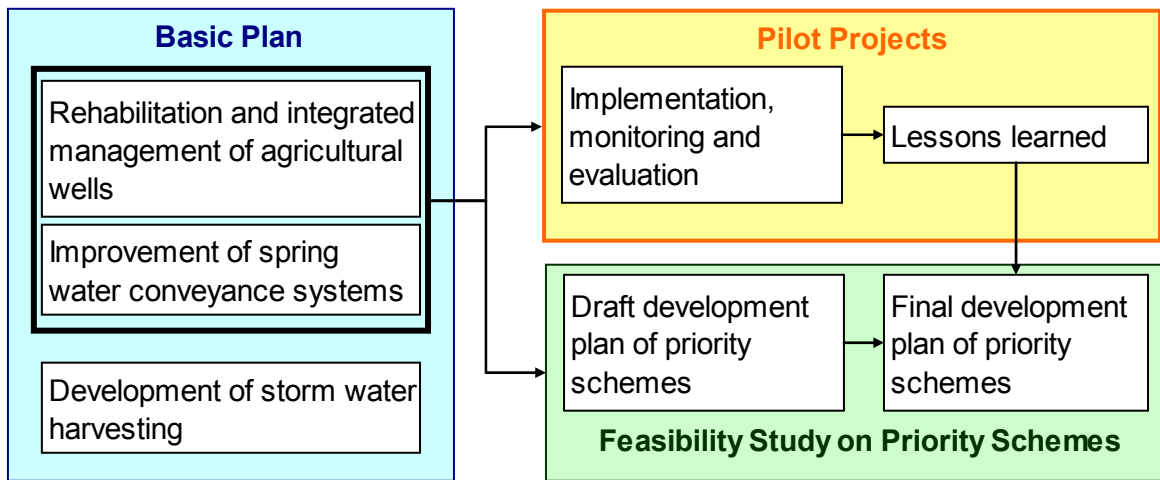


# CHAPTER 7 PILOT PROJECT

## 7.1 Objective of the Pilot Project

Two types of pilot projects, namely the rehabilitation of agricultural wells and improvement of spring water conveyance system, were implemented during the second field work. The objective of the implementation of the pilot project was to verify efficiency and effectiveness of development plans. Based on lessons learned from the implementation, the development plans are revised, which are mentioned in Chapter 8 and Chapter 11. The figure below shows function of pilot projects in the implementation.



Source: JICA Study Team

**Figure 7.1.1 Function of Pilot Project to the Feasibility Study**

The activities during the implementation of the pilot projects are mainly as follows:

- (i) Rehabilitate agricultural wells to recover their function;
- (ii) Improve and rehabilitate the main canal of spring water conveyance system in terms of prevention of leakage and seepage from the system;
- (iii) Monitor and inspect the effectiveness of rehabilitation in order to revise the development plans;
- (iv) Raise public awareness on importance of proper operation and maintenance (O&M) of water facilities, establishment of water users organizations, and realization of water saving agriculture; and
- (v) Conduct training to management organizations in order to operate and manage rehabilitated facilities properly.

## 7.2 Selection of Pilot Project for Rehabilitation of Agricultural Wells

### 7.2.1 Selection Criteria

#### (1) Scoring and Prioritization

In the basic plan of rehabilitation of agricultural wells, 19 locations were selected as the first priority agricultural wells. To select pilot project sites for the rehabilitation, the 19 wells were evaluated based on the criteria recommended in Subsection 6.2.4. In each criterion, threshold and score to be given were decided through discussions with PWA and MoA as shown in the following tables.

**Table 7.2.1 Evaluation Marks in the Criteria for Wells from Technical View**

Criteria		Marks
Technical condition		(Full mark: 60)
1. Abstraction license		
Percentage of yearly licensed abstraction/actual abstraction	More than 1	3
	Less than 1	0
2. Water quality (TDS)		
	Less than 2,000 ppm	2
	More than 2,000 ppm	0
3. Pumping status		
	Bad and/or non-pumping	10
	Fair	7
	Good	0
4. Needs		
Hydro-geological aspect	Developing	10
	Deepening	8
	Substitute well	6
Electromechanical aspect	Motor and pump	10
	Maintenance	5
5. Cost		
	USD 10,000 - 60,000	15
	More than USD 60,000	12
	Less than USD 10,000	9

Source: JICA Study Team

**Table 7.2.2 Evaluation Marks in the Criteria of Wells from Socio-economic View**

Criteria		Marks
Socio-economic condition		(Full mark: 40)
1. Alternative water source		
	No	10
	Yes	5
2. Irrigated area (donums)		
	Less than 500 dunums	5
	1000 dunums or less	7
	More than 1000 dunums	10
3. Irrigated area/Irrigable area (%)		
	Less than 30%	10
	80% or less	5
	More than 80%	2
4. Water user		
Owner and tenant and/ or other farmer	More than 20 users	10
	20 users or less	9
	Less than 11 users	8

Criteria			Marks
Only tenant and/ or other farmers	More than 20 users		7
	20users or less		6
	Less than 11 users		5
Only owner	More than 20 users		4
	20users or less		3
	Less than 11 users		2

Owner : land and well owner

Tenant : A farmer, who rent land and buys irrigation water from the well owner

Other Farmer : A farmer, who has land and buys only irrigation water from the well owner

Source: JICA Study Team

The final result of this evaluation is listed in the following table.

**Table 7.2.3 Result of Final Evaluation to Select Pilot Project Sites for Rehabilitation of Agricultural Wells**

No.	Code	Name	Location	Area	Score of selection criteria		
					Technical (60)	Socio-economic (40)	Total (100)
1	19-17/034	Rajy Al Skakah	Frush bet dajan	C	47	26	73
2	19-17/055	Jawad Al Masri	Jiftlik	C	37	32	69
3	19-17/033	Deya' Saleh 'Abdu	Jiftlik	C	42	25	67
4	19-17/047	Hasan 'Abed Al Jaleel	Frush bet dajan	C	47	19	66
5	18-18/027A	Ibrahem Dyab	Far'a	B	45	20	65
6	19-17/054	Ma'rouf Abu Samrah	Jiftlik	C	37	28	65
7	19-17/027	Hasan Al Sumadi	Jiftlik	C	37	28	65
8	19-15/008	'Abed Al Kareem Njum	Auja	A	44	20	64
9	19-19/005A	Rafeeq Al Zua'bi	Ein Al Byhda	C	34	29	63
10	18-18/036	Khaleel 'Abed Al Hadi	Far'a	B	37	26	63
11	18-18/016	Mustafa Abu Khayzaran	Far'a	A	37	25	62
12	19-20/001A	Khursheed Mbaslat	Bardalla	C	35	25	60
13	20-17/022	Sulayman Saleh	Marji Naja	C	35	25	60
14	19-14/062	Sa'eed 'Ala' Al Deen	Jericho	A	29	31	60
15	19-16/005	'Abed Al'azeez Lubbad Sarrees	Jiftlik	C	35	22	57
16	19-14/058B	Yunes 'Abdu	Jericho	A	45	12	57
17	19-17/012	Marj Na'ja C5	Marji Ghazal	C	38	17	55
18	19-15/028A	Al 'Auja	Auja	A	40	15	55
19	18-18/019	Abdul Kareem Salem	Far'a	B	34	19	53

Source: JICA Study Team

## (2) Selection

Based on the scoring result, following issues were considered for the selection of the pilot project sites:

- Type of required activities

Various types of required activities to rehabilitate wells were selected for collecting as much lessons learned as possible, through the implementation of the pilot project.

- Budgetary limitation

Maximum number of wells was decided based on the available budget.

- Readiness

JWC approval is always required prior to implementation of any activities concerned with water resources. The wells which JWC had approved were selected.

Through the above consideration, eight agricultural wells were selected as pilot project sites for the rehabilitation of agricultural wells.

## 7.2.2 Pilot Project for Rehabilitation and Integrated Management for Agricultural Wells

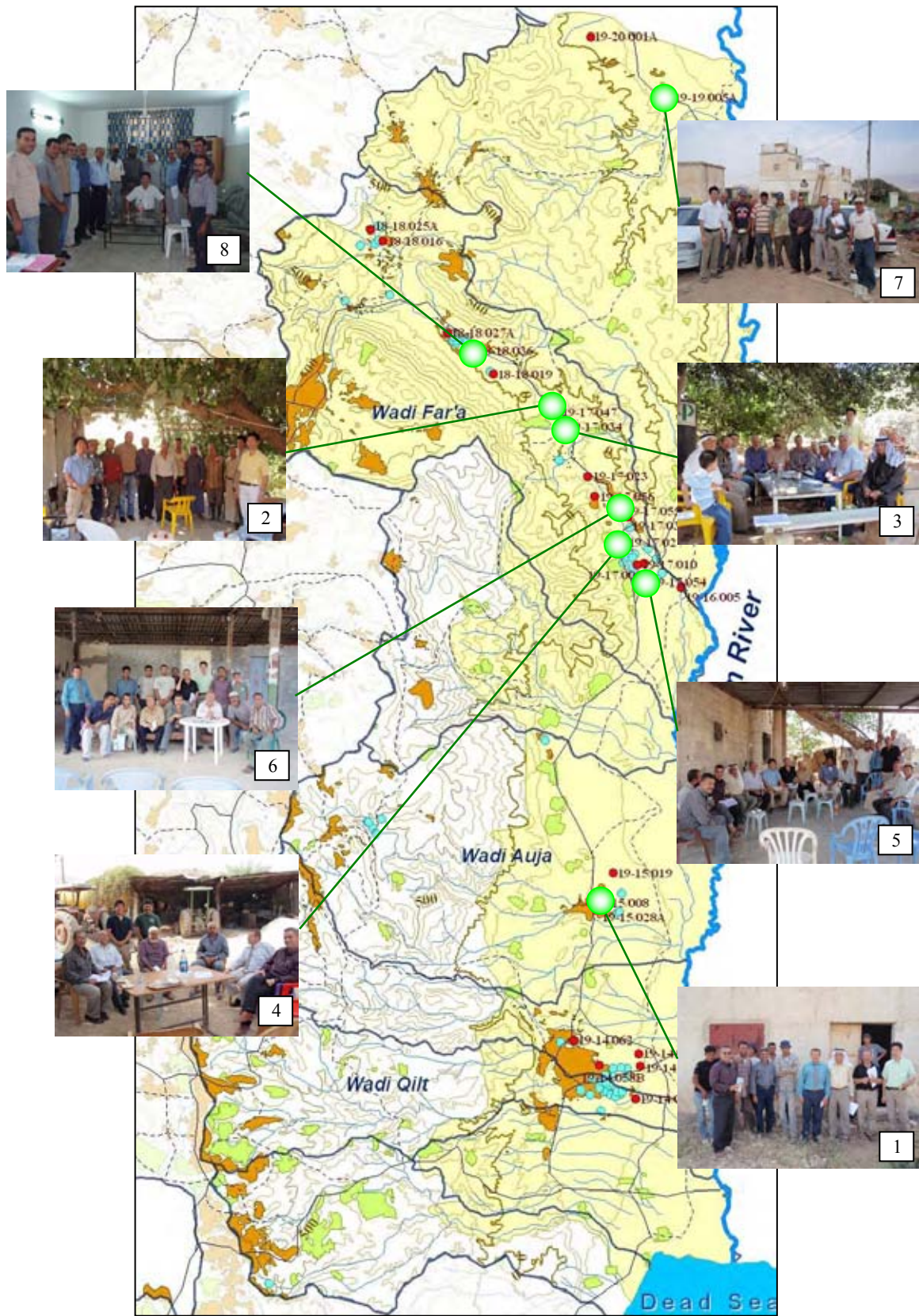
### (1) Sites of pilot project

Sites and needs for rehabilitation of the pilot projects are described in Table 7.2.4. Location map of the pilot project is shown in Figure 7.2.1.

