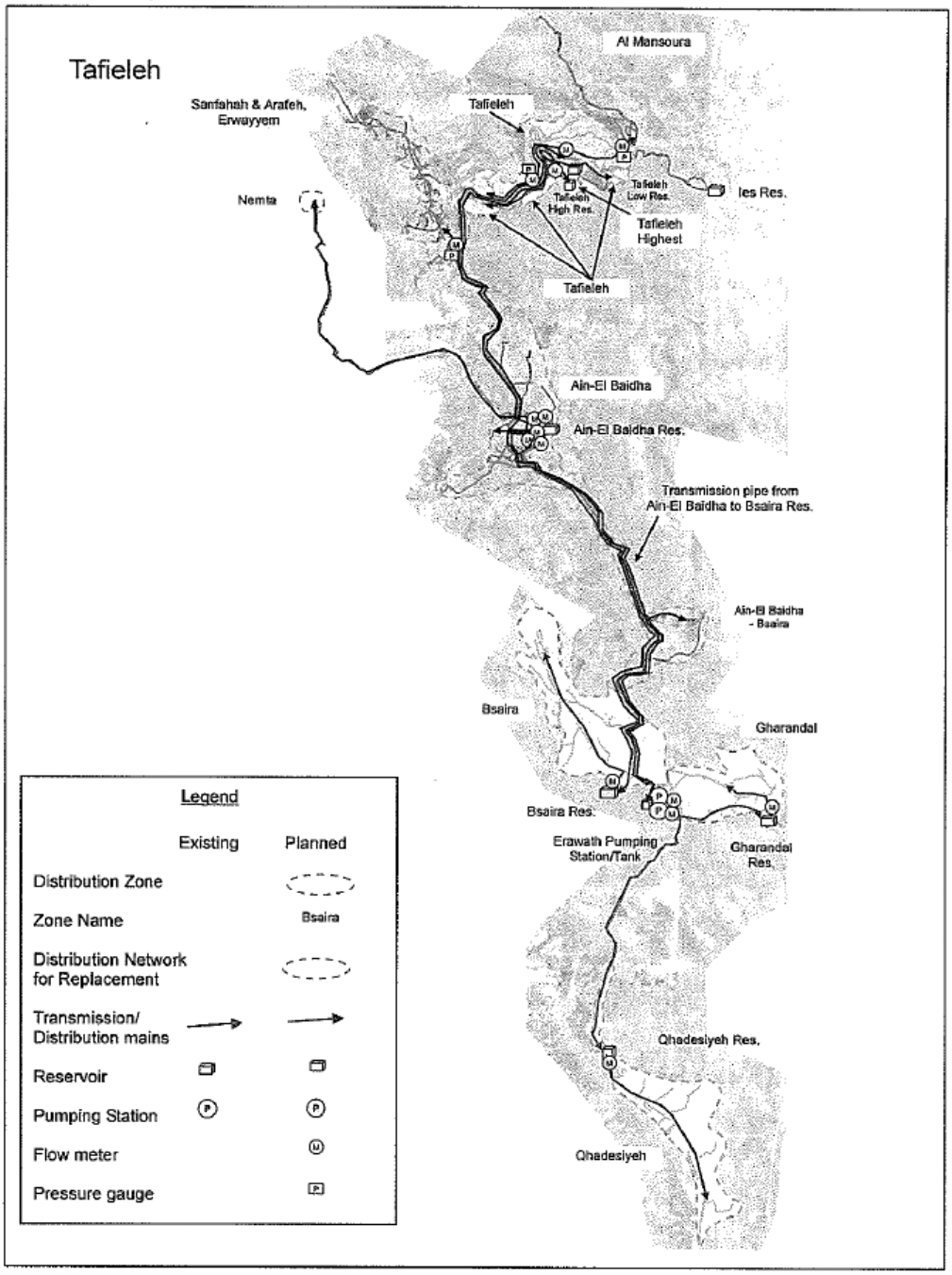
Both sides confirmed that the Jordanian side will check the necessity of EIA to related authorities based on the Project components explained by the Team. In case the EIA is required, the Jordanian side will conduct and complete it before March 2011.

Annex-1	The Components of Project
Annex-2	Project Location Map
Annex-3	Project Cost Estimate
Annex-4	Major Undertakings to be taken by Each Government
Annex-5	Tentative Schedule of Measures to be taken by Both Sides

Annex-1: The Components of Project

Facilities	Specification/capacity/quantity		
Reservoir	Bsaira	RC structure, rectangular shape, capacity: 1,200m^3 L 19.4m x W 18.8m x H 5.45m	
	Gharandal	RC structure, rectangular shape, capacity: 600m^3 L 13.4m x W 12.8m x H 5.95m	
Erawath Pumping Station (PS)	Rehabilitation for transmission pump for planned Gharandal reservoir	Renewal of existing pump equipment Q: 0.95m^3/min. x Head: 225m x 2 sets Horizontal shaft single suction multi-stages centrifugal pump Electrical works and instrumentation	
	Expansion for transmission pump for existing Qhadesiyeh reservoir	Construction of a pump house for expansion pumping station Q: 1.5 m^3/min. x Head: 380m x 2 sets Horizontal shaft single suction multi-stages centrifugal pump Electrical works and instrumentation Air breathing valve for anti-water hammer : 3 sets (on the pipe between pumping station to existing Qhadesiyeh reservoir) Altitude valve in existing Qhadesiyeh reservoir	
Transmission pipeline	Erawath PS—Planned Gharandal reservoir		DIP 150 mm x 3,540m
	Bsaira Junction – Bsaira reservoir		DIP 200 mm x 460m
	Bsaira entrance – Bsaira Junction		DIP 250 mm x 2,270m
	Ain-El Baidha reservoir – Bsaira entrance		DIP 300 mm x 7,950m
	Total		14,220 m
Distribution pipeline	Tafieleh city (14,060m)		DIP 100mm x 6,230m DIP 150mm x 3,020m DIP 200mm x 2,510m DIP 250mm x 2,210m DIP 300 mm x 90m Pressure reducing valve: 4 places
	Bsaira (7,180 m)		DIP 100mm x 3,300m DIP 150mm x 490m DIP 200mm x 2,930m DIP 250mm x 460m Pressure reducing valve: 7 places
	Gharandal (3,780 m)		DIP 100mm x 2,460m DIP 150mm x 320m DIP 200 mm x 1,000m Pressure reducing valve: 5 places
	Qhadesiyeh (5,350 m)		DIP 100mm x 2,250m DIP 150mm x 1,780m DIP 200 mm x 1,320m Pressure reducing valve: 6 places
	Total		30,370 m
Distribution monitoring system	Tafieleh city and Tafieleh south area		Central monitoring system: 1 set Flow meter: 15 sets Pressure meter: 3 sets
Procurement of pipe materials	Tafieleh city, Bsaira, Gharandal, Qhadesiyeh		HDPE 63mm x 50,100m

Annex-2: Project Location Map



Annex-3: Project Cost Estimate (Confidential)

(1) Japanese side cost obligation

This Part is closed due to the confidentiality.

(2) Jordanian side cost obligation

Items	Project cost (thousand JD)	Remarks
1. Construction of distribution reservoirs		
1) Land acquisition and creation and leveling of land	32.7	Governmental land
2) Supply of primary power of required capacity for the reservoirs	-	It is supplied by electric power company.
3) Land acquisition for access road to the site and construction	51.6	Cost for land acquisition is not included.
4) Road pavement in the site of reservoirs, setting of light, construction of fences, gates and planting along the site boundary of reservoirs	49.3	
5) Construction of reservoir drain pipe from the boundary of reservoirs to the nearby existing discharge place	53.4	
6) Provision of necessary water and chemicals (chlorine) for trial operation of the facilities constructed	3.6	
2. Renewing and expansion of a pumping station		
1) Provision of land for expansion of pumping station, and creation and leveling of land	-	Leveling by WAJ labor
2) Supply of primary power of required capacity for the pumping station and installation of a transformer with a transformer panel or replacement of existing ones	-	It is assumed to use WAJ reserve equipment.
3. Installation work of transmission and distribution pipelines		
1) Installation work of distribution pipelines (diameter: 63mm) procured by Japanese side	2,405	
2) Installation work of house connection (20 mm and 25 mm)	4,829	
3) Provision of necessary water and chemicals (chlorine) for trial operation of the facilities constructed	4.1	
4. Installation of distribution monitoring system	0	
1) Supply of primary power of required capacity for the monitoring system	-	It is supplied by electric power company
Total	7,429	

Annex-4: Major Undertakings to be taken by Both Sides

Construction/Procurement & Installation	Japan	Jordan
1. Installation work of distribution reservoir		
(1) To acquire the land for reservoirs construction sites and reclaim and level the land before the start of construction work by Japanese side		●
(2) To construct distribution reservoirs	●	
(3) To supply primary power of required capacity		●
(4) To acquire land for access road of reservoirs in Gharandal and Bsaira before August 2011		●
(5) To construct access road to reservoirs in Gharandal and Bsaira before the start of construction work by Japanese side		●
(6) To construct road paving, lighting, vegetation, fencing, gates, etc., within the site		●
(7) To lay drain pipe from the site to discharge place (Japanese side will lay it within the site boundary.)		●
2. Renewing and expansion of pumping station		
(1) To renew existing pump equipment	●	
(2) To provide, reclaim, level the land for expansion pumping station in the site of existing pumping station		●
(3) To construct expansion pumping station	●	
(4) To supply primary power of required capacity and install a transformer with a transformer panel or replacement of existing ones.		●
3. Installation work of transmission and distribution pipeline		
(1) To install transmission pipelines	●	
(2) To install distribution pipelines (Diameter: more or equal than 100 mm)	●	
(3) To procure pipe materials (Diameter: 63 mm)	●	
(4) To design pipelines to be installed by Jordanian side		●
(5) To install distribution pipelines to be procured by Japanese side (Diameter: 63 mm)		●
(6) To install house connections and water meters		●
(7) To coordinate for required approvals and permissions to implement construction works, procedure for traffic control during construction period in the road		●
(8) To cooperate in piping work, such as coordination in water cut off, communication for water cut, presence at site in piping works when required, etc.		●
4. Installation work of distribution monitoring system		
(1) To secure the land for installation of equipment		●
(2) Installation work of monitoring system for distribution flow and pressure	●	
(3) To supply primary power of required capacity		●
5. Soft component		
(1) To provide required equipments for implementation of soft-component and training room		●
(2) Implementation of soft-component (technology transfer and capacity building)	●	
6. Common items for construction works		
(1) To provide temporary stock yards for construction materials and machineries and lands for temporary works		●
(2) To take all necessary measures to secure disposal sites for excavation debris and drains for wastewater from construction works		●
(3) To provide necessary water and chemicals (chlorine) for trial operation of the facilities constructed		●
7. Other Items		
(1) To coordinate for required approvals and permissions from relevant authorities to implement detailed design studies and construction works		●
(2) To cooperate in consultation with residents living near the construction sites and to coordinate procedures for traffic control in works with relevant authorities		●
(3) To carry out necessary procedures for issue of A/P required for payments to Japanese Consultants and Contractor and to bear the commissions for advising and payment to a bank in Japan for banking services based upon the Banking Arrangement		●
(4) To ensure prompt unloading and customs clearance of the goods for the project at the port of disembarkation in Jordan		●
(5) To accord Japanese nations whose services may be required in connection with the supply of products and services under the verified contract such facilities as may be necessary for their entry into Jordan and stay there for the performance of their works.		●
(6) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies may		●

	be imposed in Jordan with respect to the supply of the products and services under the verified contract. And to take necessary measures for such tax exemption.		
(7)	To use, operate and maintain properly the facilities and equipment constructed or procured under the Japan's Grant Aid program.		•
(8)	To bear all the expenses, other than to be borne by the grant Aid, necessary for construction of the facilities		•

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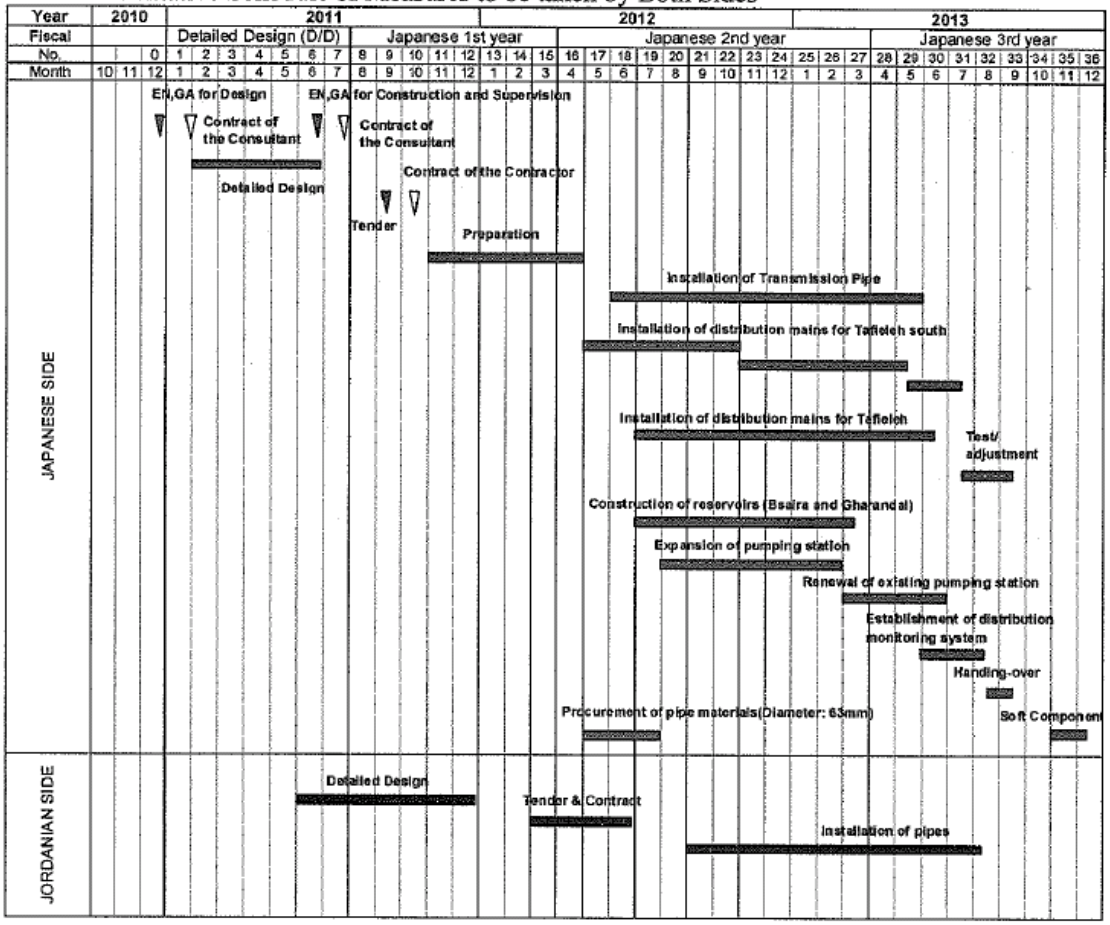
Annex-5: Tentative Schedule of Measures to be taken by Both Sides



The Project for Rehabilitation and Explanation of Water Facilities In Tafieleh Governorates in the Hashemite Kingdom of Jordan (Phase II)

Report on Soft Component Plan

October 2010

Tokyo Engineering Consultants CO., Ltd.