**Table 7.2.4 Sites and Needs for Well Rehabilitation of Pilot Projects**

	Code	Name	Location	Area			Condition		Needs		Remarks
				A	B	C	Bad	Not pumping	Cleaning	Deepening	
1	19-15/008	'Abed Al Kareem Njum	Auja	*				*	*		Cleaning up to 58 m, Installation was cancelled due to water quality through pump test.
2	19-17/047	Hasan 'Abed Al Jaleel	Frush bet dajan			*	*			*	Deepening more than 20 m, Vertical pump (80 m <sup>3</sup> /hr, Head 200m), motor(125 HP)
3	19-17/034	Rajy Al Skakah	Frush bet dajan			*	*			*	Vertical pump (50 m <sup>3</sup> /hr, Head 180m), motor(75 HP)
4	19-17/027	Hasan Al Sumadi	Jiftlik			*	*				Vertical pump (65 m <sup>3</sup> /hr, Head 80m), motor(75 HP)
5	19-17/054	Ma'rouf Abu Samrah	Jiftlik			*	*				Submergible pump (30 m <sup>3</sup> /hr, Head 70m)
6	19-17/055	Jawad Al Masri	Jiftlik			*	*				Vertical pump (90m <sup>3</sup> /hr, Head 120m), motor(75 HP)
7	19-19/005A	Rafeeq Al Zua'bi	Ein Al Byhda			*	*				Vertical pump (110m <sup>3</sup> /hr, Head 50m), motor(50 HP)
8	18-18/036	Khaleel 'Abed Al Hadi	Fara		*		*				Vertical pump (90m <sup>3</sup> /hr, Head 60m), motor(50 HP)
Total direct cost : USD500,000 (including the software component)											

Source: JICA Study Team



Source: JICA Study Team

**Figure 7.2.1 Location Map of Pilot Project (Agricultural Wells)**

(2) Component of the Works

The work items and conceptual image of the pilot project for rehabilitation of agricultural wells are described and illustrated as follows:

Components	<p>Hardware component</p> <ul style="list-style-type: none"> <li>- Cleaning of the selected wells</li> <li>- Deepening or developing of the selected wells, if required</li> <li>- Pumping tests</li> <li>- Procurement and Installation of pumping equipment</li> </ul> <p>Software component</p> <ul style="list-style-type: none"> <li>- Facilitation for forming Water Users' Association (WUA) for each well</li> <li>- Implementation of technical training for WUA staff on O&amp;M, and management of the well</li> <li>- Awareness promotion on efficient water use for water users</li> </ul> <p>Overall component</p> <ul style="list-style-type: none"> <li>- Compilation of lessons learned from the pilot project to be reflected on the basic plan and implementation plan of the priority schemes</li> </ul>
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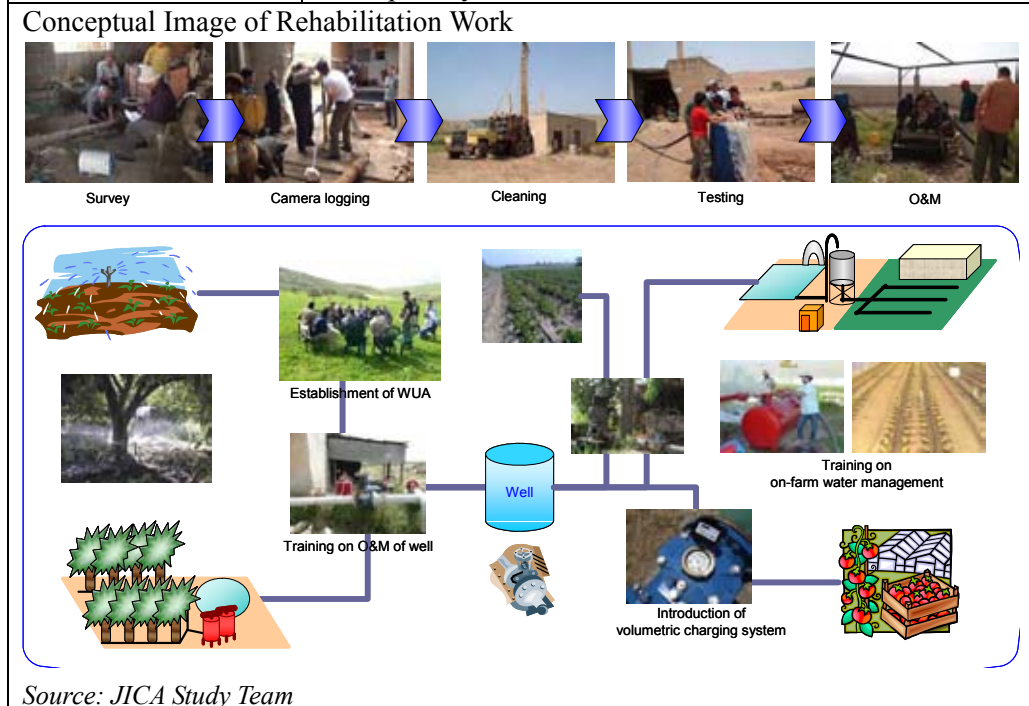


Figure 7.2.2 Work Item and Conceptual Image of Well Rehabilitation Pilot Project

7.3 Selection of Pilot Project for Improvement of Spring Water Conveyance System

7.3.1 Selection Criteria

The pilot project site was selected from the shortlist of priority project sites which were prioritized in Section 6.3 for the basic plan. The prioritized project sites are listed below:

- (i) Al Dyuk Spring;
- (ii) Al Nwai'mah Spring;
- (iii) Al Far'a Spring; and
- (iv) Al 'Auja Spring.

For the pilot project, feasibility and effectiveness of implementation are regarded as the most important aspect taking into consideration the limited budget and duration. In addition, the proposed sites should be evaluated in terms of its extent of contribution to the farmers or beneficiaries. Moreover, it is also important to pay attention to the existence of plans for improvement of spring facilities in the local authorities or farmers groups, in other words, their readiness to change the systems of water supply and use.

The following table shows the marks for evaluation of each item in the criteria for the selection of the pilot project.

**Table 7.3.1 Evaluation Marks in the Criteria**

Item		Marks		Full Marks
Feasibility	Project Scale	Less than 200,000USD	20	20
		More than 200,000USD	0	
	Location	Good	20	20
		Fair	10	
Bad		0		
Effectiveness	Rate of Assumed Loss	More than 30%	20	20
		More than 20%	15	
		Less than 20%	10	
	Discharge Stability	Stable	20	20
		Moderately Fluctuated	15	
		Considerably Fluctuated	10	
Contribution	Irrigated Area	More than 1,000 dunum	10	10
		Less than 1000 dunum	7	
		Less than 500 dunum	5	
Readiness	Existing Plan	Yes	10	10
		No	5	
Full Marks				100

Source: JICA Study Team

Explanation on the meanings of each evaluation item is given as follows:

- (1) Feasibility
  - 1) The project scale is suitable for a pilot project.
  - 2) The site location is permissible concerning obtaining approval for implementation from the Israeli side, and any construction works, construction supervision and monitoring of the project.
- (2) Effectiveness
  - 1) The rate of water loss is assumed to be improved through the project.
  - 2) The trend of discharge volume does not have seasonal fluctuation that causes reduced effectiveness of the project.
- (3) Contribution
  - 1) The irrigated area is relatively large.

(4) Readiness

- 1) There is an existing plan on the improvement of spring facilities. This means that the local authority or the other donor prioritized improvement on part of the plan.

### 7.3.2 Pilot Project for Improvement of Spring Water Conveyance System

(1) Selection of Pilot Project

The four springs, i.e. Al Dyuk, Al Nwai'mah, Al Far'a and Al 'Auja were evaluated under the selection criteria. Marks were then given to each, as follows.

**Table 7.3.2 Result of Final Evaluation for Spring Improvement Pilot Project**

Name	Feasibility		Effectiveness		Contribution	Readiness	Total
	Project Scale	Location	Assumed Loss	Discharge Stability	Irrigated Area	Existing Plan	
	20	20	20	20	10	10	100
Al Dyuk	20	20	15	20	7	5	87
	<200,000	Area A	20-30%	Stable	1,000	No	
Al Nwai'mah	20	20	15	20	7	10	92
	<200,000	Area A	20-30%	Stable	1,000	Yes	
Al Far'ah	20	10	15	15	10	5	75
	<100,000	Not good for monitoring	20-30%	Moderately Fluctuated	>1,000	No	
Al 'Auja	0	10	20	10	10	10	60
	>200,000	Area C	>30%	Considerably Fluctuated	>1,000	Yes	

Source: JICA Study Team

The Al 'Auja spring was given a zero mark in the project scale. The impracticality to identify the components or specifications of the project made it unsuitable for a pilot project. This is because the capacity of its existing canal is insufficient leading to the assumption that necessary improvements on all portions of the main canal would require a high investment.

The Al Far'a spring was given the low marks following the Al 'Auja spring due to: i) the location is not suitable for construction supervision and monitoring works; and ii) the discharge has relatively high fluctuation between winter and summer.

The Al Dyuk and Al Nwai'mah springs were evaluated to be almost equal. Al Nwai'mah was finally selected as a pilot project site since the village council has already a plan for its improvement, to be implemented urgently. A ripple effect is expected to the adjacent area as a result of the participatory approach. Moreover, the project scale is appropriate as a pilot project taking into consideration the limited implementation period.

(2) Component of the Works

The work items of the pilot project for improvement of Al Nwai'mah spring are shown in the following table, with corresponding cost for each.

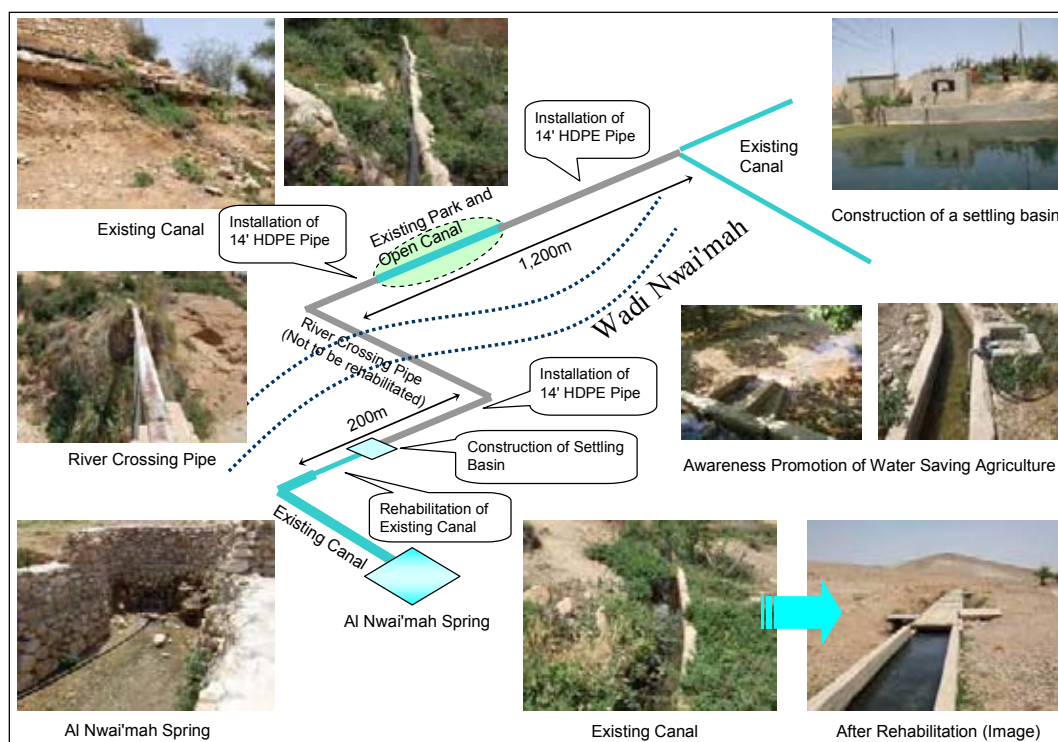


**Table 7.3.3 Work Item and Cost of Nwai'mah Pilot Project**

Work Item
(1) Rehabilitation of the first part of main open canal (approx. 30m)
(2) Construction of a settling basin (16m <sup>3</sup> , concrete structure) with bypass pipes (Approx. 40, HDPE pipe)
(3) Installation of closed pipeline (underground) replacing the second part of main open canal (approx. 1.0km, HDPE pipe with dia.14 inch)
Total cost : USD320,000 (including the software component)

Source: JICA Study Team

Conceptual image of the pilot project is illustrated in the following figure.



Source: JICA Study Team

**Figure 7.3.1 Conceptual Image of Nwai'mah Pilot Project**

The works of software components for improvement of spring water conveyance system are explained in Section 7.4.

**7.4 Supporting System for Water Resources Management**

Supporting system for water resources management is carried out in the pilot projects to assist WUA and village council in securing the sustainability of O&M of the supported equipment. This component is commenced prior to the physical assistance.

**7.4.1 Assistance for Establishment and Capacity Building of WUA for Agricultural Wells**

Assistance for formation and training of WUA and follow-up activities is divided into three stages. A first stage, called the pre-rehabilitation stage, is the period in which a

supplementary survey is conducted, and beneficiaries prepare necessary works before the rehabilitation works. A second stage, called the rehabilitation stage, is the period in which beneficiaries receive trainings on logistics of WUA works and on-farm irrigation. A third stage, called the post-rehabilitation stage, is the period in which WUA is activated and conducts O&M of the well, based on the agreed regulations. In the post-rehabilitation stage, monitoring and evaluation will be conducted as well. Through these stages awareness promotion on water use will be also conducted. Assistance and corresponding activities at each stage are shown in table below.

**Table 7.4.1 Activity of Assistance at Each Stage (Agricultural Wells)**

Stage	Assistance	Activity
Pre rehabilitation stage	Supplementary survey	<ul style="list-style-type: none"> <li>- Collection of detailed information and indicator based on baseline survey</li> <li>- Confirmation of stakeholders' will</li> <li>- Confirmation of Roles and responsibility of stakeholders</li> <li>- Signing on agreement for the rehabilitation</li> </ul>
	Establishment of WUA	<ul style="list-style-type: none"> <li>- Orientation for establishment of WUA</li> <li>- Promotion of benefit from WUA</li> <li>- Regulating roles and responsibility</li> <li>- Regulating water distribution by WUA</li> <li>- Establish of water tariff system</li> <li>- Discussion and issue of regulation</li> <li>- Election of a leader, board members, administration staffs, technical staffs</li> <li>- Registration of WUA</li> </ul>
Rehabilitation stage	Training for operation and maintenance	<ul style="list-style-type: none"> <li>- Water distribution plan</li> <li>- Calculation of water tariff</li> <li>- Maintenance plan for facility and equipment</li> <li>- Record keeping</li> <li>- Financial management</li> </ul>
	Training for on-farm water management	<ul style="list-style-type: none"> <li>- Seasonal cultivating plan and water requirement</li> <li>- Agriculture input procumbent plan</li> <li>- Irrigation facility and equipment</li> <li>- Water saving irrigation practice</li> <li>- Financial management</li> </ul>
Post rehabilitation stage	Follow up activities for operation and maintenance	<ul style="list-style-type: none"> <li>- Water distribution practice based on a distribution plan</li> <li>- Record keeping</li> <li>- Maintenance of equipment and record keeping</li> <li>- Financial management</li> <li>- Reporting</li> <li>- Revising of tariff and regulation</li> </ul>
	Follow-up activity for on-farm water management	<ul style="list-style-type: none"> <li>- Farm management</li> <li>- Water saving irrigation practice</li> </ul>
All stages	Awareness promotion on water	<ul style="list-style-type: none"> <li>- Current water situation at national and regional level</li> <li>- Importance of water management at</li> </ul>

Stage	Assistance	Activity
		regional/national level - Necessity of water saving on-farm level - Water right - Water related laws and regulations - Water tariff system - Necessity of water charge collection

Source: JICA Study Team

### (1) Pre-rehabilitation Stage

#### 1) 1st agreement

1st agreement is submitted by well owner, allowing execution of activities for the rehabilitation of the well. This agreement has to be signed by all the owners of the well.

#### 2) Supplementary survey

Basic information was collected in the baseline survey. At the beginning of the stage, supplementary data and information are collected, especially for the baseline indicators, such as pumping cost, pumping volume, and O&M system.

#### 3) Understanding on pilot project and confirmation on stakeholders' will

All stakeholders have to understand the objectives and scope of the project. In this detailed survey, willingness of water users will be confirmed. In particular, beneficiaries' responsibility and contribution to the rehabilitation need to be confirmed.

#### 4) 2nd agreement

After stakeholders properly understand the study, the pilot project, their roles and responsibilities, a 2nd agreement is signed by designated representatives of the land and well owners, WUA, and the study team. The 2nd agreement clearly defines roles and responsibilities of concerned parties.

#### 5) Forming of WUA

WUA is formed during this period. All beneficiaries should participate in this process. Beneficiaries will confirm the necessity, role and responsibility of WUA. They will elect board members and appoint logistics personnel. They have to draft regulations and establish a tariff system. Finally, WUA will be registered to PWA as a water service provider.

### (2) Rehabilitation Stage

#### 1) Training on O&M of the well

In this stage, WUA staffs receive training on O&M of well, such as water distribution planning based on cultivation plan, well operation in accordance with the plan, bill calculation and fee collection, financial management, and maintenance of facility and equipment.

2) Training on on-farm water management

Water users also receive training on on-farm water management in this period. This training will be conducted with the assistance of JICA’s technical cooperation project.

(3) Post-rehabilitation Stage

This stage commences upon completion of the rehabilitation work. WUA will practically operate and maintain the well. In this stage performance of the well and WUA is periodically monitored, and follow-up activities for WUA are conducted. Regulation of WUA, tariff system and O&M system will be revised accordingly, if necessary.

**7.4.2 Assistance for Establishment of Coordination Committee and Capacity Building of Village Council for Spring**

Spring water is generally utilized for domestic, agriculture, and industrial use. In order to operate the system properly, it is necessary to establish a committee, which accommodates the interest of each party. The committee should consist of representatives from each stakeholder group, such as village council, farmers who have water rights, and residents.

Similar to well rehabilitation, the assistance is divided into three stages. At pre-rehabilitation stage, activities to be conducted include supplementary survey, stakeholder analysis, series of meetings to let stakeholders understand the basics of the project, and support for establishment of the coordination committee. At the next stage, the rehabilitation stage, O&M unit of village council shall receive trainings on logistics. At post-rehabilitation stage, O&M is conducted by village council based on the regulations. In the post-rehabilitation stage, monitoring and evaluation will be conducted as well. Through these stages awareness promotion on water use will be also initiated. Assistance and corresponding activities at each stage are shown in the table below. Subsequent assistance on O&M will be required for capacity building and training of the organizations.