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1. Background of Soft Component Plan

The Grant Aid Project "The Project for Rehabilitation and Explanation of Water Facilities in Tafieleh Governorate in the Hashemite Kingdom of Jordan" targets at Tafieleh governorate in southern area in the Hashemite Kingdom of Jordan (hereafter refer to as Jordan) and is implemented for the purpose of reconstruction of transmission and distribution system (Construction of distribution reservoir, replacement of distribution pipelines, definition of district metering area, installation of pressure reducing valves and distribution monitoring system, and setting of proper capacity for transmission pumps), reduction of non-revenue water, fair distribution of the increased water and improvement of water supply condition.

1) Current Situation

The waterworks in southern area in Jordan has wells as water resources and supply water from distribution reservoir by gravity or pumping, however, because of high rate of non revenue water and the poor capacity of main water supply facilities, supply hours have been restricted and per capita consumption has been in low level (Tafieleh governorate: 84 liters, Ma'an governorate: 113 liters). The rates of non-revenue water in the governorates of Tafieleh and Ma'an are approximately 47% and 61% respectively, and higher than 43.9% of the national average. About half of the non-revenue water is likely leakage caused from the aged distribution pipelines and high water pressure. The remaining half is due to customer meter under-registration and illegal connections. Majority of distribution pipelines in the these governorates is galvanized steel and black steel pipe which are over 22 to 39 years old on average. Galvanized steel pipe is susceptible to leakage due to corrosion, and black steel pipe has been seen causing water quality problem due to deterioration with age.

Tafieleh governorate is located at plateau area with rough terrain (Elevation: 1,000 to 1,600 m), however, pressure reducing facilities and district metering areas are not set here to secure appropriate water pressure. For this reason, the area at low elevation has high water pressure while the area at high elevation has low water pressure. This phenomenon causes occurrence of leakage at low areas and insufficient water supply at higher areas. In addition, distribution reservoirs and the pump equipment with appropriate capacity have not been installed, therefore, appropriate water amount is not supplied. Water supply in Bsaira, Gharandal and Qhadesiyeh in southern area in Tafieleh governorate is carried out 1 to 3 days in a week and people's daily life is suffering.

2) Necessity of Soft Component Plan

Through this Project, the transmission and distribution facilities and district metering area in the target area of Tafieleh governorate will be set and its system will be improved. However, effectiveness of the Project will not be exhibited unless management and utility of distribution data, continuous upgrade of distribution network information, and appropriate operation and management of distribution network are implemented. On the other hand, knowledge and technology skill level of staff in WAJ Tafieleh branch office is insufficient to implement these activities, and it is necessary to enhance their capacity related to distribution water management and non-revenue water control.

Moreover, this soft component plans to utilize achievement of the Technical Cooperation Project

named “Capacity Development Project for Non-Revenue Water Reduction in Jordan”. Technical cooperation project supports to capacity development and institutional system formulation related to non-revenue water control in WAJ. Through this soft component plan, the technology acquired through the pilot project, which is a part of the technical cooperation project, can be applied to the entire system by preparation of GIS database for leakage locations, repair locations, unsatisfactory water supply locations, and by appropriate application of distribution monitoring system, as well as implementation of technical transfer and capacity development related to data management and analysis.

2. Objectives of Soft Component Plan

The capability related to distribution management and non-revenue water control of WAJ Tafieleh will be improved.

3. Outputs of Soft Component Plan

The outputs of implementation of soft components may be classified as below.

a. The conditions of distribution pipeline network can be understood better using GIS.
   ① Updated information on pipelines will be reflected on GIS maps.
   ② Operation and maintenance data will be reflected on GIS maps. (Water leak complaints, leak repair locations, unsatisfactory water supply locations, meter replacement locations, illegal connection locations, etc.)

b. Hydraulic conditions of water transmission and distribution systems can be understood better.
   ① Water transmission and distribution amounts and distribution pressure data can be managed by computer.
   ② Technology of network analysis can be transferred, and hydraulic conditions can be understood by simulating distribution pipeline networks.

c. Water transmission and distribution data can be utilized in managing water distribution management and non-revenue water management.
   ① Using the data in water distribution management
   ② Using the data in non-revenue water management

4. Method of Confirming Outcome Achievement Level

The outcome achievement level by soft component can be verified by the methods mentioned below. Out of 3 trainees, 2 are to satisfy all the achievement levels listed below. The target is to be approved as a water distribution management manager.

Table 1 Method of Verifying Outcomes

Program	Method of verifying outcomes	Indicator of outcome achievement level
Level before training	Grasp the level before training by a small test	None
Mapping of distribution pipeline network	Small test on mapping technique Tabulation of pipeline network data, drawing charts,	70 points and above 70 points and above

	submission of interpreted reports	
Management of water distribution data	Tabulation of water distribution data, drawing charts, submission of interpreted reports	70 points and above
Analysis of distribution pipeline network	Submission of EPANET2 case study report	70 points and above
General water distribution management	Submission of reports on water distribution management and operation plans	70 points and above

5. Activities of Soft Component Plan

The detailed activities include the items indicated below.

Table 2 Detailed Activities of Soft Component Plan

No.	Activity
1)	Preparations
①	Domestic preparations
D-1	Preparation of transfer of technology plans
D-2	Test preparation, questionnaire preparation, training text (draft) preparations
②	Implementation preparations and introductory technical briefing
②-1	Training room establishment, C/P meeting, implementation preparations, briefing preparations
②-2	Selection of trainees (pre-test training, questionnaire, evaluation, selection)
②-3	Implementation briefing
2)	Distribution pipeline network data GIS management
①	Pipeline network data update
①-1	Explanations and input method for pipeline network mapping input data
①-2	Input of pipeline network data updates (OJT)
①-3	Tabulation, charts and analyses of pipeline networks
②	GIS visualization of operation and maintenance data
②-1	Preparation of input format for operation and maintenance data
②-2	Input of operation and maintenance data (OJT)
②-3	Analysis and utilization of operation and maintenance
3)	Water transmission and distribution management data
①	Analysis and utilization of water transmission and distribution data
①-1	Collection of water transmission and distribution data (OJT)
①-2	Analysis (OJT) and utilization of water transmission and distribution data
②	Pipeline network model construction and simulation
②-1	Simulation method for water transmission and distribution pipeline network (EPANET2)
②-2	Construction of new water distribution zone model
②-3	Pipeline network analysis (water pressure, water amount, flow direction) and analysis of results of new water distribution zone
4)	Water transmission and distribution management
①	Using data for water transmission and distribution management
②	Using data for non-revenue water management
5)	General report
①	Technology transfer seminar
①-1	Technology transfer seminar preparations
①-2	Technology transfer seminar
②	Preparation of reports and provision of manual
② -1	Soft component evaluation
② -2	Preparation and submission of general report

6. Procurement of Implementation Resources

In this soft component, water distribution management experts will be dispatched for 1.47 months and implemented by the type of direct support. The necessary qualifications of water distribution management experts dispatched to Jordan are as below.

1) Has fully understood pipeline network hydraulics
2) Can use proposed mapping GIS software and pipeline network analysis software
3) Can propose water transmission and distribution operation plans
4) Has the skills to manage training programs

This expert should have extensive knowledge of hydraulics, GIS and network analysis software, experience related to water transmission and distribution plans, language skills to communicate with Jordanian engineers, and is required to understand problems of operation and maintenance for water transmission and distribution in developing countries.

The experts for network hydraulics, GIS and network analysis software can be dispatched from Jordan and third countries, however, the experts who have comprehensive technology understanding and skills to manage training programs cannot be dispatched. Therefore, dispatch of Japanese experts who meet the necessary qualifications and understand current situation of transmission and distribution system is appropriate. Staff assignment plan is shown in Table 3.

Table 3 Staff Assignment Plan

Field	No. of persons	Belonging to	Description
Water distribution management experts	1	Japan	The water distribution management technology of Japan is to suit the technical level of the trainees and conditions on site. The following items are to be implemented: ・ Preparation of text for training, implementation of training ・ Preparation and evaluation of tests and homework reports ・ Provision of various formats ・ Implementation of seminars ・ Data collection, editing and modeling ・ Evaluation

7. Soft Component Implementing Stages

The construction work of the main facilities will be implemented in twenty-two and half months. The implementation of the soft component will require distribution amount and water pressure data measured in the planned facilities. Accordingly, the soft component will be implemented after facilities, for which data can be collected, are completed. The entire stage will take approximately one and a half months. The implementation plan is shown in Figure 1, while the detailed activity plan is shown in Figure 2. The number of required man-days shown in the table of detailed activity plan is as given below.

- No. of actual work days: 39 days (domestic preparations 5 days; on-site 34 days)
- Equivalent man-months: Domestic preparation time: 0.17 MM; dispatch period: 1.47 MM

NO.	Activities	Japan	In Jordan 1st month	In Jordan 2nd month
1)	**Preparations**			
①	Domestic preparations	▬		
②	Implementation preparations and introductory technical briefing		▬	
2)	**Distribution pipeline network data GIS management**			
①	Pipeline network data update		▬▬	
②	GIS visualization of operation and maintenance data		▬	
3)	**Water transmission and distribution management data**			
①	Analysis and utilization of water transmission and distribution data		▬	
②	Pipeline network model construction and simulation		▬	
4)	**Water transmission and distribution management**			
①	Using data for water transmission and distribution management			▬
②	Using data for non-revenue water management			▬
5)	**General report**			
①	Technology transfer seminar			▬
②	Preparation of reports and provision of manual			▬

Figure 1 Implementation Plan of Soft Component

Items	No	Activity	Month	Tafieleh	Domestic	1st month	2nd month	Remarks
			Days	Days	1 2 3 4 5	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 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	
1) Preparation								
	1)	Preparation						
	①	Domestic preparation						
	D-1	Preparation of report for technology transfer plan	1					
	D-2	Preparation of test questionnaire and training text (draft)	4					
		Travel	2					
	②	Explanatory meeting for the implementation and adopted technology						
	②-1	Selection of training room, meeting with C/P, preparation of implementation and explanatory meeting	2					
	②-2	Selection of trainees (Evaluation and selection before test and questionnaire)		1				Questionnaire, test
	②-3	Explanatory meeting						Report for technology transfer plan
		Sub-total	9	1				
2) Distribution network data management by GIS								
	2)	GIS Management of distribution network						
	①	Input of distribution network						
	①-1	Explanation of input data of distribution network		1				Training manual
	①-2	Input rehabilitated network data（OJT）		2				ArcGIS
	①-3	Visualization and analysis of network data		2				ArcGIS
	②	Visualization of O&M data by GIS						ArcGIS
	②-1	Definition of the input format of O&M data		1				ArcGIS
	②-2	Input O&M data（OJT）		2				ArcGIS
	②-3	Analysis and utilization of O&M data		2				ArcGIS
		Sub-total		10				
3) Transmission and Distribution data management								
	3)	Transmission and distribution data management						
	①	Analysis and utilization of transmission and distribution data						ArcGIS
	①-1	Collection of transmission and distribution data（OJT）		1				ArcGIS
	①-2	Analysis and utilization of transmission and distribution data（OJT）		2				ArcGIS
	②	Distribution network model and simulation						
	②-1	Transmission and Distribution network simulation technology（EPANET2）		2				EPANET2
	②-2	Formulation of new DMA model		1				EPANET2
	②-3	Network analysis of new DMA (Pressure, flow, direction) and Analysis of the result		2				EPANET2
		Sub-total		8				
4) Transmission and Distribution management								
	4)	Transmission and Distribution management						
	①	Utilization of data for transmission and distribution management		2				EPANET2, ArcGIS
	②	Utilization of data for NRW control		2				EPANET2, ArcGIS
		Sub-total		4				
5) Comprehensive report								
	5)	Comprehensive report						
	①	Comprehensive seminar						
	①-1	Preparation of comprehensive seminar	2					
	①-2	Comprehensive seminar	1					
	②	Preparation of manual and reporting						
	②-1	Evaluation of soft-component	1					
	②-2	Reporting of comprehensive report and submission	1					Comprehensive completion report
		Sub-total	5					
Return								
		Return to Tokyo	2					
		Total	16	23				

Figure 2 Detailed Activity Plan

8. Outcomes of Soft Component Plan

The following reports and outcomes are to be prepared and submitted:

Report	Description	Timing
Transfer of technology plan (in English)	Description, achievement target, detailed schedule, implementation method, etc. of soft component	At the start
Completion Report (in English with Japanese summary)	General report including description of transfer of technology, results of upgrading skills, training evaluation, etc., transfer of technology manual, photos, GIS, and pipeline network data	At completion
Outcomes		
Pipeline network data	One set of GIS pipeline network mapping data	At completion
Pipeline network analysis model	EPANET2 pipeline network analysis model	At completion
Distribution data collection	Input distribution data	At completion
Manuals	Mapping manual Pipeline network analysis manual Distribution data input and management manual	At completion
Others	Teaching records, outputs, training texts	At completion

9. Cost Estimation of Soft Component Plan

The total cost of soft component is 4,861 thousand Yen. The breakdown is 1,952 thousand Yen for direct cost including local staff and 1,633 thousand Yen for overhead. The detailed cost is shown in attachment 1.