**Table 7.4.2 Activity of Assistance at Each Stage (Spring Water Conveyance System)**

Stage	Activity	Activity
Pre rehabilitation stage	Supplementary survey	<ul style="list-style-type: none"> <li>- Collection of detailed information based on baseline survey</li> <li>- Confirmation of stakeholders’ will</li> <li>- Confirmation of Roles and responsibility of stakeholders</li> <li>- Orientation for establishment of coordination committee</li> <li>- Establishment of coordination committee</li> </ul>
	Capacity building of related organization	<ul style="list-style-type: none"> <li>- Promotion of benefit from cooperative management</li> <li>- Roles and responsibility of stakeholders</li> <li>- Water distribution</li> <li>- Water tariff system</li> </ul>

Stage	Activity	Activity
		<ul style="list-style-type: none"> <li>- Discussion and issue of a regulation</li> <li>- Election of a leader, board members, administration staffs, technical staffs</li> </ul>
Rehabilitation stage	Training for operation and maintenance	<ul style="list-style-type: none"> <li>- Water distribution plan for domestic, agriculture and industry use.</li> <li>- Calculation of water tariff</li> <li>- Maintenance plan for facility and equipment</li> <li>- Record keeping</li> <li>- Billing and fee collection</li> <li>- Financial management</li> </ul>
	Training for on-farm water management	<ul style="list-style-type: none"> <li>- Seasonal cultivating plan and water requirement</li> <li>- Agriculture input procurement plan</li> <li>- Irrigation facility and equipment</li> <li>- Water saving irrigation practice</li> <li>- Financial management</li> </ul>
Post rehabilitation stage	Follow up activities for operation and maintenance	<ul style="list-style-type: none"> <li>- Water distribution practice based on a distribution plan</li> <li>- Record keeping</li> <li>- Maintenance of equipment and record keeping</li> <li>- Financial management</li> <li>- Reporting</li> <li>- Revising of tariff and bylaw</li> </ul>
	Follow-up activity for on-farm water management	<ul style="list-style-type: none"> <li>- Farm management</li> <li>- Water saving irrigation practice</li> </ul>
All stages	Awareness promotion on water	<ul style="list-style-type: none"> <li>- Current water situation at national and regional level</li> <li>- Importance of water management at regional/national level</li> <li>- Necessity of water saving on-farm level</li> <li>- Water right</li> <li>- Water related laws and regulations</li> <li>- Water tariff system</li> <li>- Necessity of water charge collection</li> </ul>

Source: JICA Study Team

(1) Pre-rehabilitation Stage

1) Supplementary survey

Basic information is supposed to be collected during the baseline survey in this study. At the beginning of the stage, supplementary data and information are collected, especially for the baseline indicators.

2) Understanding on a project and confirmation of stakeholders' will

All stakeholders have to understand the objectives and scope of the project. Willingness of water users on the rehabilitation of the system should be confirmed especially the beneficiaries' responsibility and contribution to the rehabilitation.

### 3) Forming Coordination Committee

Coordination committee is formed during this period. All beneficiaries should participate in this process. Beneficiaries confirm the necessity, role and responsibility of the committee. They elect board members from each beneficiary group, which is classified according to water utility and geology. They have to draft regulations and establish a tariff system.

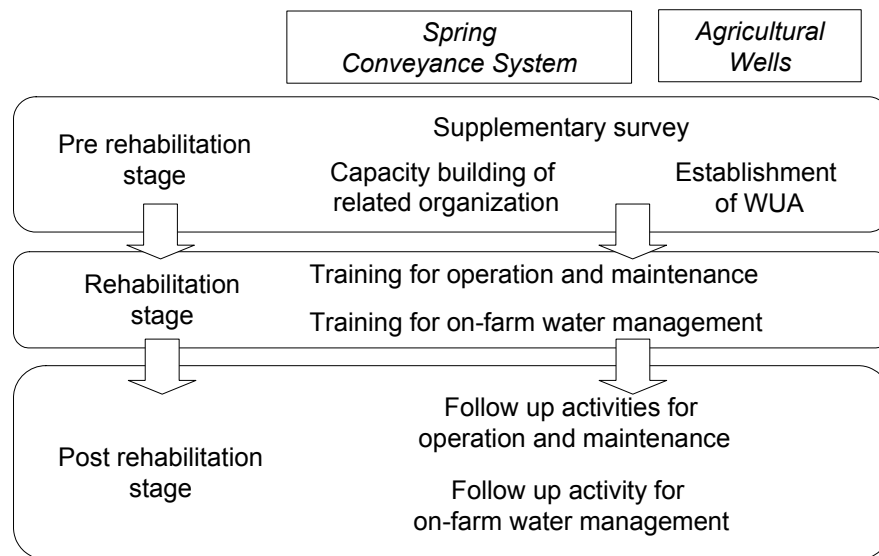
### (2) Rehabilitation Stage

In this stage, village council staffs receive training on O&M of the spring water conveyance system, such as water distribution plan, bill calculation and fee collection, financial management, and maintenance of facilities and equipment.

### (3) Post-rehabilitation Stage

This stage commences upon the completion of the rehabilitation work. Village council will practically operate and maintain the spring water conveyance system. In this stage, performance of the system and village council is periodically monitored, and follow-up activities for O&M are conducted.

Flow chart of the supporting system is shown in Figure 7.4.1.



All stages: Awareness promotion on water management system

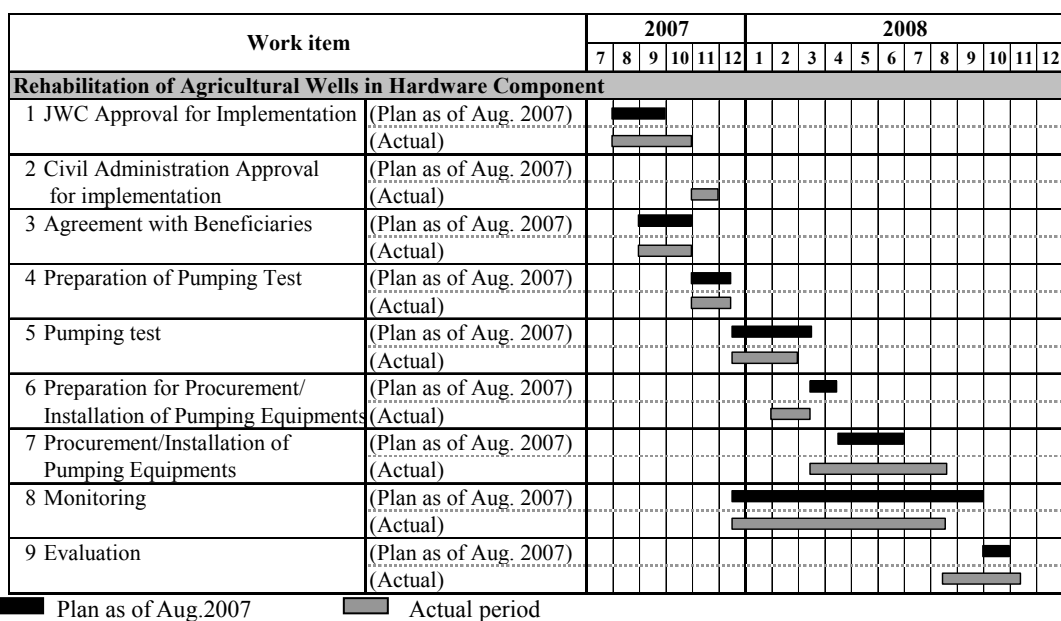
Source: JICA Study Team

**Figure 7.4.1 Flow Chart of the Supporting System**

## 7.5 Implementation Schedule of Pilot Project

### 7.5.1 Pilot Project for Rehabilitation of Agricultural Wells

Implementation schedule of the pilot project for rehabilitation of agricultural wells is shown in the following figure. Because of a limited project period and unexpected additional work caused by Civil Administration, the original implementation schedule was modified as shown in the following figure.

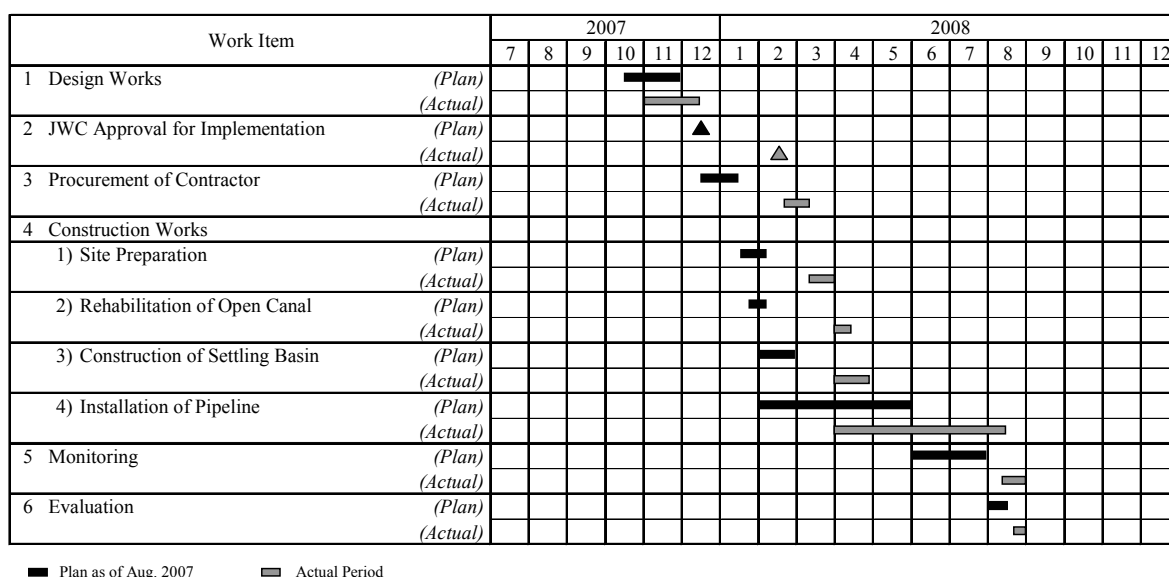


Source: JICA Study Team

**Figure 7.5.1 Implementation Schedule of Pilot Project (Agricultural Wells)**

### 7.5.2 Pilot Project for Improvement of Spring Water Conveyance System

Implementation schedule of the pilot project intended for the improvement of Nwai'mah Spring Conveyance System is shown in the following figure. The actual time schedule was revised because of: i) Delay of JWC approval; and ii) Disagreement on pipe connection with a water right holder.



Source: JICA Study Team

**Figure 7.5.2 Implementation Schedule of the Pilot Project (Nwai'mah Spring)**

### 7.5.3 Supporting System for Water Resources Management

The work was commenced in the middle of November 2007, and completed at the middle of November 2008.

- (1) Pre-rehabilitation stage (formation of WUA and water management section): (3 months)
- (2) Rehabilitation stage (technical training): (5 months)
- (3) Post-rehabilitation stage (follow-up training, monitoring, and reporting): (3 months)

## **7.6 Monitoring and Evaluation of Pilot Project**

### **7.6.1 Project Design Matrix (PDM) of Pilot Project**

Monitoring and evaluation of the pilot projects are carried out based on a PDM and implementation plan. PDMs for each pilot project are presented in Table 7.6.1 and 7.6.2.



**Table 7.6.1 PDM: Pilot Project for Well Rehabilitation**

**Location of Site:** Jericho, Nablus, Tubas

**Target Group:** Well owners and farmers

**Executing Agency:** PWA, MoA

**Implementation Period:** From Nov. '07 to Aug. '08

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><b>Overall Goal</b> Similar projects on rehabilitation works and capacity enhancement of WUA are carried out in other sites.</p>	<ul style="list-style-type: none"> <li>•No. of similar projects implemented</li> <li>•Volume of water extraction and financial situation of WUA in the project sites</li> </ul>	<ul style="list-style-type: none"> <li>•List of similar project implementation by PWA and MOA</li> <li>•Records of water charge collection, water extraction and account book of WUA kept by WUA</li> <li>•Monitoring result conducted by PWA</li> </ul>	<ul style="list-style-type: none"> <li>•Access to the project sites is secured.</li> </ul>
<p><b>Project Purpose</b> Efficient and effective development plan of the priority scheme for rehabilitation of agricultural wells is formulated.</p>	<ul style="list-style-type: none"> <li>•Work component, implementation schedule and management unit</li> <li>•B/C and IRR of Feasibility Study on rehabilitation of agricultural wells</li> </ul>	<ul style="list-style-type: none"> <li>•Final report of the JICA Study</li> </ul>	<ul style="list-style-type: none"> <li>•Cost of fuel and electricity is not drastically increased.</li> <li>•Similar package of project implementation are approved by JWC.</li> </ul>
<p><b>Outputs</b> 1-1.Wells' extraction capacity is recovered up to the licensed one.</p> <p>1-2.O&amp;M cost for the selected wells becomes cheaper.</p> <p>2.The management unit of rehabilitated wells is established to operate and manage appropriately.</p> <p>3.Farmers' understanding on efficient use of agricultural water is deepened.</p> <p>4.Procedure, implementation schedule, cost and desired management system are clarified through all activities.</p>	<ul style="list-style-type: none"> <li>•Volume of extraction</li> <li>•Unit cost of pumped water</li> <li>•Organization chart of WUA for O&amp;M of the rehabilitated wells</li> <li>•Records kept by the WUA</li> <li>•Expected financial balance of WUA</li> <li>•No. of farmers participating the training and their understandings on water saving agriculture</li> <li>•Lessons learnt from the pilot project</li> </ul>	<ul style="list-style-type: none"> <li>•Record of water extraction kept by WUA</li> <li>•Field survey on water extraction capacity conducted by JICA Study Team</li> <li>•Record of water extraction and account book kept by WUA</li> <li>•Result of interview survey to WUA</li> <li>•Internal rule of the WUA</li> <li>•Interview survey to the WUA</li> <li>•List and contents of records to be kept by the WUA</li> <li>•Interview survey to the participants</li> <li>•Record of water extraction kept by WUA</li> <li>•Field survey on water extraction capacity by JICA Study Team</li> <li>•Interview survey to the well owners, WUA and farmers</li> <li>•Study report of the JICA Study</li> </ul>	
<p><b>Activities</b> 1.Rehabilitation of Agricultural Wells •Preliminary survey and needs assessment •Pumping test including cleaning and development of wells •Detail design for pump and generator replacement •Pump and generator replacement 2.Facilitation of formation of WUA •Obtaining agreement from well owners about implementation of the pilot projects •Training on formation of WUA to farmers and well owners •Support of registration of WUA •Facilitation to prepare internal rule of WUA •Training on O&amp;M of wells, optimization of water charge, record keeping •Awareness promotion of water saving agriculture 3.Support of optimum agricultural water use •Training on water saving agriculture to water users 4.Documentation of lessons learnt from the project and suggestion for the next</p>	<p><b>Inputs</b> <u>Palestinian Side</u> Monitoring and guidance (Counterpart personnel)</p> <p><u>Japanese Side</u> Well rehabilitation Pumping test (Contract work) Replacement of pumps and generators (Contract work) Formation of WUA Facilitation (Contract work) Training materials (Contract work) Promotion of water saving agriculture Training materials Transportation Monitoring and guidance Pumping test (Foreign expert) Replacement of pumps and generators (Foreign expert) WUA' formation (Foreign expert) Water saving agriculture (Foreign expert)</p>	<ul style="list-style-type: none"> <li>•Access to the pilot project sites is secured.</li> </ul> <p><b>Pre-conditions</b> •Well owners and water users agree the implementation of pilot project.</p>	

Source: JICA Study Team

**Table 7.6.2 PDM: Pilot Project for Improvement of Spring Water Conveyance System**

**Location of Site:** Jericho Governorate **Locality:** Nwai'mah **Target Group:** Village Council and farmers  
**Executing Agency:** PWA, MoA **Implementation Period:** From Nov. '07 to Aug. '08

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><b>Overall Goal</b>                      It is realized in the F/S target areas that water conveyance efficiency is improved and spring water is allocated effectively after the projects on improvement of spring water conveyance system are implemented.</p>	<ul style="list-style-type: none"> <li>•No. of projects implemented</li> <li>•Efficiency of conveyance system at the project sites</li> <li>•Condition of water allocation at the project sites</li> <li>•Condition of spring water conveyance system</li> <li>•Financial condition of water management unit of spring water</li> </ul>	<ul style="list-style-type: none"> <li>•List of project implemented by PWA and MOA</li> <li>•Interview survey to village councils, water management units and farmers at the project sites</li> <li>•Field survey to check water leakage from the improved conveyance system</li> <li>•Record of discharge measurement, water allocation, account book kept by the management units</li> </ul>	<ul style="list-style-type: none"> <li>•Access to the project sites is secured.</li> </ul>
<p><b>Project Purpose</b>                      Efficient and effective development plan of the priority scheme for improvement of spring water conveyance system is formulated.</p>	<ul style="list-style-type: none"> <li>•Work component, implementation schedule and management unit</li> <li>•B/C and IRR of Feasibility Study on improvement of spring water conveyance system</li> </ul>	<ul style="list-style-type: none"> <li>•Final report of the JICA Study</li> </ul>	<ul style="list-style-type: none"> <li>•Project implementation on improvement of spring water conveyance system and capacity enhancement of water management units is approved by JWC.</li> </ul>
<p><b>Outputs</b>                      1.Conveyance loss of spring water is decreased.                      -----                      2-1.Spring water is allocated effectively and efficiently.                      -----                      2-2.A water management unit of spring water conveyance system is established to operate and manage appropriately.                      -----                      3.Procedure, implementation schedule, cost and desired management system are clarified through all activities.</p>	<ul style="list-style-type: none"> <li>•Volume of conveyed water and leakage</li> <li>•Expected condition of water allocation</li> <li>•Organization chart of the water management unit for O&amp;M of the improved conveyance system</li> <li>•Records kept by the management unit</li> <li>•Expected financial balance of the management unit</li> <li>•Lessons learnt from the pilot project</li> </ul>	<ul style="list-style-type: none"> <li>•Discharge record</li> <li>•Field survey on water leakage</li> <li>•Discharge record</li> <li>•Field survey on water leakage</li> <li>•Water allocation plan</li> <li>•Internal rule of the management unit</li> <li>•Training report</li> <li>•Interview survey to the village council and farmers</li> <li>•Scope of work of the management unit</li> <li>•List and contents of records to be kept by the management unit</li> <li>•Interview survey to the village council</li> <li>•Study report of the JICA Study</li> </ul>	
<p><b>Activities</b>  <u>1.Improvement of spring water conveyance system of Nwai'mah spring</u>                      •Topographic survey                      •Detail design for improvement of the conveyance system                      •Implementation of the improvement of spring water conveyance system  <u>2.Facilitation of formation of a management unit</u>                      •Obtaining agreement from Nwai'mah village council about implementation of the pilot project                      •Training on formation of water management unit to village council                      •Support of registration of water management unit of village council                      •Facilitation to prepare internal rule of water management unit of village council                      •Training on O&amp;M of wells, optimization of water charge, record keeping                      •Awareness promotion of water saving agriculture  <u>3.Documentation of lessons learnt from the project implementation and suggestion for the next</u></p>	<p>Inputs                      Palestinian Side                      Monitoring and guidance (Counterpart personnel)                      Japanese Side                      Improvement of spring water conveyance system                      Topographic survey and detail design (Contract work)                      Improvement of spring water conveyance system (Contract work)                      Formation of a management unit                      Facilitation (Contract work)                      Training materials (Contract work)                      Monitoring and guidance                      Topographic survey (Foreign expert)                      Improvement of spring water conveyance system (Foreign expert)                      Formation of management unit (Foreign expert)</p>	<ul style="list-style-type: none"> <li>•Access to the pilot project sites is secured.</li> </ul> <p><b>Pre-conditions</b>                      •Stakeholders agree the implementation of pilot project</p>	

Source: JICA Study Team

## 7.6.2 Monitoring Method

The main part of the monitoring, especially those included in the initial stage of the pilot projects, is to confirm whether the “inputs” and “activities” presented in the PDMs are reflected on the implementation plan schedule. In the latter stage of the Study, the achievement of the “outputs” and “project purpose” on the PDMs are also objectively monitored using the “indicators” written in the PDMs. The “important assumption” and “preconditions” are also investigated to assess the monitoring results.

## 7.6.3 Evaluation Method

Evaluation of the pilot project consists of three steps, i.e., baseline survey (or collection of baseline data and information), mid-term evaluation and final evaluation. Major portions of the baseline data and information have already been collected during the first field work period.

The mid-term evaluation was conducted for reviewing the initial plan of the pilot projects. The final evaluation was carried out at the final stage of the pilot projects to summarize the lessons learned and recommendations. The outcomes from this evaluation were the basis for review and revision of the development plan.

## 7.6.4 Monitoring and Evaluation of Pilot Project

(1) Progress of the pilot project for rehabilitation of agricultural wells

The following table shows the progress of the pilot project at activity level. All these activities including monitoring and evaluation were completed in the middle of November 2008.

**Table 7.6.3 Progress of Activities in the Pilot Project for Rehabilitation of Agriculture Wells**

As of November 2008

1.Rehabilitation of Agricultural Wells	
- Preliminary survey and needs assessment	Done
- Pumping test including cleaning and development of wells	Done
- Detail design for pump and generator replacement	Done
- Procurement and installation of pumping equipment	Done
2.Facilitation of formation of WUA	
- Obtaining agreement from well owners about implementation of the pilot projects	Done
- Training on formation of WUA to farmers and well owners	Done (Continuous monitoring is recommended.)
- Support of registration of WUA	Done
- Facilitation to prepare internal rule of WUA	Done
- Training on O&M of wells, optimization of water charge and record keeping	Done (Continuous monitoring is recommended.)
- Awareness promotion of water saving agriculture	Done (Continuous monitoring is recommended.)
3.Support of optimum agricultural water use	
- Training on water saving agriculture to water users	Done (Continuous monitoring is recommended.)

4. Procedure, implementation schedule, cost and desired management system are clarified through all activities.	
- Monitoring and evaluation	Done (Continuous monitoring is recommended.)

Source: JICA Study Team

Project Purpose and outputs are evaluated by indicators described in the PDM. Results are shown in the evaluation grid table below.