10. Duties of Counterpart

1) Probability of implementation

The personnel in charge of the WAJ Head Office know that efficient water distribution and non-revenue water management are possible when the completed facility is utilized more effectively by soft components. The desire to participate and cooperate at the level of the personnel in charge is high, and the possibility of implementation is likewise high. No new operation and maintenance equipment are necessary for this component, and the equipment listed below are sufficient. The probability of implementation is high if the staff participate.

- Use computer equipment, software, printer, etc.
- Ensure training location
- Use ArcGIS

2) Factors causing hindrance and measures

Since there is no training room in WAJ Tafeleh office, it is necessary to ensure training space in the offices.

To ensure that the training is successful, the trainees need to have appropriate knowledge beforehand.

The WAJ Tafieleh Office, and the Japanese experts must select the trainees carefully. The following are the necessary conditions for selection of trainees:

- Should have experience in water distribution management
- Should have interest in the training program
- Should be able to communicate in English
- Should be familiar with basic operations of the computer
- Should be familiar with basic operations of basic software (MS-Excel and MS-Word)
- Should be able to devote adequate time for training (at least 3 hours per day)
- Should have experience in using GIS software.

Attachment 1

Detailed Cost Estimation of Soft Component

Local currency: 1JD=JPY130.07 (Exchange Rate in OD)

Items			JPY	JD	Exchange to JPY	Remarks
Direct labour cost	(Japanese: Water distribution management experts)					The grade of Japanese expert is equivalent to three.
	Domestic	0.17 M/M	132,260		132,260	
	Field	1.47 M/M	1,143,660		1,143,660	
	Sub-total		1,275,920		1,275,920	
Direct cost	Local staff	1.40M/M		735.00	95,601	Interpreter (Arabic-English)
	Daily allowance		203,850		203,850	
	Accommodation		515,040		515,040	
	Air fare		855,375		855,375	
	Rent car fee			2,150.57	279,724	
	Reporting cost		2,500		2,500	
	Sub-total		1,576,765	2,885.57	1,952,090	
Indirect cost	Overhead		1,148,328		1,148,328	Direct labour cost × 90%
	Technical cost		484,850		484,850	(Direct labour cost+Overhead)×20%
	Sub-total		1,633,178	0.00	1,633,178	
Total					4,861,188	

Appendix 6: Other Relevant Data

Table of Contents

Data 1. Water Quality in the Target Area in the Governorates of Tafieleh and Ma'an

Source: WAJ Water Quality Laboratory

(1) Water Quality of Reservoirs in Target Area (1/2)

Location Description	Data	pH	Turbidity	Residual Chlorine	Ammonium	Nitrate	Nitrite	Hardness	Chloride	Sodium	Sulfate	Fluoride	Barium	Antimony	Cadmium
		unit	NTU	mg/L	mg/l as NH4	mg/L	mg/L	mg/L As CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Standards		6.5-8.5	5		0.1	50	2	500 (TH)	500	200	500	1.5	1	0.005	0.003
Tafieleh															
Erawath Booster	Max	8.24	0.70	1.20		18.30		249	62.13	39.79	31.68	0.37			
	Ave	8.18	0.51	1.01	<0.10	12.74		244	58.05	36.11	27.84	0.34	0.08		<.003
	Min	8.14	0.40	0.80		8.27		235	53.96	32.43	24.00	0.30			
Hasa No.3 Pump Station	Max														
	Ave	7.57	0.53	1.40	<0.10	11.27									
	Min														
Ain El Baidha Reservoir	Max	8.07	0.73	1.40		12.59		253	64.61	52.21	34.08	0.29			
	Ave	7.99	0.43	1.13	<0.10	10.63	<.2	240	60.35	43.93	30.96	0.29	0.08		<0.003
	Min	7.91	<.2	1.00		7.63		223	56.09	35.65	27.84	0.29			
Ise Reservoir	Max	8.09	0.90	1.50	<0.10	18.24		291	55.03	30.59	22.08				
	Ave			1.10											
	Min			1.00											
Tafieleh 1000 m3 Reservoir	Max	8.15	0.70	1.50											
	Ave	7.97	0.52	1.11		15.72		239							
	Min	7.79	0.23	0.80											
Tafieleh 4000 m3 Reservoir	Max	8.30	3.98	1.50	<0.10	14.36		267	68.87	37.26	35.52				
	Ave	8.14	0.98	1.10	<0.10	11.50	<0.20	243	62.13	37.15	31.20	<0.20	0.08		<0.003
	Min	8.00	0.20	0.80	<0.10	8.93		207	55.38	37.03	26.88				
Zabda Reservoir	Max	8.28	0.82	1.40	<0.10	7.42		412	46.15	28.52	51.84	0.59	0.10		<.003
	Ave	7.61	0.36	1.27	<0.10	6.16	<.2	390	44.73	27.22	50.56	0.53	0.09	<0.005	<.003
	Min	7.32	<0.20	1.00	<0.10	3.61		353	43.31	25.99	49.92	0.46	0.08		<.003
Maan															
Tahoonah new Reservoir	Max	8.12	1.01	1.50	<0.10	1.45		373							
	Ave	7.92	0.90	1.33	<0.10	0.94		336	86.62	38.87	44.16	0.76	0.09	<.005	<.003
	Min	7.73	0.79	1.00	<0.10	<.2		305							

(2) Water Quality of Reservoirs in Target Area (2/2)

Location Description	Data	Cyanide	Zinc	Arsenic	Chromium	Copper	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Total Coliforms
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	MPN/100mL
Standards		0.07	4	0.01	0.05	1	1	0.01	0.1	0.07	0.07	0.01	0.1	
Tafieleh														
Erawath Booster	Max													<1.1
	Ave	<.05	<.06	<.005	<.01	<.01	<.1	<.01	<.01	<.01	<.01	<.005	<.01	<1.1
	Min													<1.1
Hasa No.3	Max													<1.1
Pump Station	Ave													<1.1
	Min													<1.1
Ain El Baidha Reservoir	Max		0.07		<.02	<.02	0.14		<0.02		<.02			<1.1
	Ave	<.05	0.07	<0.005			0.14	<0.01		<.02		<.005	<.02	<1.1
	Min		<0.06		<0.01	<0.01	<0.10		<0.01		<0.01			<1.1
Ise Reservoir	Max		<0.06		<.02	<.02	<0.10		<0.02		<.02			<1.1
	Ave													<1.1
	Min													<1.1
Tafieleh	Max													1.10
1000m3	Ave													1.10
Reservoir	Min													<1.1
Tafilah	Max		<0.06		<.02	<.02	0.12		<0.02		<.02			<1.1
4000 m3	Ave		<0.06	<0.005			0.12	<0.01						<1.1
Reservoir	Min		<0.06		<0.01	<0.01	<.1		<0.02		<0.01			<1.1
Zabda Reservoir	Max		0.19	<0.005	<.02	0.03	0.18	<.01	<0.02	0.27	0.07	<.005	<0.02	>8
	Ave	<0.05	0.09	<0.005			0.14	<.01		0.24	0.06	<.005	<0.02	<1.1
	Min		0.04	<0.005	<.01	<.01	0.10	<.01	<.01	0.21	0.04	<.005	<0.02	Abscence
Maan														
Tahoonah	Max													<1.1
new	Ave	<.05	<.06	<.005	<.01	<.01	0.18	<.01	<.01	0.01	<.01	<.005	<.01	<1.1
Reservoir	Min													<1.1

(3) Water Quality of Wells Directly Supplied to Target Area (1/2)

Location Description	Treatment Stage	Note	Well No	pH	Turbidity	Residual Chlorine	Ammonium	Nitrate	Nitrite	Hardness	Chloride	Sodium	Sulfate	Fluoride	Barium	Boron	Antimony	Cadmium
				unit	NTU	mg/L	mg/l as NH4	mg/L	mg/L	mg/L As CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Standards			6.5-8.5	5		0.1	50	2	500(TH)	500	200	500	1.5	1	1	0.005	0.003
Samneh Well	Raw water	Max	G 4086	7.51	0.80	1.20		16.00		477	268.38	113.16	146.40					<0.003
		Ave		7.13	0.58	1.10	<0.10	8.52	<.2	452	222.66	108.56	121.54		0.06			<0.003
		Min		6.77	0.27	1.00		3.81		430	197.38	106.26	100.80					<0.003
Samneh No.2 Well	Raw water	Max	G 4096	7.74	2.29		<0.10	11.55	<0.50	495	217.97	100.51	116.16	0.80				<0.003
		Ave		7.51	1.27		<0.10	6.83		453	209.45	93.10	111.26	0.75	0.05			<0.003
		Min		7.39	0.61		<0.10	5.15	<.2	431	203.42	90.16	108.00	0.69				<0.003
Samneh No.4 Well	Wash out	Max	G 4099	7.65	13.20		<0.10	8.56	<0.50	464	235.37	113.39	121.92	1.03				<0.003
		Ave		7.49	4.57		<0.10	4.69		448	212.33	107.03	110.24	0.77	0.06	0.30		<0.003
		Min		7.39	0.50		<0.10	3.15	<.2	432	190.64	102.12	98.40	0.48				<0.003
Samneh No.5 Well	Raw water	Max	G 3206	7.72	22.10		<0.10	5.55	<.2	467	227.20	118.91	132.48	1.20				<0.003
		Ave		7.51	12.83		<0.10	4.92	<.2	449	214.95	111.44	122.40	0.78	0.05			<0.003
		Min		7.41	5.84		<0.10	4.54	<.2	434	209.45	104.65	111.84	0.39				<0.003
Tahoonah No.2 Well	Raw water	Max	G 1265	8.87				6.41		326	127.80	87.40	101.76					
		Ave		8.05				2.26		262	99.47	51.52	55.68					
		Min		7.62				0.31		101	68.16	25.76	19.20					
Fujaij No.3 Well	Raw water	Max	CF1085															
		Ave		7.7	<.2		<0.10	7.86	<.2	215	35.86	21.16	17.28					
		Min																
Hasa No.2 Well	Post chlorination	Max	CF1041	8.30	0.90	1.80	<0.10	11.83	<0.20	271	63.55	39.79	35.04	0.57				<0.003
		Ave		7.69	0.66	1.19	<0.10	9.62	<0.20	244	57.67	35.39	29.97	0.48	0.08		<0.005	<0.003
		Min		6.73	<.2	0.80	<0.10	7.36	<0.20	141	54.32	30.59	27.84	<0.20				<0.003
Jarf Daraweesh Well	Post chlorination	Max	CF1072	8.22		1.00		9.93		270	80.94	39.56	44.16					
		Ave		7.96		1.00		3.01		260	63.55	32.66	29.34					
		Min		7.60		1.00		<.2		252	54.32	25.30	21.60					
Juthah No.1 Well	Raw water	Max	G 3135	7.49				0.65	<.2	410	140.58	64.86	72.48	0.78				
		Ave		7.35				0.48	<.2	384	115.02	55.43	59.60	0.62				
		Min		7.22				<.2	<.2	316	72.07	44.62	48.00	0.45				
Manshiyeh Well	Raw water	Max	G 1344	8.13	0.30	1.50	<0.10	6.01		269	52.19	28.29	37.44	0.72	0.05			
		Ave		7.84	0.30	1.39	<0.10	3.20	<.2	248	48.20	25.70	32.28	0.64	0.05	<0.2		
		Min		7.58	0.30	1.10	<0.10	<.2		185	43.67	23.23	27.84	0.46	0.05			
Qa Maan No.2 Well	Raw water	Max	G 1231	8.06	2.50		<0.10	16.46	<.2	266	75.62	38.18	35.04	0.56	0.06			<.003
		Ave		7.84	2.04		<0.10	10.44	<.2	192	44.83	26.35	28.66	0.38	0.05	<0.2		<.003
		Min		7.59	1.52		<0.10	4.93	<.2	117	30.53	20.93	24.48	0.14	0.02			<.003
Unaizah Well	Raw water	Max	G 3167	8.03	16.60		1.50	4.56	<0.2	346	108.99	66.01	100.32	1.69	0.06			
		Ave		7.63	8.08		0.90	2.83	<0.2	323	94.51	60.59	83.04	1.44	0.06	<0.2		<0.003
		Min		7.46	2.27		0.15	<.2	<0.2	297	74.55	48.99	50.88	1.26	0.05			

(4) Water Quality of Wells Directly Supplied to Target Area (2/2)