**Table 7.6.4 Evaluation Grid based on PDM for Rehabilitation of Agriculture Wells**

PDM code	Indicators	Source/ Method	Result
<b><u>Project Purpose</u></b> Efficient and effective development plan of the priority scheme for rehabilitation of agricultural wells is formulated.	<b><u>Indicator 1</u></b> Work component, implementation schedule and management unit	Final report of the JICA Study	Development plan for the priority schemes was formulated based on the result of the pilot project. Lessons from the future monitoring activities to be conducted by MoA and PWA should be reflected on the implementation.
	<b><u>Indicator 2</u></b> B/C and IRR of Feasibility Study on rehabilitation of agricultural wells	Final report of the JICA Study	The financial and economic evaluation for the priority schemes was finalized based on the result of the pilot project.
<b><u>Output 1-1</u></b> Wells' extraction capacity is recovered up to the licensed level.	<b><u>Indicator</u></b> Volume of extraction	- Record of water extraction kept by WUA - Field survey on water extraction capacity conducted by JICA Study Team	Since full operation has not been started, actual extraction volume cannot be recorded. However, the result of pumping test indicated that extraction volume per hour was increased more than 30% in average. Actual effect shall be confirmed through monitoring by MoA and PWA after commencement of full operation.
<b><u>Output 1-2</u></b> O&M cost for the selected wells becomes cheaper.	<b><u>Indicator</u></b> Unit cost of pumped water	- Record of water extraction and account book kept by WUA - Result of interview survey to WUA	Since full operation has not been started, actual O&M cost yet to be seen. However, the result of pumping test indicated that unit fuel cost for m <sup>3</sup> was decreased more than 30% in average.
<b><u>Output 2</u></b> The management unit of rehabilitated wells is established to operate and manage appropriately.	<b><u>Indicator 1</u></b> Organization chart of the WUA for O&M of the rehabilitated wells	- Internal rule of the WUA - Interview survey to the WUA - List and contents of records to be kept by WUA	Regulation of WUA was developed and issued in all WUA, and training on O&M was completed. Continuous monitoring by MoA and PWA is required.

PDM code	Indicators	Source/ Method	Result
	<u>Indicator 2</u> Records kept by the WUA	- Internal rule of the WUA - Training report - Interview survey to the WUA - List and contents of records to be kept by WUA	Training of O&M and record keeping was completed in participation of well owners, operators and record keepers. Continuous awareness raising activities and timely/appropriate guidance by MoA and PWA are required.
	<u>Indicator 3</u> Expected financial balance of WUA	- Interview survey to WUA - List and contents of records to be kept by WUA	The tariff system was proposed to make the financial balance sound, but it was not applied because full operation of pumping equipment is not started yet. Continuous awareness raising activities and timely/appropriate guidance by MoA and PWA are required.
<b>Output 3</b> Farmers' understanding on efficient use of agricultural water is deepened.	<u>Indicator</u> No. of farmers participating the training and their understandings on water saving agriculture	- Interview survey to the participants - Record of water extraction kept by WUA - Field survey on water extraction capacity conducted by JICA Study Team	124 trainees, who include 80% of the farmers, participated in the training course. 96.3% of trainees intend to change their irrigation practice based on the training course they received. Continuous awareness raising activities and timely/appropriate guidance by MoA and PWA are required.
<b>Output 4</b> Procedure, implementation schedule, cost and desired management system are clarified through all activities.	<u>Indicator</u> Lessons learned from the pilot project	- Interview survey to the well owners, WUA and farmers - Study report of the JICA Study	Many practical lessons learned were obtained through the process of the pilot project activities. Regarding the post project period, continuous monitoring is needed for evaluation.

Source: JICA Study Team

The pumping test before and after the rehabilitation showed positive results in either pumping capacity or pumping efficiency in all target wells (see table below). As a result, unit pumping cost was dramatically improved although fuel cost was increased by 20%. Pumping capacity in the well 19-17/047 became more than double by reason of the effect of deepening. In other wells, even though there was not big improvement in pumping capacity, fuel consumption was dropped. These caused lowering the unit pumping cost in all target wells. The results shown in table below are simple test results. Therefore, further pumping test needs to obtain more precise data collection.

**Table 7.6.5 The Results of Pumping Test**

No.	Wells ID	December-07 Old equipment				August-08 New Equipment				Extraction License (m <sup>3</sup> /yr)
		A (m <sup>3</sup> /hr)	B (lit.)	C (m <sup>3</sup> /lit.)	D (NIS/m <sup>3</sup> )	A (m <sup>3</sup> /hr)	B (lit.)	C (m <sup>3</sup> /lit.)	D (NIS/m <sup>3</sup> )	
1	19-17/055	85	22	3.86	1.29	118	14	8.43	0.71	300,000
2	19-17/027	50	18	2.78	1.80	50	9	5.56	1.08	247,000
3	19-17/034	55	18	3.06	1.64	55	9	6.11	0.98	126,000
4	18-18/036	80	18	4.44	1.13	90	9	10.00	0.60	117,000
5	19-17/047	30	18	1.67	3.00	80	14	5.71	1.05	50,000
6	19-17/054	30	5	6.00	0.83	40	5	8.00	0.75	138,000
7	19-19/005A	100	13	7.69	0.65	150	7	21.43	0.28	214,200

A: Pumping capacity (m<sup>3</sup>/hr), B: Fuel consumption (lit.), C: Pumping efficiency (m<sup>3</sup>/lit.), D: Unit pumping cost (NIS/m<sup>3</sup>), Fuel cost used in above table were 5NIS/lit in December 2007 and 6NIS/lit in August 2008.

Source: JICA Study Team

1) Problems

- In three of the eight target wells, extraction license was either not renewed or missing at the time of registration. Out of which, two are absentee-owned wells, and thus, its extraction license had not been renewed periodically. It took time for the registration of its WUA in PWA.
- Some well owners misunderstood that WUA would take over the ownership of the well and their water rights.
- It took more time than planned to collect precise data and information, to be used as baseline for the evaluation, from owners and farmers.
- Database on water quality in PWA has not been periodically updated. A well that produce saline water, was selected as the target well.
- There were occasions when it took time for the contractors' staff to pass through the Israeli check point, due to security reasons.
- Implementation schedule of software component was postponed due to the delay of equipment procurement.
- Rehabilitation works were delayed due to a problem that occurred concerning disputes between well owners and tenants.

2) Lessons learned

- Among selected 8 agricultural wells, installation of pump equipment for well No. 19-15/008 in Auja was abandoned because that water quality of the well with a high electric conductivity of about 4,000 to 6,000µs/cm was observed through 1st stage works. It causes restriction of the cropping in the area.
- For the prioritization of the proposed wells, score setting on each criterion should be considered, so that difference among wells can be clearly appeared.
- Any activities requiring farmers' participation should not be planned from June to August, since they are not available on site during this period.
- Orientation or introduction of the project activity requires longer time and patience. In particular, owners of absentee-owned wells tend to misunderstand about ownership of their well and water rights.

- For the facilitation of WUA establishment, a period for rapport building among stakeholders and facilitators varies depending on the condition of the well. Experiences in the pilot project indicate that at least six months need to be allotted.
- For smooth movement of the staff tasked to perform field works, identification card should be issued by the project or Palestinian Authority.
- If a target well is absentee-owned or owner managed, its proposed rehabilitation should be approved first by the well owners, as well as establishment of WUA. This obtained approval shall be confirmed in a written document in order to avoid any problems during the implementation works.
- Renewal of extraction license should be monitored by PWA as part of the routine works in order to avoid any delay of implementation.
- Establishment of WUA has to be scheduled before the procurement of equipment. This is intended to more possibly execute the collective works for the formation of WUA.
- Approval of well rehabilitation by JWC requires many procedures and takes time. Approval of JWC on wells that need rehabilitation, should be obtained prior to submission of the rehabilitation proposal to the donors.
- Most of the target wells in pilot project are located in Area C, thus requires approvals from concerned Israeli authorities, who are in charge of security in the project site. These authorities have to be properly informed about the project in order to avoid any obstacles concerning the movement of staff and equipment.
- Most of well equipment has to be imported from outside of Palestine through the Israeli port. Delivery schedule may be delayed due to official procedures in the port. Hence, three months should be allotted for the procurement of equipment
- An electric motor as power source is preferable in terms of lowering the operation cost. This is consistent with the policy of PWA. Possibility of considering the electric motor in the detailed design should to be carefully examined in any area.
- If a target well produces saline water, well owners have to be adequately informed about the quality of water, options for water use in agriculture and other purposes.

### 3) Recommendation

- In order to avoid any obstacles during and after the implementation of a project, a lease agreement between well owners and tenants, and any confirmation between stakeholders and a project/implementing agency should be established and confirmed in written documents.
- It is recommended that the Palestinian Authority allocates enough budgets to PWA, at least for the works which fulfill their roles and responsibility.
- After the Study Period, it is recommended that the Steering Committee, which

was established for this Study, continues to monitor and evaluate the pilot project periodically. In particular, the sustainability of WUA activity is rendered as the most important element for O&M of the water supply facility. Lessons learned from WUA activity would be helpful for the formation process in the priority scheme.

- Rehabilitated wells, especially the deepened wells, should be surveyed and rearrange its license volume. The license volume affects the calculation of the depreciation cost and tariff.

(2) Progress of the pilot project for improvement of spring conveyance system

The following table shows the progress of the pilot project at activity level. All the activities including monitoring and evaluation were completed in the middle of November 2008.

**Table 7.6.6 Progress of Activities in the Pilot Project for Improvement of Spring Water Conveyance system**

As of November 2008

1. Conveyance loss of spring water is decreased.	
- Topographic survey	Done
- Detail design for improvement of the conveyance system	Done
- Implementation of the improvement of spring water conveyance system	Done
2-1. Spring water is allocated effectively and efficiently.	
- Obtaining agreement from Nwai'mah village council about implementation of the pilot project	Done
- Training on formation of water management unit to village council	Done (Continuous monitoring is recommended.)
- Support of establishment of water management unit of village council;	Done (Continuous monitoring is recommended.)
- Facilitation to prepare internal rule of water management unit of village council	Done (Continuous monitoring is recommended.)
2-2. The management unit of spring water conveyance system is established to operate and manage appropriately.	
- Training on O&M of spring water conveyance system, optimization of water charge, record keeping	Done (Continuous monitoring is recommended.)
- Awareness promotion of water saving agriculture	Done (Continuous monitoring is recommended.)
3. Procedure, implementation schedule, cost and desired management system are clarified through all activities.	
- Monitoring and evaluation	Done (Continuous monitoring is recommended.)

Source: JICA Study Team



**Table 7.6.7 Evaluation Grid based on PDM for Improvement of Spring Water Conveyance System**

PDM code	Indicators	Source/ Method	Result
<p><b><u>Project Purpose</u></b> Efficient and effective development plan of the priority scheme for improvement of spring water conveyance system is formulated.</p>	<p><b><u>Indicator 1</u></b> Work component , implementation schedule and management unit</p>	- Final report of the JICA Study	Development plan for the priority schemes was formulated based on the result of the pilot project. Lessons from the future monitoring activities to be conducted by MoA and PWA should be reflected on the implementation.
	<p><b><u>Indicator 2</u></b> B/C and IRR of Feasibility Study on improvement of spring water conveyance system</p>	- Final report of the JICA Study	The financial and economic evaluation for the priority schemes was finalized based on the result of the pilot project.
<p><b><u>Output 1</u></b> Conveyance loss of spring water is decreased.</p>	<p><b><u>Indicator</u></b> Volume of conveyed water and leakage</p>	- Discharge record - Field survey on water leakage	The water loss in the target conveyance line was 38.5% before the project. The result of water flow monitoring shows that it was improved to be 9.9% after the project.
<p><b><u>Output 2-1</u></b> Spring water is allocated effectively and efficiently.</p>	<p><b><u>Indicator</u></b> Expected condition of water allocation</p>	- Discharge record - Field survey on water leakage	It can be conceivable that the water volume conveyed to the users is increased to be another 0.7 million m <sup>3</sup> /year from the result of water flow monitoring mentioned above.
<p><b><u>Output 2-2</u></b> A management unit of spring water conveyance system is established to operate and manage appropriately.</p>	<p><b><u>Indicator 1</u></b> Organization chart of the management unit for O&amp;M of the improved conveyance system</p>	- Water allocation plan - Interview survey to the village council	Stakeholders decided that two existing water management bodies be merged to promote efficient management. An organization structure of merged management committee was proposed, but not yet started. In order to get ready for the improvement works for the entire conveyance system, awareness raising activities by MoA and PWA are required continuously.
	<p><b><u>Indicator 2</u></b> Records kept by the management unit</p>	- Scope of work of the management unit - Training report - Interview survey to the village council and farmers - List and contents of records to be kept by the management unit	No. of training participants was 7, who were nominated as candidates for the committee members. They were explained on the proposed scope of works for O&M. Continuous awareness raising activities and timely/appropriate guidance by MoA and PWA are required.

PDM code	Indicators	Source/ Method	Result
	<u>Indicator 3</u> Expected financial balance of the village council on water	- Interview survey to the village council - List and contents of records to be kept by the village council	The tariff system was proposed to make the financial balance sound, but it will not be applied until the entire conveyance system is improved. Continuous awareness activities by MoA and PWA are required.
<b>Output 3</b> Procedure, implementation schedule, cost and desired management system are clarified through all activities.	<u>Indicator</u> Lessons learned from the pilot project	- Interview survey to the village council - Study report of the JICA Study	Many practical lessons learned were obtained through the process of the pilot project activities. Regarding the post project period, continuous monitoring is needed for evaluation.

Source: JICA Study Team

#### 1) Problems

- It took more time than expected to identify the absentee water rights holders.
- The design works for the pilot project was completed in December 2007 as scheduled. However, the tender procedure is suspended because JWC approval was not obtained. As a result, commencement of the implementation works were three months behind the original schedule.
- It was confirmed with the village council on the designing stages that there were no Bedouin water users in the projected site to be replaced with pipelines. However, it was realized that they were using water taken from the open canals at the upper area of the site. The JICA Study Team informed them that the beginning section of the conveyance line, where available water can be taken, is kept open.
- It was ascertained in the meeting with the village council that even the main line need to have distribution connection, following the current connection points that include the old ones that have not been used for years. The design considers installation of new distribution connection points at the same points of the existing ones.
- It was expected that some friction could occur between the village council and farmers if the traditional distribution system would be changed in the portion replaced by the closed pipes. The distribution system in the portion to be improved should therefore be designed to be almost similar to the system with gate operation.
- A part of the existing canal passes through an amusement park in the Nwaim'ah Village. The owner of the park requested the village council to keep the canal in the park open, for recreational use of its customers. Since said owner is one of the spring water rights holders, this part was excluded from the project scope.
- A farmer in the target site refused pipe connection to his farm land, although he previously agreed with the village council during the design stage of the project. This has caused delay of the works. As a result, the design at this part was

modified during the implementation works since consensus with said farmer was not obtained.

- At the part kept opened near the spring source, seasonal weed or algae grow in the canal. This will cause damage to the pipeline materials. Maintenance works for existing open canals are required in the O&M plan, as well as the works for the parts to be renewed.

## 2) Lessons Learned

- On the design stage, it is necessary to have a workshop to discuss with both the O&M bodies and water rights holder to obtain consensus on the outline of proposed facilities and proposed O&M methods.
- It is preferable to maintain the traditional distribution methods and structures of the distribution lines to realize project consensus with the users, taking into consideration current user's operating methods, even in cases where the conveyance system is replaced by closed pipelines.
- The user connection components should be user-friendly
- The construction plan should be designed in consideration of water demand periods of the users.
- In case a conveyance system is rehabilitated partially, an O&M plan for the proposed projects should include a work item for the O&M of the whole system.
- If there are existing groups, which are involved in any O&M activity in the system, utilization of these groups for O&M of improved system should be considered rather than new one to establish.

## 3) Recommendation

- The PWA is required to strengthen the planning, presentation, and coordination capability of approval process of relevant organizations.
- It is recommended that the counterpart or related governmental organization, as a regulator, supervisor or instructor, would conduct a workshop with O&M bodies and users on project outline, considering concept and necessity from the viewpoint of water resources management.
- In order to as much as possible avoid design changes during the construction stage, site reconnaissance is recommended to be conducted with the O&M bodies and water rights holders, to the design location and structures of user connection.
- Even though the process for consensus building with water rights holders seems adequate in the design stage, some cases of design changes may be anticipated especially in the distribution connections. In this regard, flexible correspondence is required in the procedures for procurement and supervision.
- After the study period, it is recommended that the Steering Committee, which was established for this study, continues to monitor and evaluate the Pilot Project periodically, especially the sustainability of O&M activities including the water flow monitoring.

### 7.6.5 Monitoring and Evaluation of the Pilot Project in Post Study Period

In the pilot project, rehabilitation and construction work for the wells and the spring were completed, as well as establishment of WUA and capacity development of WUA and staff of village council. The process of above activities were monitored and evaluated in the study period as explained above. Since the sustainability of WUA activity is rendered as the most important element for O&M of the water supply facility as well as formulation of future projects, continuation of the monitoring and evaluation in the pilot projects by Steering Committee, which established for this study, is proposed.

#### (1) Member

##### 1) Palestinian side

Representatives from PWA, MoA, MoP, and EQA

##### 2) Japanese side

Representatives from JICA Palestine office

##### 3) Observer

Embassy of Japan

##### 4) The secretariat for the committee

PWA

#### (2) Methodology

On the post rehabilitation stage, monitoring and evaluation focus on sustainability and impact of the pilot project.

##### 1) Monitoring work

###### Frequency of Monitoring

Monitoring work is periodically conducted as three (3) times a year, at the beginning, at the middle and at the end of agriculture water use period. Necessary data and information are collected and analyzed by PWA and MoA.

###### Data and Information to be Collected

- Availability of water distribution plan (time table)
- Water distribution according to the water distribution plan (O&M record book)
- Condition of facility and equipment (O&M record and observation)
- Water fee collection rate (record book)
- Accumulation of O&M cost (Bank statement or account book)
- Accumulation of depreciation cost (Bank statement or account book)
- On-farm water management practice (observation)
- Social and environmental impact (interview and observation)

##### 2) Evaluation Work

Based on the monitoring results and field observation, evaluation team, which consists of Steering Committee members, evaluates the pilot project in terms of

sustainability and impact. The evaluation results are presented and discussed in the Steering Committee meeting.

Timing of Evaluation

The timing of the evaluation is once a year. The evaluation work after the harvest season is preferable.

Criteria to be Examined

**Sustainability:** Sustainability means whether the WUA and the Village Council can continue O&M properly after the study period.

**Impacts:** Impacts are positive and negative effects of the implementation of the pilot project, either direct or indirect should be examined. These include effects that were not foreseen at the time of planning.

Evaluation items from several aspects are summarized as follows:

Aspects	Impacts	Sustainability
Policy aspects	Effects on policy both national and regional level	Will government support for WUA and systems necessary to retain project activities and outputs continue to be provided in the future?
Technical aspects	Technological innovation,	Are the WUA and village council capable of preserving and disseminating the necessary technology?
Environmental aspects	Pollution or protection of water sources	Will WUA and village council be adversely affected by changes in the environment, or, conversely, Will they have a negative impact on the environment?
Socio-cultural aspects	Enhancement of status of stakeholders, widening the gap between rich and poor. Any collective activities beyond O&M work in WUA and village council.	Will continued activities by WUA and village council have a negative socio-cultural impact in future or will the socio-cultural negative impact threaten the survival of WUA and village council and continuation of their activities?
Institutional and management aspects	Effects on related organizations and groups, changes laws and regulations.	Can WUA and village council, and water supply systems be maintained in the future in terms of manpower supply, personnel expertise and organizational structure?
Economical and financial aspects	Economic benefits to participants, related organization and local community	Can WUA and village council continue O&M in terms of financial status, and capable to renew facility and equipment by themselves.

Evaluation report

The evaluation team makes the evaluation report and presents to the Steering Committee meeting. Following contents should be included in the evaluation report:

- (i) Results of evaluation;
- (ii) Lessons learned; and
- (iii) Recommendations.

## CHAPTER 8 FEASIBILITY STUDY ON PRIORITY SCHEMES

### 8.1 Development Plan for the Rehabilitation of Agricultural Wells

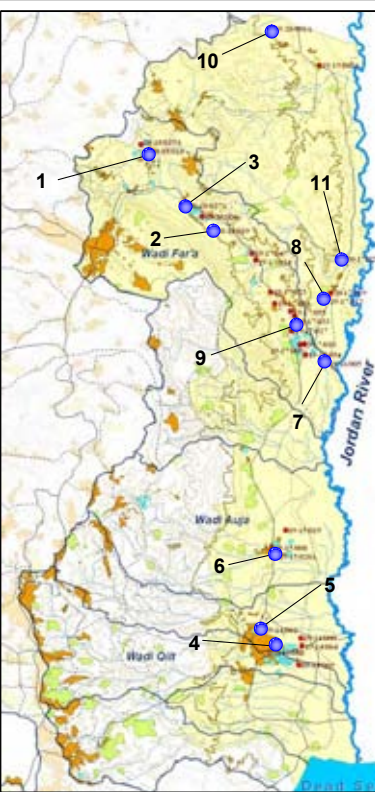
#### 8.1.1 Preparation of Development Plan for the Rehabilitation of Agricultural Wells

##### (1) Site Location of Priority Schemes

The first priority agricultural wells for rehabilitation were selected in the Basic Plan presented in Chapter 6. Among the 19 wells, eight were selected as the pilot project while the remaining 11 were included as priority schemes for rehabilitation of agricultural wells.