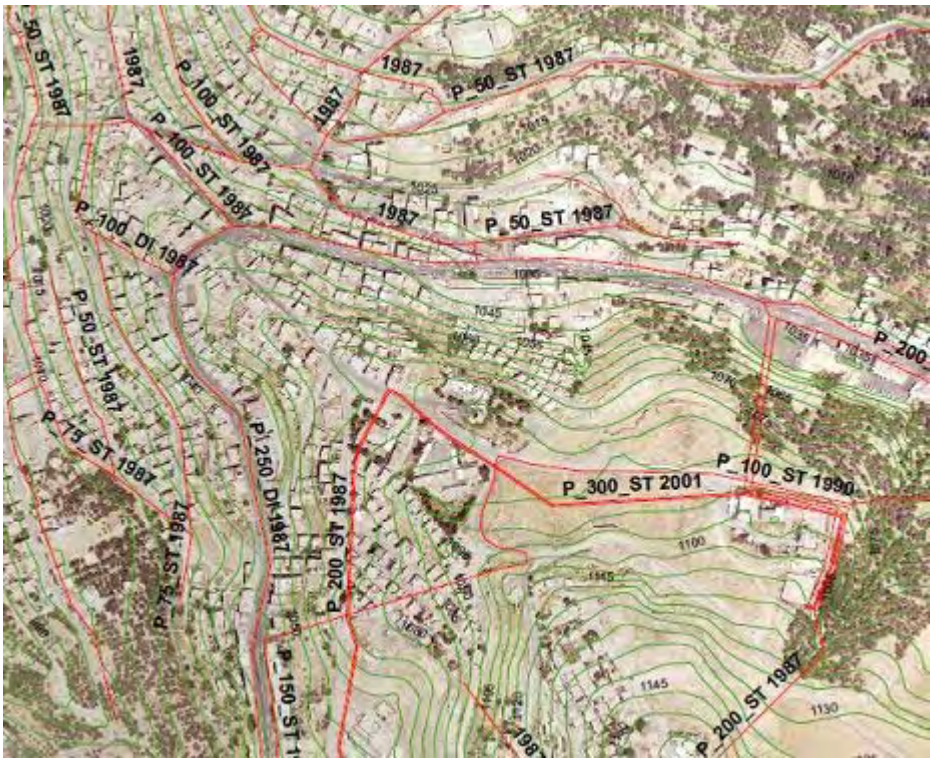
Location Description	Treatment Stage	Note	Well No	Cyanide	Zinc	Arsenic	Chromium	Copper	Iron	Lead	Manganese	Molybdenum	Nickel	Selenium	Silver	Total Coliforms	Escherichia coli
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	MPN/100mL	MPN/100mL
	Standards			0.07	4	0.01	0.05	1	1	0.01	0.1	0.07	0.07	0.01	0.1		
Samneh Well	Raw water	Max	G 4086		<0.06	<0.01	<0.02	<0.04	<0.10	<0.01	<0.04		<0.02	<0.01		23.00	<2
		Ave		<0.05					0.07	<0.01		<0.02			<0.02	11.14	2.00
		Min			<0.04	<0.005	<0.01	<0.02	0.06	<0.01	<0.02		<0.01	<0.005		<1.1	<1.8
Samneh No.2 Well	Raw water	Max	G 4096		<0.06	<0.01	<0.02	<0.02	0.48	<0.01	<0.02		<0.02	<0.01	<0.02	27.00	<2
		Ave		<0.05				0.01	0.24	<0.01	0.01	0.02			<0.02	14.83	<2
		Min			<0.04	<0.005	<0.01	<0.01	<0.10	<0.01	<0.01		<0.01	<0.005	<0.02	<1.8	<2
Samneh No.4 Well	Wash out	Max	G 4099	<0.05	0.35	<0.01	0.04	<0.04	1.76		0.06	<0.02	0.22	<0.01	<0.02	7.80	<2
		Ave		<0.05	0.35		0.04		0.49		0.04	<0.02	0.12		<0.02	6.32	2.00
		Min		<0.05	0.35	<0.005	<0.01	<0.02	0.10		<0.02	<0.02	<0.01	<0.005	<0.02	<1.8	<1.8
Samneh No.5 Well	Raw water	Max	G 3206		<0.06	<0.005	<0.02	0.15	0.88	<0.01	<0.02	<0.02	<0.02	<0.005		17.00	<2
		Ave		<0.05	0.04	<0.005		0.12	0.53	<0.01	0.01	<0.02		<0.005	<0.02	6.42	<1.8
		Min			<0.04	<0.005	<0.01	<0.02	0.17	<0.01	<0.01	<0.02	<0.01	<0.005		<1.8	<1.8
Tahoonah No.2 Well	Raw water	Max	G 1265														
		Ave															
		Min															
Fujaij No.3 Well	Raw water	Max	CF1085													4	
		Ave			<.06	<.005	<.02	<.02	<.1		<0.02	<.02	<.02	<.005	<.02	<1.8	0
		Min															
Hasa No.2 Well	Post chlorination	Max	CF1041		<0.06	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01		<0.01			2.60	<1.1
		Ave		<.05	0.04		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<.02	<1.1	<1.1
		Min			<0.04	<0.005	<0.01	<0.01	<0.06	<0.01	<0.01		<0.01				<1.1
Jarf Daraweesh Well	Post chlorination	Max	CF1072													<1.1	
		Ave														<1.1	
		Min														<1.1	
Juthah No.1 Well	Raw water	Max	G 3135		<.06	<.005	<.02	<.02	0.19		<0.02	<.02	<.02	<.005			
		Ave			<.06	<.005	<.02	<.02	0.17		<0.02	<.02	<.02	<.005		13.00	<1.8
		Min			<.06	<.005	<.02	<.02	0.16		<0.02	<.02	<.02	<.005		<1.8	
Manshiyeh Well	Raw water	Max	G 1344		<0.06	0.01	<0.02	0.08	0.44		<0.02	<0.02	<0.02	<0.005		1600.00	
		Ave			<0.06	0.01	<0.02	0.07	0.33		<0.02	<0.02	<0.02	<0.005	<0.02	356.50	2.00
		Min			<0.06	0.01	<0.02	<0.02	0.23		<0.02	<0.02	<0.02	<0.005		<1.1	<1.8
Qa Maan No.2 Well	Raw water	Max	G 1231		0.45	<.005	<0.02	<0.02	0.72	<.01	0.02	0.02	0.02	<.005	<0.02	23.00	<1.8
		Ave		<0.05	0.22	<.005			0.34	<.01				<.005	<0.02	7.66	<1.8
		Min			<.06	<.005	<.01	<.01	<0.10	<.01	<.01	<.02	<.01	<.005	<0.02	<1.8	<1.8
Unaizah Well	Raw water	Max	G 3167		0.09	<0.01	<0.02	<0.02	1.92		0.12	<0.02	0.04	<0.01	<0.02	7.80	<1.8
		Ave			0.09				0.98	<0.01	0.05	<0.02			<0.02	3.98	<1.8
		Min			0.08	<.005	<0.01	<0.01	0.15	0.00	0.03	<0.02	<0.01	<0.005	<0.02	<1.1	<1.8

Data 2. GIS Basic Map and Database of Transmission and Distribution Pipelines

(1) Type of GIS base map and quantity

Procurement from	Type of GIS data	Contents
Royal Jordan Geographic Center （RJC）	Aerial photo is purchased and used for base map.	- Tafieleh Governorate Aerial photo: 146km^2 (2007) 1/2,500 Aerial photo: 14km^2 (2000) 1/25,000 - Ma'an Governorate Aerial photo: 40km^2 (2007) 1/2,500 Aerial photo: 134km^2 (2000) 1/2,500
	Contour line in Tafieleh governorate	Contour line with 5m interval of 146km^2 is purchased and used.
	Contour line in Ma'an governorate	Contour line with 5m interval of 174km^2 is purchased and used. Contour line with 5m interval of 174km^2 is requested to create and purchased.
Department of Land and Survey （DLS）	Cadastral map	Procured from WAJ

(2) Created GIS facilities map (Sample)



Existing pipelines and contour line (5m interval) in Tafieleh City

(3) Pipeline network data in each area

Length of Distribution Pipeline in AL-Mansoora (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	0	0	1,850	0	0	0	0	0	0	0	0	0	1,850
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	4,023	0	0	0	0	0	0	0	0	0	4,023
150	0	0	0	0	0	3,991	0	0	0	0	0	0	0	3,991
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	56	0	0	0	0	0	0	0	0	0	56
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	5,929	0	3,991	0	0	0	0	0	0	0	9,920

Length of Distribution Pipeline in Tafieleh City (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	0	0	6,455	0	0	0	0	0	0	0	0	0	6,455
75	0	0	0	2,090	0	0	0	0	0	0	0	0	0	2,090
100	0	0	0	4,478	0	0	0	0	0	0	0	0	0	4,478
150	0	0	1,834	637	0	531	0	0	0	0	0	0	0	3,002
200	0	0	97	0	0	0	0	0	0	0	0	0	0	97
250	0	0	0	5,369	0	0	0	0	0	0	0	0	0	5,369
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	1,931	19,029	0	531	0	0	0	0	0	0	0	21,491

Length of Distribution Pipeline in Sanfah (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	0	4,593	0	0	386	0	854	0	0	0	0	0	5,832
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	3,922	0	0	1,852	0	0	0	0	0	0	0	5,775
150	0	0	774	0	0	0	0	0	0	0	0	0	0	774
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	9,289	0	0	2,239	0	854	0	0	0	0	0	12,381

Length of Distribution Pipeline in Nemati (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	0	0	0	0	4,322	0	0	0	0	0	0	0	4,322
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	4,322	0	0	0	0	0	0	0	4,322

Length of Distribution Pipeline in Ain-El Baidha (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	7,699	0	0	0	7,700	0	0	0	0	0	0	0	15,399
75	0	1,043	0	0	0	1,813	0	0	0	0	0	0	0	2,855
100	210	0	0	0	0	5,100	0	0	0	0	0	0	0	5,310
150	146	0	0	0	0	838	0	0	0	0	0	0	0	984
200	0	1	0	0	0	0	0	0	0	0	0	0	0	1
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	356	8,743	0	0	0	15,450	0	0	0	0	0	0	0	24,549

Length of Distribution Pipeline in Bsaira (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	11,350	0	0	0	0	0	0	0	0	0	0	0	11,350
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	3,860	0	0	0	0	0	1,553	0	0	0	597	976	6,986
150	0	0	0	0	0	0	0	0	0	1,788	792	0	0	2,580
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	15,210	0	0	0	0	0	1,553	0	1,788	792	597	976	20,916

Length of Distribution Pipeline in Gharandal (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	0	0	0	5,047	0	0	0	0	0	0	0	0	5,047
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	5,823	0	0	0	0	0	0	0	0	5,823
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	332	0	0	0	0	0	0	0	0	0	0	0	332
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	332	0	0	10,870	0	0	0	0	0	0	0	0	11,201

Length of Distribution Pipeline in Qhadesiyeh (m)

Dia	1960	1970	1985	1987	1989	1990	1995	1998	2001	2005	2008	2009	2010	Total
50	0	10,889	0	0	0	0	0	0	0	0	0	0	0	10,889
75	0	1,047	0	0	0	0	0	0	0	0	0	0	0	1,047
100	0	4,216	0	0	0	0	0	0	0	0	0	0	0	4,216
150	0	927	0	0	0	0	0	0	0	0	0	0	193	1,120
200	0	0	0	0	0	0	0	0	0	0	0	0	267	267
250	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	0	401	0	0	0	0	0	0	0	0	0	0	0	401
Total	0	17,480	0	0	0	0	0	0	0	0	0	0	459	17,940

Length of Distribution Pipeline in Ma'an city (m)

Dia.	1970	1980	1986	1989	1990	1991	1996	1999	2000	2002	2004	2005	2006	2007	2009	2010	Total
50	2,847	0	5,541	7,038	19,451	265	8,368	3,411	956	288	0	92	0	0	2,148	0	50,406
63	0	0	0	0	0	0	4,142	0	0	0	0	0	0	0	0	0	4,142
75	0	0	0	0	62	451	0	0	0	0	0	0	0	0	0	0	512
80	0	0	2,255	565	137	1,746	0	0	0	0	0	0	0	0	0	0	4,702
100	292	574	16,326	3,671	10,396	3,299	3,748	241	1,470	44	75	478	1,616	238	6,965	0	49,432
150	0	0	3,003	605	13,516	0	3,664	0	0	0	0	0	0	0	2,401	104	23,294
200	0	0	0	471	491	808	4,824	0	0	0	0	0	0	0	0	1,925	8,520
250	0	0	0	0	36	760	0	0	0	0	0	0	0	0	0	0	796
300	0	0	0	0	0	0	5,389	0	0	0	0	0	0	0	5,572	0	10,960
350	0	0	0	0	0	0	463	0	0	0	0	0	0	0	0	0	463
400	0	0	0	0	0	0	4,839	0	0	0	0	0	0	0	0	0	4,839
Total	3,139	574	27,125	12,350	44,089	7,328	35,438	3,653	2,426	332	75	570	1,616	238	17,086	2,029	158,068

Data 3. Socio Condition Survey

Survey Report for the Socio-economic and Willingness to Pay Survey for the Project of Rehabilitation and Expansion of Water Facilities in Southern Governorates of Tafieleh and Ma'an

1.0 INTRODUCTION

Located in the heart of the Middle East, Jordan is a small country with a present population of nearly 6 million people. Since its independence in 1946, Jordan has had one of the fastest growing populations in the world; with a population of only 0.25 million in 1946 expected to reach 9.7 million by year 2025. Inadequate supplies of water and other natural resources, international debt, poverty, and unemployment have become fundamental problems in Jordan. Nearly 10% of the population earns less than $2 per day, placing approximately 30% of the population in below-the-poverty line living conditions. Furthermore, nearly 70 % of the population lives in only three urban governorates; Amman, Zarqa and Irbid. Access to municipal and other vitally important services is unevenly distributed, and rural areas/municipalities in the south and northeast of the country are under-served. These shortfalls in service delivery have reduced development opportunities, which in turn have decreased people's ability to pay for services.

The most valuable natural resource available to mankind is water. This is particularly true in the Middle East and North Africa Region (MENA), which is the most water scarce region in the world. Home to almost 6.5% of the world's population, the region contains barely 1.5% of the world's renewable fresh water resources. This makes the MENA Region one of the poorest locations in the world in terms of water resources. In the region, Israel, Jordan and Palestine, are considered to be particularly deficit in water scarcity. Most experts consider Countries with a "per capita" water consumption rate below 1,000 cubic meters per year to be water-poor countries. In the year 2000, the per capita water resource potentials in Israel, Jordan, and Palestine were 250 m^3, 234 m^3 and 115 m^3, respectively. Placing these countries at nearly 20 % of the water poverty level. The current water situation in the three countries is expected to worsen over the next twenty years. In the year 2020 for example, the per capita water availability is expected to be almost one-half of what was available in the year 2000. Several political analysts believe that conflicts in the Middle East region will arise over water in the coming years. In fact, previous wars and confrontations in the region have already been related to water. Despite the Jordan/Israeli and Palestinian/Israeli peace treaties, conflicts over water have arisen

Box 1: Water Scarcity Statistics in Jordan

The Water Poverty Index (WPI) was designed to measure the availability of water resources in various countries. It indicates the richness or poverty of an area in terms of the volume of water resources (renewable and non-renewable) available to meet domestic and irrigation requirements necessary to cover a country's food needs.

Based on this definition, and under the assumption that all rain fed areas within a country are productive, Jordan is considered water poor since its water resources cover only 15.5 % of the country's food needs.

The Water Stress Index (WSI) is another indicator of the availability of water within a certain area. A WSI of less than 1700 m^3/capita/year indicates water stress; a WSI of less than 1000 m^3/capita/year indicates water scarcity, while a WSI of less than 500 m^3/capita/year indicates absolute scarcity. With a WSI of 234 m^3/capita/year, Jordan is categorized as a country with absolute scarcity.

again in the past few years. It was the newly signed peace agreements alone that prevented those conflicts from escalating any further. With the projected water shortages, and unless serious water management measures are taken, the recurrence of such conflicts over water is inevitable.

1.1 Tafieleh and Ma'an Governorates

Ma'an Governorate is located south of the capital Amman. With 36% of the country's total area located within Ma'an, it is the largest Jordanian governorate. In contrast, Ma'an's population constitutes a mere 1.4% of the total population. However, the percent of Ma'an's population constitutes 1.4% of the total population. On the other hand, Tafieleh governorate is located south-west of Amman. Its area constitutes 2.5% of Jordan's total area, hosting about 1.6 % of Jordan's population.

According to the ministry of Planning, 2006 there is 22 regions identified as poverty pockets in Jordan. One of those poverty pockets is Bsaira in Tafieleh Governorate. The percent of population below poverty line is 31.9. In addition, two regions in Ma'an are considered as poverty pockets which are Mareigha and Al Jafer with a poverty percentage of 27.1 % and 26.6 % respectively.

2.0 BACKGROUND

The overall objective of the study in Tafieleh and Ma'an is to understand present social conditions including water use, household characteristics, and willingness to pay for water supply. The target sample size was 300 households. Interviews were carried out using a tailor made survey tool in the form of a questionnaire. The questionnaire consisted of multiple sections relating to various indicative measures for the study. The following table lists the sections of the questionnaire:

Table 1. Lists the sections of the survey tool

#	Section Title
1	Information about respondent
2	Family structure and economic condition
3	Condition of Water Usage
4	Awareness of people about water supply service
5	Condition of Toilet
6	Sanitary Conditions

The components of the survey contained comprehensive quantitative and qualitative analysis. The main component of each section is described below.

1- Information of Respondent

This information includes name, gender, house type and size.

2- Family Structure and Economic Condition

This information includes family size, income source and employment patterns. The goal is to have basic household information that might explain some of the results and suggest preferences toward certain options.

3- Condition of Water Usage

This information covers issues related to the water availability, water bills, and water consumption patterns.

4- Awareness of People about Water Supply Service

Along with the previous section, this information should help in identifying the urgent needs of households, and would provide a preliminary understanding of their willingness to pay for better services.

5- Condition of Toilet

This section would give an indication of social level awareness of using the toilet and sanitation facilities.

6- Sanitary Condition

The assessment of the sanitation utilities will help in understanding the water consumption pattern.

3.0 SAMPLING

The sampling locations and sample size were classified into three household's surveyed areas which are Tafieleh City, Tafieleh South and Ma'an. Table 2 presents the sample sizes and locations in the three surveyed household's areas.

Table 2. Sampling Locations and Sample Size

	Abbreviation	Population in 2009	Sample Size
Tafieleh Governorate	TA		
Tafieleh city	TAC	26,147	76
Ezhaigah	EZH	65	2
Sanfah	SAN	661	5
Tal'et Hussain	TAH	218	3
Arafah	ARA	1,208	7
Erqayyem/Erwayyem	ERA	1,935	9
Ain El-baidha	AEB	9,227	26
Namteh	NMT	71	2
Abel	ABE	750	6
Sel'e	SEL	10	2
Bsaira	BSR	7,647	22
Um Essarab	UES	558	5
Gharandal	GHA	4,439	15
Rashadiyyeh	Ras	1,007	6
Dhana	DHA	91	2
Qhadesiyeh	QHA	7,712	22
Subtotal		**61,746**	**134**
Ma'an Governorate	MA		
Ma'an city	MAC	36,370	90
Total		**98,116**	**300**

4.0 METHODOLOGY OF IMPLEMENTATION

In total, the survey was conducted for 300 households randomly selected and distributed according to the sampling locations and sizes presented in Table 2. Three teams were involved; two in Tafieleh and one in Ma'an. It included participants from both genders; females and males. In addition, each team consisted of two persons, and the survey teams collected data on a daily basis throughout the duration of the study. Given that the study area consists of the southern part of Tafieleh City and Tafieleh City centre, the survey team started with the southern part of Tafieleh City then moved into Tafieleh City centre. The team chose the highest volume residential areas in those two areas to carry out the survey. Similarly, the survey was implemented in Ma'an. However, the Ma'an study area was limited to the City centre only.

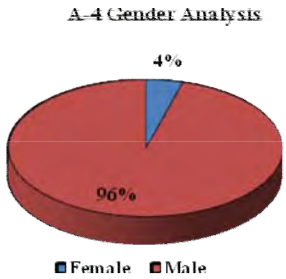
Once a household was approached, a member of the survey team gave them a little background on the survey; its purpose, what the data collected is to be used for, and the importance of their cooperation in providing accurate answers to the various questions. A very few families expressed their concern on who the survey was conducted for, however, the I*d*RC engineer assured them that it was eventually for the benefit of their communities.

The field work was carried out from the May 18 to June 3, 2010. The survey tool is included in the Appendix, and the results of the survey are presented in the following section.

5.0 SURVEY RESULTS

5.1 Information of Respondent

Given the conservative nature of the study area, it was the male head of the household that chose to conduct the interview in most cases. Thus, the majority of respondents were males with a proportion of 96 % and only 4 % of females accepted to conduct the survey as presented in Figure 1. In addition, the table shown in Figure 1 presents the percent of respondents out of the entire sample (300 surveyed households) of males and females in Tafieleh City, Tafieleh South, and Ma'an City. The entire surveyed sample indicated the availability of the WAJ water meter in their houses as presented in Figure 2.



Sample Area	% of Males	% of Female
Tafieleh City	25%	0.3%
Tafieleh South	44%	0.6%
Ma'an City	27%	3.0%
Total	**96%**	**4%**

Figure 1. Gender Analysis

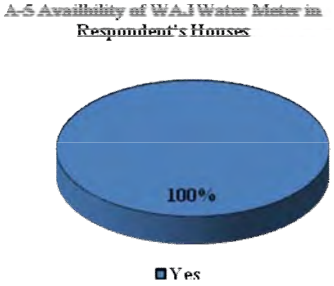


Figure 2. Availability of WAJ Water Meter in Respondents' Houses

5. 2 Family Structure and Economic Condition

Figure 3 illustrates the family structure distribution according to gender. The Figure indicates that the distribution of females and males in the entire surveyed sample is approximately the same with a percentage of about 50% each. In addition, the distribution of adult males and females as well as child males and females is approximately the same. In addition, Figures from 4 through 6 present the gender age decomposition in Tafieleh City, Tafieleh South, and Ma'an City.

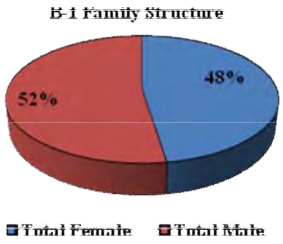


Figure 3. % of Total Females and Males out of the Entire Sample

While the average family size in Tafieleh South is 7 members, the average family size in Tafieleh and Ma'an cities is 6 members.

Figures 4 through 6 present the males and females decomposition in the three household's surveyed areas. The % of each age decomposition category is taken out of the total numbers of males and females in each household surveyed sample.

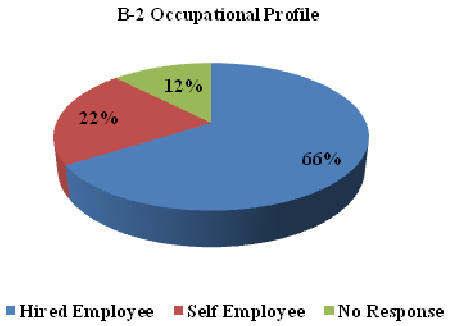
Figure 4. Males and Females age Decomposition in Tafieleh City

Figure 5. Males and Females age Decomposition in Tafieleh South

Figure 6. Males and Females age Decomposition in Ma'an City

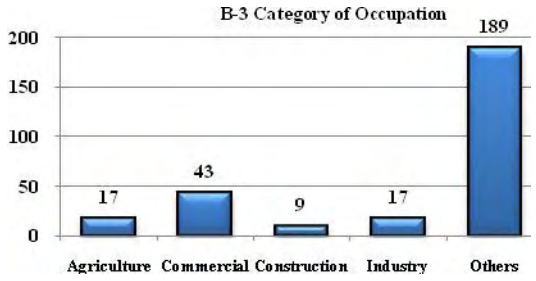
Figure 7 shows that 66 % of the entire respondents (300) are hired employees while 22% are self employed and the reminder have no response. Also, the Table in the Figure illustrates the % of the main income source for the three surveyed households' samples. The occupational profile of the surveyed sample showed that the majority work in the "other sector" rather than the prevailing major sectors such as agricultural, industrial, commercial, and construction as presented in Figure 8. Also, the Table in Figure 8 indicates the category of occupation for the three surveyed areas.

If the category of the respondents indicating employment in "Other Category" is removed, it can be concluded that the majority of the sample works for the commercial sector. The second dominant occupational profile is distributed evenly between the industrial and agricultural sectors. Finally, a small portion of the households in the surveyed sample works in the construction sector.



Sample Area	% of Hired Employee	% of Self Employed	% No Response
Tafieleh City	16%	7%	2%
Tafieleh South	25%	10%	10%
Ma'an City	25%	5%	0%
Total	**66%**	**22%**	**12%**

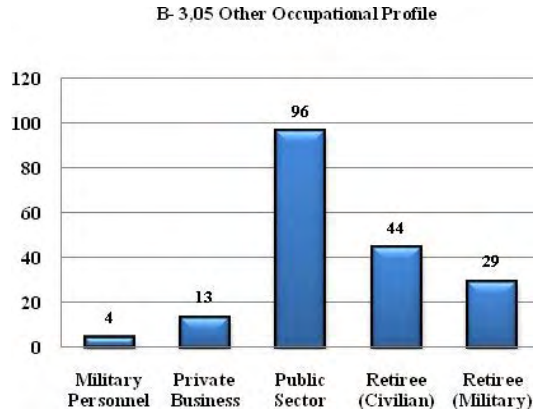
Figure 7. Main Income Source Distribution



Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
Agriculture	6	11		**17**
Commercial	17	15	11	**43**
Construction	1	7	1	**9**
Industry	2	10	5	**17**
Others	35	81	73	**189**

Figure 8. Occupational Profile

On the other hand, if the category of the respondents indicating employment in "Other Category" is further examined, it can be concluded that 96 out of 189 respondents indicated that they work for the public sector. Nevertheless, 73 respondents indicated that they are retirees, of which 44 respondents are civilian retirees and the remaining 29 respondents are military retirees. In addition, 13 respondents own private businesses and 4 respondents are military personnel as presented in Figure 9. In addition, the Table in the figure presents further illustration of the "other category" occupation in the three surveyed sample.



Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
Military Personnel		4		**4**
Private Business	3	4	6	**13**
Public Sector	19	18	69	**96**
Retiree (Civilian)	15	28	1	**44**
Retiree (Military)	4	24	1	**29**

Figure 9. Other Categories of Occupation

5.3 Condition of Water Usage

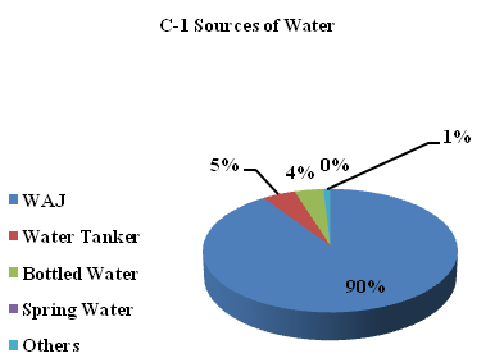
While most of the households in the surveyed sample receive water from WAJ, small numbers of respondents depend on water tankers and bottled water. Figure 10 shows that 98.7 % of the respondents depend on WAJ as the main source of water. Nevertheless, 1% of respondents depend on other sources of water, and none of the households in the surveyed sample depend on springs or well water. In addition the Table in the figure further illustrates the water source among the three surveyed sample areas. Indeed, the Department of Statistics (DoS) in

Jordan, 2006 indicated that

100 % of Tafieleh Households depend on public Network "WAJ" as a main source for the supply of water. On the other hand, 94% of Ma'an City households depend on Public network "WAJ", while

2.8% depend on water tanker, and 3.5 depend on other resources [1].

http://www.dos.gov.jo/dos_home_a/main/index.htm



Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
WAJ	25.3	43.7	29.7	98.7
Water Tanker	1.3	2.3	1.3	5.0
Bottled water	0.7	0.0	3.7	4.3
Spring	0.0	0.0	0.0	0.0
Others	0.3	0.7	0.0	1.0

Figure 10. Sources of Water

Respondents who use water tankers indicated an average usage of 6.4 m^3 per month. On the other hand, respondents who use bottled water reported an average usage of 7.5 units per month; each unit has a volume of 20 liters. On average, respondents consume 52.5 m^3 per quarter in the summer, while in the winter their consumption increases to reach an average of 56.5 m^3 per quarter. The averages of water consumption for different sources of water utilized by the households in different surveyed areas are presented in Table 3.

Table 3. Averages of water consumption of different sources of in the three surveyed areas

Averages Consumption	Tafieleh City	Tafieleh South	Ma'an City
WAJ Summer Average m^3/Quarter	53	52.6	49.44
WAJ Winter Average m^3/Quarter	56	55.3	57.0
Water Tanker(m^3/month)	8.2	5.0	6.62
Bottled Water (Unit =20 Liter)	5	6.0	7
Spring or Well Averages	0	0	0

Respondents indicated that they receive water from WAJ twice a week in the summer for 47.07 hours and three times a week in the winter for an average of 78 hours. Table 4 illustrates the average days and hours of the water received by the three surveyed areas.

Table 4. presents the days and hours of the water received by the three surveyed areas

Surveyed areas	Tafieleh		Tafieleh South		Ma'an	
	days	Hour	days	Hour	days	Hour
Summer	2.0921	35.03	1.2612	26.16	3.7556	88.85
winter	2.723	65.37	1.3731	32.96	6.3889	156.4

For further illustration of the water consumption in different region in Tafieleh and Ma'an Governorates,

the household surveyed sample is categorized into four study areas; Tafieleh city area, Ain Al Baidha and surroundings, Southern of Tafieleh, and Ma'an Governorate as presented in Table 5. Then, a 95% confidence interval for each of the four categorized survey sample constructed. The result of confidence interval calculation is presented in Table 6.

Table 5 .Grouping for Comparative analysis by area

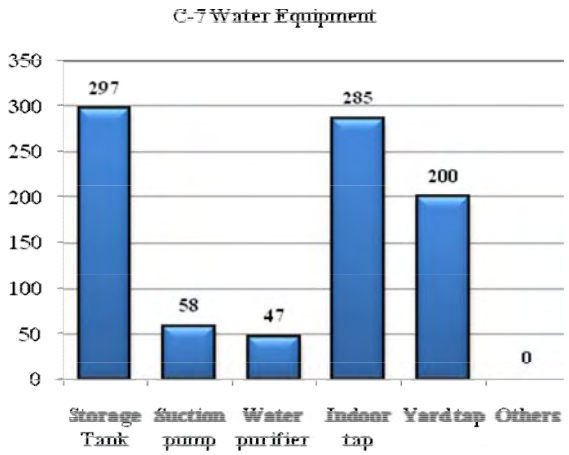
Tafieleh Governorate	TA	Population	Samples	Category
Tafieleh city	TAC	26,147	76	
Ezhaigah	EZH	65	2	1. Tafieleh city area
Sanfah	SAN	661	5	
Tal'et Hussain	TAH	218	3	
Arafah	ARA	1,208	7	
Erqayyem/Erwayyem	ERA	1,935	9	
Ain El-baidha	AEB	9,227	26	2. Ain El-baidha and surroundings
Namteh	NMT	71	2	
Abel	ABE	750	6	
Sel'e	SEL	10	2	
Bsaira	BSR	7,647	22	
Um Essarab	UES	558	5	
Gharandal	GHA	4,439	15	
Rashadiyyeh	Ras	1,007	6	
Dhana	DHA	91	2	3. South of Tafieleh
Qhadesiyeh	QHA	7,712	22	
Subtotal		61,746	210	
Ma'an Governorate	MA			4. Ma'an Governorate
Ma'an city	MAC	36,370	90	

Table 6. Confidence interval calculation

Categorized Surveyed Sample	**Average Water Consumption in JOD per Quarter**		**95% Lower Limit Water Consumption in JOD per Quarter**		**95% Upper Limit Water Consumption in JOD per Quarter**	
	Winter	**Summer**	**Winter**	**Summer**	**Winter**	**Summer**
Tafieleh City Area	19.02	24.87	16.118	21.42	21.92	28.32
Ain Al Baidha and Surrounding	19.144	25.185	16.596	22.074	21.691	28.29
South of Tafieleh	17.896	23.820	15.05	19.73	20.743	27.90
Ma'an Governorate	18.73	24.65	16.352	21.74	21.11	27.56

It can be concluded from the above table that the entire averages of the categorized surveyed sample lies between the highest value and the lowest value. Therefore, statistically there is uniformity in water consumption within each categorized households surveyed sample. Also, the similarity of the averages of water consumption for the four regions indicates the cultural homogeneity in the southern governorates of Jordan.

In terms of water outlets in the household, the surveyed sample indicated that the average number of bathrooms per household is two, and the majority of respondents use Turkish toilets. On the other hand, only 100 respondents use regular toilets. In addition, half of the surveyed sample households have a garden with an average area of 510 m^2. Furthermore, the average area of a garden per the surveyed households in Ma'an is about 237 m^2, 681m2 per household in Tafieleh South and 592.4 m^2 in Tafieleh City. In addition, each household in the three surveyed area has one car on an average, and the respondents in the three surveyed areas indicated that they wash their car once a week.



Water Outlet	Tafieleh City	Tafieleh South	Ma'an City	Total
Storage Tank	76	133	88	**297**
Suction Pump	2	0	56	**58**
Water Purifier	7	10	30	**47**
Indoor tap	68	128	89	**285**
Yard Tap	45	94	61	**200**
Others	0	0	0	**0**

Figure 11. Water Outlet Used by the Surveyed Sample

Figure 11 shows that 300 respondents frequently use storage tanks as an in-door water source in the surveyed sample. The respondents indicated that the average volume of the tank is three cubic meters. The second mostly used in-door water source is the indoor tap, followed by the yard tap. Finally, the respondents indicated that suction pumps and water purifiers are almost equally used among the surveyed sample. The suction pumps are used to lift the received water from WAJ and collected in house water wells to their storage tanks on the roof of their houses. In addition, the figure illustrates different types of water outlets used in the three surveyed sample.

5.4 Awareness of People about Water Supply Services

This section of the survey was designed to measure the awareness of people about water supply services. Responses indicate that 87 % of the total sample has seen water leakages on the road. The percentage of household's awareness of the water leakage in the three surveyed areas is presented in Figure 12.

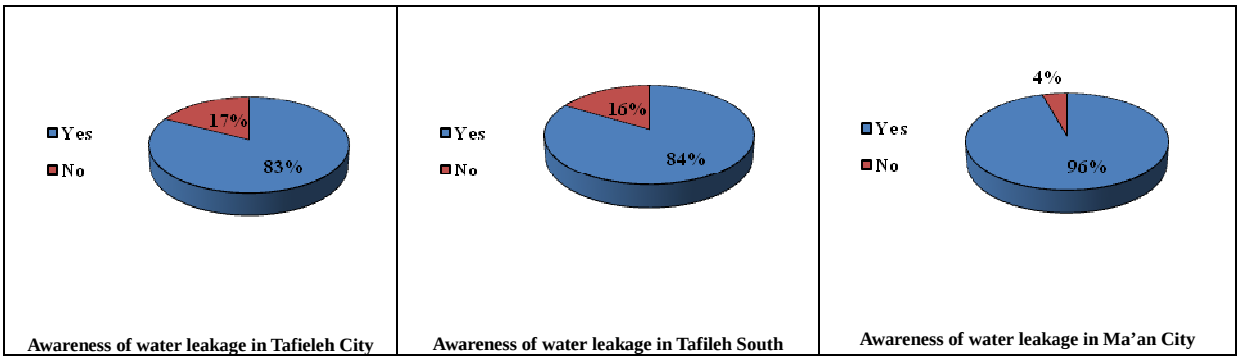


Figure 12. Presents the Awareness of the Households Surveyed sample in the Three Areas the Water Leakage[2]

[2] It must be noted that the percentages were taken out of the total number of households in each area. For example, the sample size in Tafieleh City is 76, in Tafieleh South is 134, and in Ma'an City is 90.

In addition, 92% of the sample indicated that water is precious in Jordan. Figure 13 Presents the awareness of the households in the three surveyed sample of the water scarcity in Jordan.

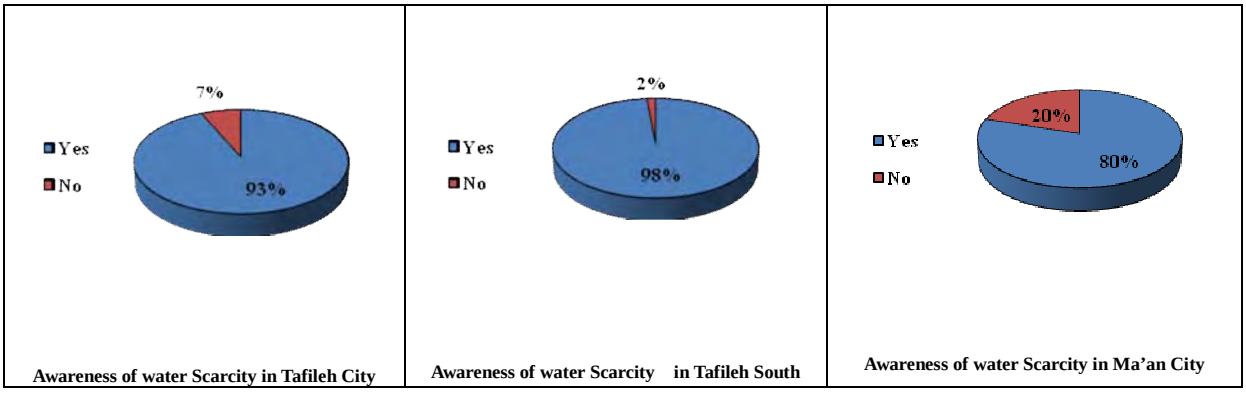


Figure 13. Presents the Awareness of the Households Surveyed sample in the Three Areas about Water Scarcity [2]

[2] It must be noted that the percentages were taken out of the total number of households in each area. For example, the sample size in Tafieleh City is 76, in Tafieleh South is 134, and in Ma'an City is 90.

Approximately 100 % of the sample thinks that water saving is important. Figure 14 presents the awareness of the households surveyed sample in the three surveyed areas.

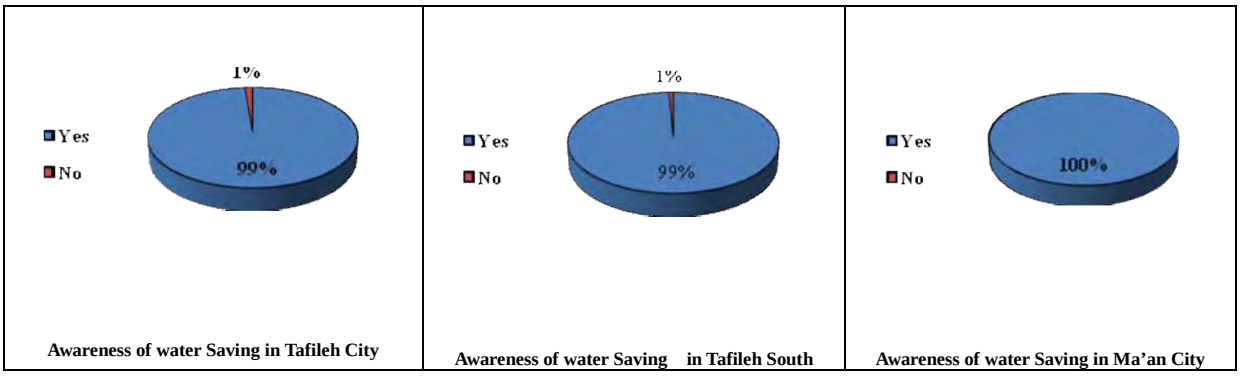
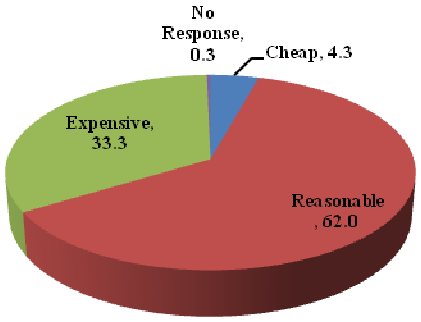


Figure 14. Presents the Awareness of the Households Surveyed sample in the Three Areas about Water Saving[2]

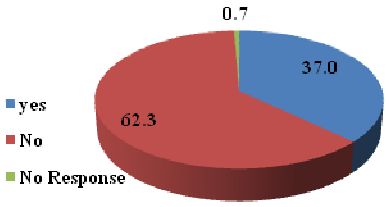
Figure 15 presents the sample's perspective of the water cost. As can be seen, 62% of the surveyed sample thinks that water cost is reasonable, 34 % thinks that it is cheap, and the reminder believes that it is expensive. Moreover, the Table in the Figure presents the sample perspective of water cost in the three surveyed areas. It must be noted that the percentage representation in both the entire sample and the subcategorized surveyed sample were taken out of the total sample (300).



Sample Perspective	% of Respondents in Tafieleh City	% of Respondents in Tafieleh South	% of Respondents in Ma'an City	Total
Cheap	1.0%	2.0%	1.3%	**4.3%**
Reasonable	16.3%	27.3%	18.3%	**62%**
Expensive	8.0%	15.3%	10.0%	**33.3%**
			0.3%	**0.3%**
			Total	**100%**

Figure 15. Sample Perspective of Water Cost

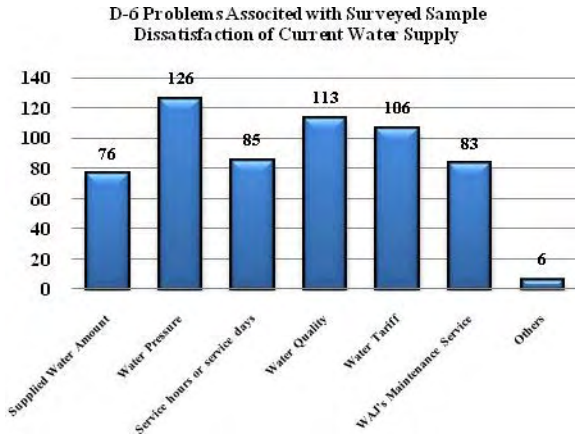
Figure 16 shows that 66 % of the respondents are not satisfied with the current water supply service. In addition, the Table in the Figure presents the households satisfaction with the current water service in the three surveyed areas. It must be noted that the percentage representation in both the entire sample and the subcategorized surveyed sample were taken out of the total sample (300).



Sample Satisfaction	% in Tafieleh City	% in Tafieleh South	% in Ma'an City	Total
Yes	9%	24%	4%	**37.0%**
No	16%	20.3%	26	**62.3%**
No Response	0.33%	0.33%	0	**0.7%**
				100%

Figure 16. Survey Sample Satisfaction of Water Service

In addition, the unsatisfied respondents indicated that this is related to many problems as presented in Figure 17. The Figure11 illustrates the problems related to the surveyed sample's dissatisfaction of water supply service. The main three problems are the water pressure, water quality, and the water tariff. The Figure shows that 126, 113 and 106 respondents indicated that they are not satisfied with water supply pressure, quality, and tariff, respectively. On the other hand, approximately the same number of respondents related their dissatisfaction to the supplied water amount, WAJ's maintenance services, and water service hours and days. Further illustration of different water problem related to the household's dissatisfaction in the three surveyed areas is presented in the table shown in the Figure 17.

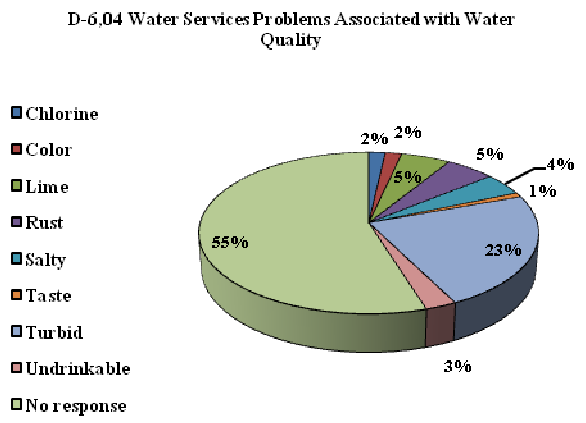


Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
Supplied Water Amount	11	18	47	**76**
Water Pressure	21	47	58	**126**
Service Hours or service days	13	28	44	**85**
Water Quality	17	22	74	**113**
Water Tariff	19	45	42	**106**
WAJ's Maintenance Services	10	16	56	**83**
Others	1	1	4	**6**

Figure 17. Problems Associated With Sample Satisfaction of the Water Supply

Figure 18 shows that 27 out of 113 respondents, who confirmed that they are not satisfied with water quality, believe that water turbidity is the major problem associated with water quality.

Respondents' opinion about the WAJ services is indicated by 16 out of 83 respondents who illustrated that WAJ's maintenance services is one of the problems associated with the water supply service. While 10 respondents think that the response of WAJ's maintenance service is slow, the remaining 6 respondents state that there is no response at all from the WAJ maintenance services. The percentage of respondents in Ma'an Households sample who think that a water maintenance service is slow is about 80%. While only 10% of the households surveyed in each of Tafieleh City and Tafieleh South thinks that the water maintenance is slow. On the other hand, around 66.7 % in Ma'an Households sample thinks that there is no response from WAJ's maintenance service. While 16.7 % in each of Tafieleh City and Tafieleh South thinks that there is no response from WAJ's Maintenance service.



Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
Chlorine			1.77%	**1.77%**
Color	0.855		0.885	**1.74%**
Lime			5.31%	**5.31%**
Rust			5.31%	**5.31%**
Salty	1.77%	1.77%	0.855%	**4.4%**
Taste		0.885		**0.855%**
Turbid	1.77%	2.655%	18.6%	**23.025%**
Undrinkable	1.77%		0.885%	**2.655%**
No Response				**54.87%**
				100%

Figure 18. Water Supply Dissatisfaction Associated With Water Quality

Furthermore, the problems associated with water supply are categorized into first and second orders of priority as presented in Figure 19. Respondents ranked water service problems according to their priority. For first priority rankings, water pressure comes in first place, followed by water quality in second place, and finally supplied water amount in third place. For second priority rankings water quality came in first place, while water tariff and maintenance services tied in second place. The Tables in the figures present the first and second orders of priorities in the three surveyed households' areas.

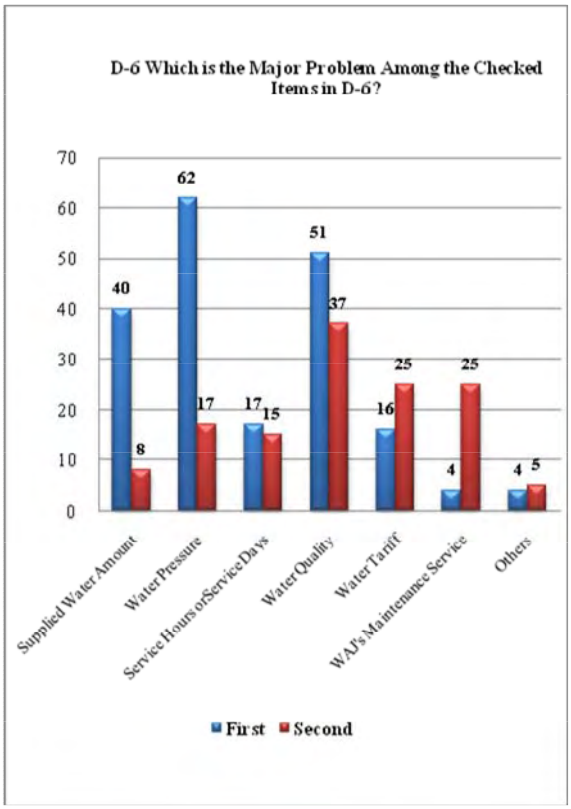


Figure 19. First and Second Orders of Priority of the Related Problems With the Current Water Service

First Order of Priority of the Related Problems With the Current Water Service				
Sample Area	**Tafieleh City**	**Tafieleh South**	**Ma'an City**	**Total**
Supplied Water Amount	8	10	22	**40**
Water Pressure	13	31	18	**62**
Service Hours or service days	7	5	5	**17**
Water Quality	10	10	31	**51**
Water Tariff	5	10	1	**16**
WAJ's Maintenance Services	3	1	1	**4**
Others	2	1	1	**4**

Second Order of Priority of the Related Problems With the Current Water Service in the Three Areas				
Sample Area	**Tafieleh City**	**Tafieleh South**	**Ma'an City**	**Total**
Supplied Water Amount	1	2	5	**8**
Water Pressure	4	7	6	**17**
Service Hours or service days	2	7	6	**15**
Water Quality	2	4	31	**37**
Water Tariff	6	12	7	**25**
WAJ's Maintenance Services	5	6	14	**25**
Others	1	2	2	**5**

Figure 20 presents the weighted average of the first and the second orders of priority. The Figure suggests that water pressure, supplied water amount, and water quality are the major problems associated with the current water supply service as perceived by our target sample.

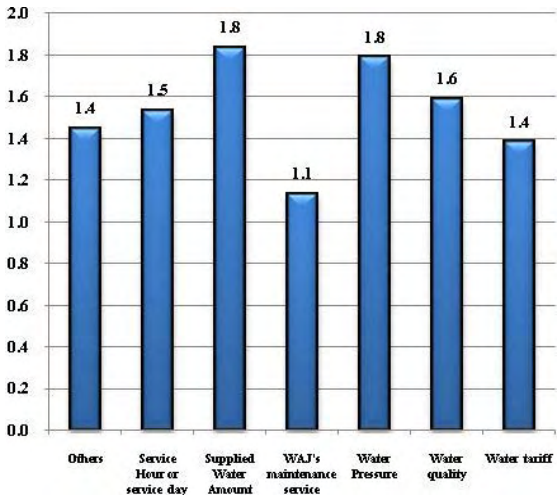
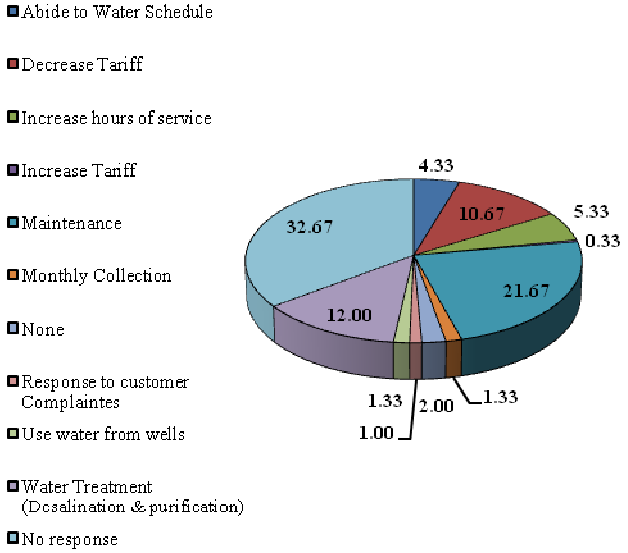


Figure 20. Weighted Average for the First and Second Orders of Priority

To improve the level of satisfaction with the current water supply service, the respondents indicated that there are many services to be improved. The percentages of those services are shown in Figure 21. About 22% of the respondents state that improving maintenance services would improve the overall water service. In addition, 12% thinks that desalination and water treatment would improve the current water service. Also, 1.33 % of respondents indicated that the use of water from wells would help in improving water service. Also, 11% indicated that the decreasing tariff would improve water service, and 4 % identified that abiding to the water schedule would improve water service.



	Tafieleh City	Tafieleh South	Ma'an City	Total %
Abide to Water Schedule	1.67	1.00	1.67	**4.33**
Decrease Tariff	3.33	5.33	2.00	**10.67**
Increase hours of service	4.00	0.00	1.33	**5.33**
Increase Tariff	0.33	0.00	0.00	**0.33**
Maintenance	4.33	3.67	13.67	**21.67**
Monthly Collection	0.33	0.33	0.67	**1.33**
None	1.00	1.00	0.00	**2.00**
Response to customer Complaints	0.33	0.00	0.67	**1.00**
Use water from wells	0.00	0.00	1.33	**1.33**
Water Treatment (Desalination & purification)	0.67	3.00	8.33	**12.00**
No response	24.33	8.00	0.33	**32.67**

Figure 21. Water Service Suggested Improvement

Smaller percentages of respondents pointed to other suggestions to improve water services. This included using water from wells, monthly collection, and improvement to WAJ customer services. Furthermore, 2% of respondents expressed their apathy towards improvements of the water services since they stated that no action can make a difference. The Table in the Figure presents the percentage of different services to be improved in the three households' surveyed areas.

Respondents expressed their willingness to pay an average of 9.24 JOD per quarter for the water service under the current conditions.

Table 7. Average amount of money to be Paid Under the Current Conditions of Water Supply in the Three Households' surveyed Areas

Sample Area	Number of Respondents	JOD/Quarter
Tafieleh City	33	12.15
Tafieleh South	87	14
Ma'an City	50	20.0

However, they expressed their willingness to pay up to 13.05 JOD per quarter on an average granted good water quality as well as continuous supply. Nevertheless, currently the household survey sample pays an average of 20.99 JOD per quarter in summer and an average of JOD 24.65 in winter.

Figure 22, illustrates the reasons of respondents who refused to pay under the current water service. Three respondents are not willing to pay due to bad water quality, four respondents are not willing to pay due to financial inability and one respondent is not willing to pay due to the existing high tariff.

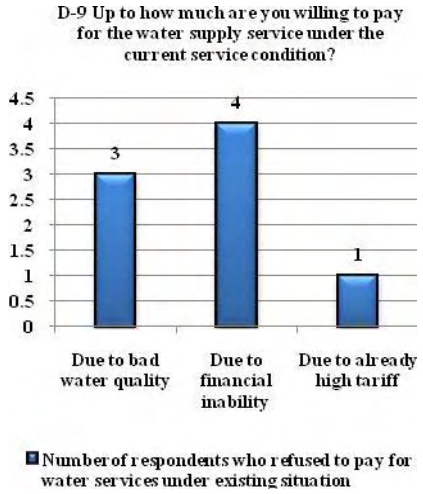


Figure 22. Number of Respondents who Refused to pay for the Current Water Services

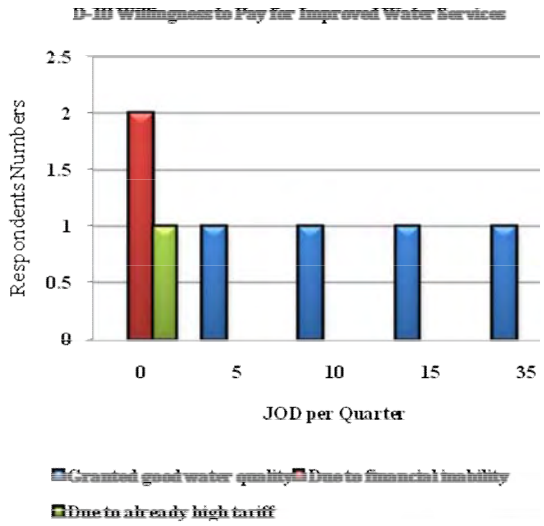
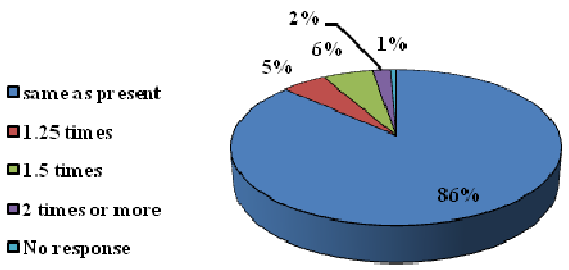


Figure 23. Willingness to pay for Improved Water Services

In addition, Figure 23 illustrates some comments of the respondents who are willing to pay. Only one respondent in each proposed price category, that represents the amount of JOD to be spent per quarter, indicated their willingness to pay granted good water quality. It can be concluded from the Figure that the minimum and maximum amount of money to be paid granted good water quality is 5 JOD per quarter and 35 JOD per quarter respectively. On the other hand, two respondents are not willing to pay due to financial inability. In addition, one respondent refused to pay due to existing high tariff of water service.

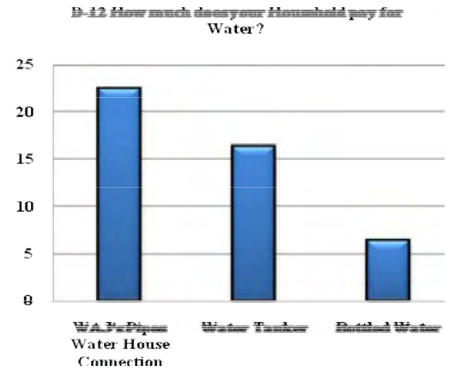
Figure 24 shows that 86% of respondents would keep the same pattern of water consumption even if the water is not limited. However, 6% of respondents would increase their water consumption by one and a half times the current consumption of water. Moreover, 5% would consume one and a quarter times the current consumption. Finally, 2% of the respondents would consume twice as much of the current consumption pattern.



Sample Area	Tafieleh City	Tafieleh South	Ma'an City	Total
same as present	23.33	41.00	22.33	**86.67**
1.25 times	1.33	1.33	2.33	**5.00**
1.5 times	0.33	1.33	4.00	**5.67**
2 times or more	0.33	0.33	1.33	**2.00**
No response		0.67		**0.67**
				100%

Figure 24 Water Consumption if the Water is not Limited

Figure 25 presents the average amount of money to be paid for the supply of water from different water sources. In addition, Figure 26 presents the percentage of respondents from the total surveyed sample who answered for specific water supply source. The Figure indicates that 99% of the sample is paying 22.5 JOD per quarter for WAJ's piped water house connection, in addition 11.7% are paying 16.34 JOD per month for water supplied by water tanker, and 22.3 % are paying 6.4 JOD per month for bottled water.



	Public Network		Water Tanker	Bottled Water	T per Month
	JOD/Q	JOD/Month	JOD/month	JOD/Month	
Tafieleh City	22	7.33	22	6.57	**35.9**
Tafieleh South	23.42	7.801	14.25	8.4	**30.5**
Ma'an City	21.5	7.16	16.16	10	**33.3**
					99.7

Figure 25. Amount of Money to be Paid for the Supply of Water

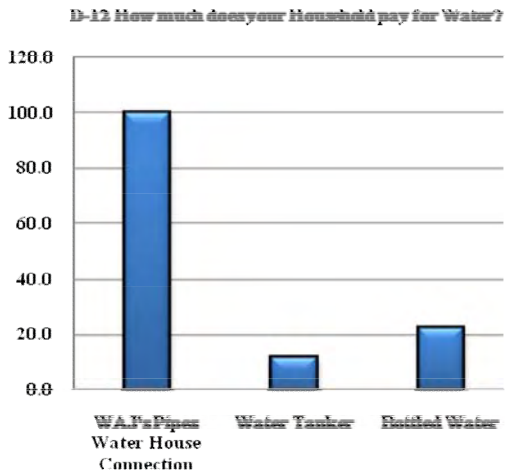
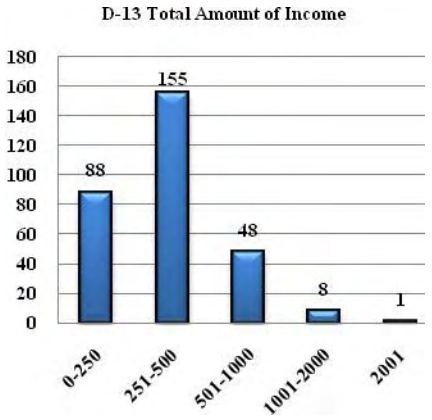


Figure 26. Percentage of Respondents to pay the Amount of Money Presented in Figure 25

In terms of monthly income, the majority of respondents reported an average monthly income in the range of 251 JOD to 500 JOD per month. In addition, 48 respondents have an average monthly income in the range of 501 to 1000 JOD per month. Only eight respondents have an average income in the range of 1001 to 2000 JOD per month as presented in Figure 27. Figure 28 illustrates that meal expenses is the largest expense among other expenses in the surveyed sample of households. The average household spends about 164 per month on meals. On the other hand, the average water expenditure is about 10.3 JOD per month which represents the lowest expenditure. Other expenses are education, housing, fuel, and clothing. The Average water expense from the total amount of income is 3.2%. Furthermore, Table 7. Presents the categorized expenditures for the three household's surveyed areas.



	Tafieleh City	Tafieleh South	Ma'an City	Total
0-250	21	50	17	**88**
251-500	49	65	41	**155**
501-1000	5	17	26	**48**
1001-2000	1	2	5	**8**
>2001		0	1	**1**

Figure 27. Income Ranges in JOD per Month

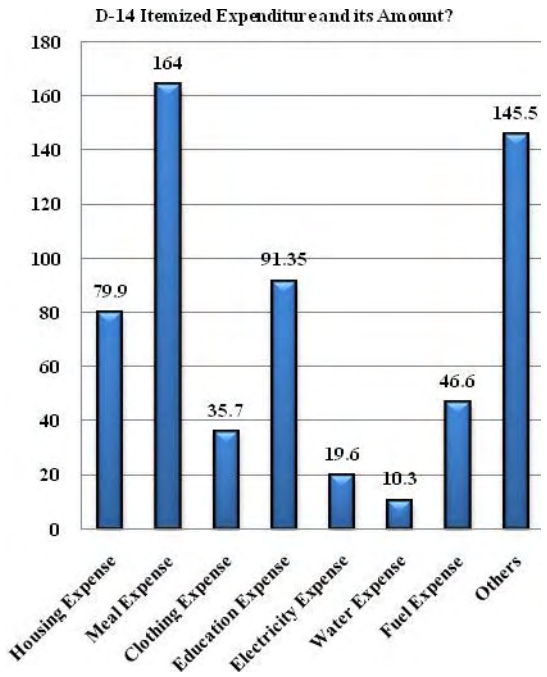


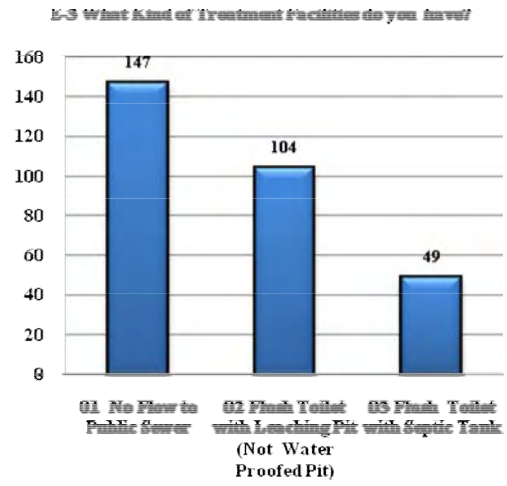
Figure 28. Expenditure of Household in JOD/ Month

Table 7. The Categorized Expenditures for the Three Household's Surveyed Areas.

Expenses	Number of Respondents	Tafieleh City	Number of respondents	Tafieleh South	Numbers of Respondents	Ma'an City
Housing	25	84.55	36	67.7	43	84.5
Meal Expense	76	165.66	133	142	87	195.5
Clothing	60	28	104	32.26	85	45.3
Education	41	78.53	65	103.4	54	86.75
Electricity	71	19.7	126	18	82	22.5
Water	68	8.276	124	8.4	79	14.85
Fuel expense	50	38.7	70	51.154	49	49.21
others			6	257	3	45

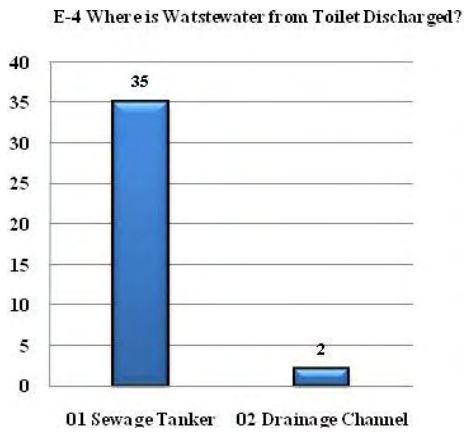
5.5 Condition of Toilet

All the surveyed families have in-house toilet facilities. In addition, Figure 29 presents that 147 of the surveyed families are using public sanitation, 104 families are using flush toilet with leaching pit (not water proofed pit), and 49 families are using flush toilet with septic tank. Out of the 49 families who are using flush toilet with septic tank, 35 families use sewage tanker to empty their septic tank. Figure 30 shows that only two families are using drainage channels to empty the septic tank. Further illustration of the types of treatment facilities and the end destination of wastewater discharge for the three households' surveyed areas are presented in the Tables below Figures 29 and 30.



	Tafieleh City	Tafieleh South	Ma'an City	Total
No Flow to Public Sewer	65	5	77	147
Flush Toilet with Leaching Pit	7	92	5	104
Flush Toilet with Septic Tank	4	37	8	49

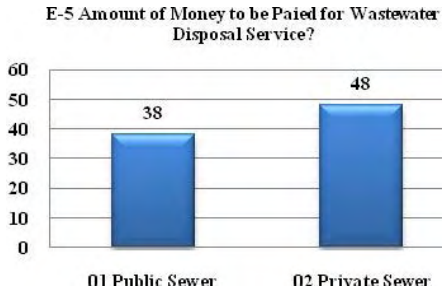
Figure 29. Types of Treatment Facilities



	01 Sewage Tanker	02 Drainage channel
Tafieleh City	4	
Tafieleh South	27	1
Ma'an City	4	1
Total	35	2

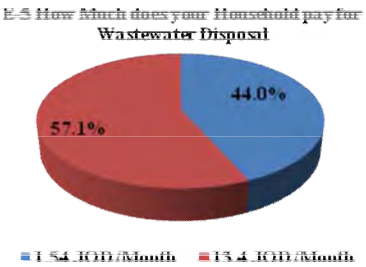
Figure 30. The end Destination of Wastewater Discharge

Figure 31 indicates the numbers of respondents who pay for both public and private sewers. In addition, Figure 32 shows the breakdown of the percentage of the respondents who are paying for both public sewer and private services (Suction Truck). The Figure shows that 44% of respondents pay 1.54 JOD per month for public sewer and 57% are paying 13.4 JOD per month for private sewer service. Further illustration of the Distribution of Respondents who pay for Both Private and Public Sewer and the average amount paid for both public and private are presented in Tables below Figures 31 and 32.



	Public Sewer	Private Sewer
Tafieleh City	22	4
Tafieleh South	4	35
Ma'an City	12	9
	38	48

Figure 31. Distribution of Respondents who pay for Both Private and Public Sewer

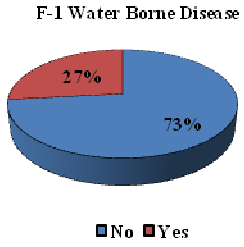


	Public Sewer	Private Sewer
Tafieleh City	1.4	17.5
Tafieleh South	1	13.03
Ma'an City	1.9	13.11

Figure 32. Amount of Money Which is Paid for Both Public and Private Sewer

5.5 Sanitary Conditions

It can be concluded from Figure 27 that 27% of the families in the survey sample indicated that their members have been infected by water borne disease. The Table under the Figure illustrates the % of households' member infected of water borne disease in the three households' surveyed sample. Yearly, the average infection rate is two members per family. The sample indicated that the average cost of treatment per family member is around JOD 110 per year of which the average cost of treatment of infected member of 10 households in Tafieleh City is JOD 28.5, the average cost of treatment of infected member of 27 households in Tafieleh South is JOD 72.3, and the average cost of treatment of infected member of 37 households in Tafieleh City is JOD 164.32



	% of No	% of Yes
Tafieleh City	5.33	20
Tafieleh South	9.0	35.67
Ma'an City	12.33	17.67
Total	**27**	**73**

Figure 33. Availability of Water Borne Disease