Locations of the priority schemes are illustrated in Figure 8.1.1.

No.	Code	Name	Location	Area	Status
1	18-18/016	Mustafa Abu Khayzaran	Far'a	A	Bad condition
2	18-18/019	Abdul Kareem Salem	Far'a	B	Bad condition
3	18-18/027A	Ibrahem Dyab	Far'a	B	Not pumping
4	19-14/058B	Yunes 'Abdu	Jericho	A	Not pumping
5	19-14/062	Sa'eed 'Ala' Al Deen	Jericho	A	Fair condition
6	19-15/028A	Al 'Auja	Auja	A	Not pumping
7	19-16/005	'Abed Al'azeez Lubbad Sarrees	Jiftlik	C	Bad condition
8	19-17/012	Marj Na'ja C5	Marji Ghazal	C	Not pumping
9	19-17/033	Deya' Saleh 'Abdu	Jiftlik	C	Not pumping
10	19-20/001A	Khursheed Mbaslat	Bardalla	C	Not pumping
11	20-17/022	Sulayman Saleh	Marji Naja	C	Not pumping



Source: JICA Study Team

**Figure 8.1.1 List and Location of Priority Schemes**

##### (2) Present Condition of the Agricultural Wells in the Priority Schemes

The basic information of the agricultural wells in the priority schemes is summarized in the following tables.

**Table 8.1.1 Mechanical Condition of the Priority Wells**

	Well ID	Condition	Source of power supply	Remarks
1	18-18/016	Bad	Diesel	<ul style="list-style-type: none"> <li>The pump is old and has low efficiency.</li> <li>The electrical panel for the well is old and has low efficiency.</li> </ul>
2	18-18/019	Bad	Diesel	<ul style="list-style-type: none"> <li>The pump is old and has low efficiency.</li> <li>The generator is old and has low efficiency.</li> </ul>
3	18-18/027A	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>All well equipment is old and need to be replaced.</li> </ul>
4	19-14/058B	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>No pumping equipment is available.</li> </ul>
5	19-14/062	Bad	Diesel	<ul style="list-style-type: none"> <li>All pumping equipment needs to be either repaired or replaced.</li> <li>The current pump does not operate with full capacity.</li> </ul>
6	19-15/028A	Not pumping	-	<ul style="list-style-type: none"> <li>No pumping equipment is available.</li> </ul>
7	19-16/005	Bad	Diesel	<ul style="list-style-type: none"> <li>Pumping rate is reduced.</li> <li>All pumping equipment need to be either repaired or replaced.</li> <li>No room is available for the well and its operator.</li> </ul>
8	19-17/012	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>No pumping equipment is available.</li> </ul>
9	19-17/033	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>No pumping equipment is available.</li> </ul>
10	19-20/001A	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>No pumping equipment is available.</li> </ul>
11	20-17/022	Not pumping	(Diesel was used.)	<ul style="list-style-type: none"> <li>The pump was broken in 2005.</li> </ul>

Source: JICA Study Team

**Table 8.1.2 Hydrogeological Condition of the Priority Wells**

	Well ID	Aquifer	Well depth (m)	Extraction license (m <sup>3</sup> /year)	Pumping discharge (m <sup>3</sup> )	Static water level (m BGL)	Dynamic water level (m BGL)
1	18-18/016	Eocene	140	420,000	60	61	71
2	18-18/019	Upper Beit Kahel	150	117,900	80	47	56
3	18-18/027A	Neogene	55	27,000	0	NA	NA
4	19-14/058B	Quaternary Deposits	80	53,100	0	NA	NA
5	19-14/062	Quaternary Deposits	110	147,000	45	66	75
6	19-15/028A	Quaternary Deposits	88	NA	0	NA	NA
7	19-16/005	Quaternary Deposits	50	89,000	60	7	17
8	19-17/012	Eocene	NA	NA	0	NA	NA
9	19-17/033	Quaternary Deposits	57	50,400	0	NA	NA
10	19-20/001A	Neogene	120	14,400	0	NA	NA
11	20-17/022	Quaternary Deposits	75	73,000	0	NA	NA

BGL: Below Ground Level, NA: Not Available, TDS: Total Dissolved Solid

Source: PWA database

**Table 8.1.3 Socio-economic Condition around the Priority Wells**

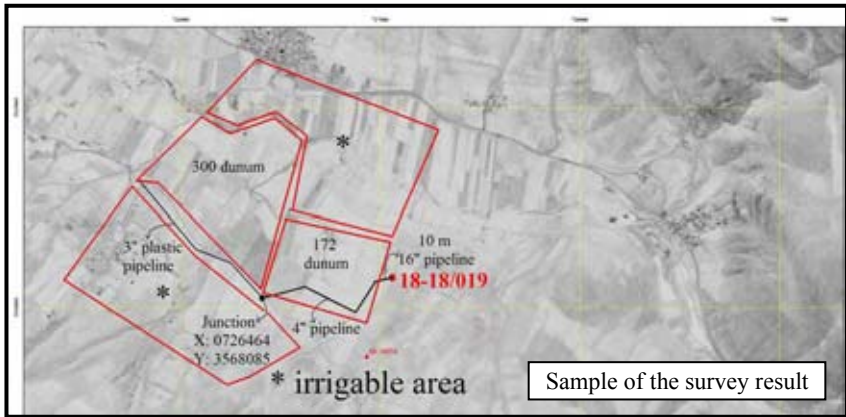
	Well ID	Number of users (Households)	Irrigable area (dunum)	Irrigated area (dunum)	Alternative water source
1	18-18/016	18	1,200	1,200	Not available
2	18-18/019	8	132	132	Not available
3	18-18/027A	3	40	0	Available
4	19-14/058B	5	150	150	Available
5	19-14/062	17	1,500	965	Not available
6	19-15/028A	15	2,000	0	Not available
7	19-16/005	10	400	200	Not available
8	19-17/012	9	97	97	Not available
9	19-17/033	5	250	0	Not available
10	19-20/001A	9	250	0	Not available
11	20-17/022	16	500	0	Not available

Source: JICA Study Team

(3) Detailed Survey and Assessment of the Priority Schemes

Based on the detailed field survey and review of available information in PWA, the priority schemes were assessed from the hydrogeological point of view. In addition, expected water use after the rehabilitation was also surveyed during the field investigation. The details of the survey and assessment are summarized in the following table.

**Table 8.1.4 Summary of Detailed Survey and Assessment of the Priority Schemes**

<b>Objectives</b>	
<ul style="list-style-type: none"> <li>To confirm the present situation at/around the agricultural wells</li> <li>To identify necessary work components for the rehabilitation</li> <li>To estimate the expected extraction volume and discharge after the rehabilitation</li> </ul>	
<b>Activities</b>	
<ul style="list-style-type: none"> <li>Field survey on water use after rehabilitation</li> <li>Hydrogeological assessment</li> </ul>	
<b>Summary of the activities</b>	
1. Field survey on water use after rehabilitation	
Items to be clarified	<ul style="list-style-type: none"> <li>Present irrigated areas</li> <li>Irrigable areas (expected irrigated area after rehabilitation)</li> <li>Existing water distribution networks</li> </ul>
Data source	Field survey with GPS receivers and interview survey of well owners
Output from the survey	





the pilot projects in this Study, the past relevant activities conducted by PWA and MoA, and the hydrogeological assessment. Concept for the development plan is as follows:

1) Prerequisite

- As a prerequisite, approval and permission from relevant institutions must be obtained prior to implementation of the rehabilitation. The duration required for obtaining the approval is not included in the implementation period.
- An agreement from all well owners should be obtained before the implementation of rehabilitation.

2) General

- The rehabilitation is implemented under three phases namely: pumping test phase, procurement and installation of pumping equipment phase, and monitoring and evaluation phase.
- Volume of extraction license of each well is regarded as the maximum volume of extraction from the corresponding well.
- Hardware component (pumping test, procurement and installation of pumping equipment) and software component (establishment of WUA with necessary training, training of on-farm water management) are merged into one project package.

3) Pumping test

- Work items in the pumping test phase consist of deepening and developing of the wells, pumping test, and water quality test.
- The water quality test is one of the PWA's routine works and recorded in PWA database. However, water quality of non-pumping wells not measured by PWA is only included in the development plan.
- If it is found through the pumping tests that water quantity of a well is not applicable for agricultural use or its quantity is insufficient, the remaining rehabilitation activities for the said well might not be performed.

4) Procurement and installation of pumping equipment

- All pumping equipment is subjected to replacement as part of the rehabilitation works since they are very old.
- After the pumping tests are analyzed, work items and costs for procurement and installation of pumping equipment are to be confirmed and finalized.
- Under the present situation, electricity supply to pumping equipment is very limited. Therefore, a diesel generator is regarded as the essential equipment in the rehabilitation plan. However, electrification is strongly recommended by PWA and MoA. If electricity supply to the target wells is confirmed before the implementation, necessity of the diesel generator is reconsidered.

(5) Design Criteria

1) Deepening

To secure the sustainability of agricultural wells, deepening of the wells is required.

In the priority scheme, necessity and depth of the deepening is determined based on the hydrogeological assessment. The procedure is illustrated in Table 8.1.4. The deepening is required in seven wells among the priority schemes. A new substitute well is planned to be drilled instead of an existing well.

2) Developing of wells

Developing of wells is conducted by bailing and pumping. The pumping will continue until the water becomes free from mud, sand and other suspended materials. In the pilot project, it took around one week at maximum before the wells were developed.

3) Casing

Casing length is calculated based on the following formula:

$$\text{Casing length} = H - C_{ext} + Ov - Re$$

Where,

*H*: Depth of the well after deepening

*C<sub>ext</sub>*: Length of existing casing

*Ov*: Overlap length of the existing casing and new casing (5 m)

*Re*: Length from the bottom of the well to the bottom of the new casing (5 m)

4) Slotting of the casing

Shorter slotting length of the casing is selected in comparison with two results calculated from the following formulas:

*Case1*: Slotting length = Casing length - *Re*

*Case2*: Slotting length = Depth of the well - SWL - *Re*

Where,

*SWL*: Static water level estimated based on the hydrogeological assessment

*Re*: Length from the bottom of the well to the bottom of the new casing (5 m)

5) Pumping test

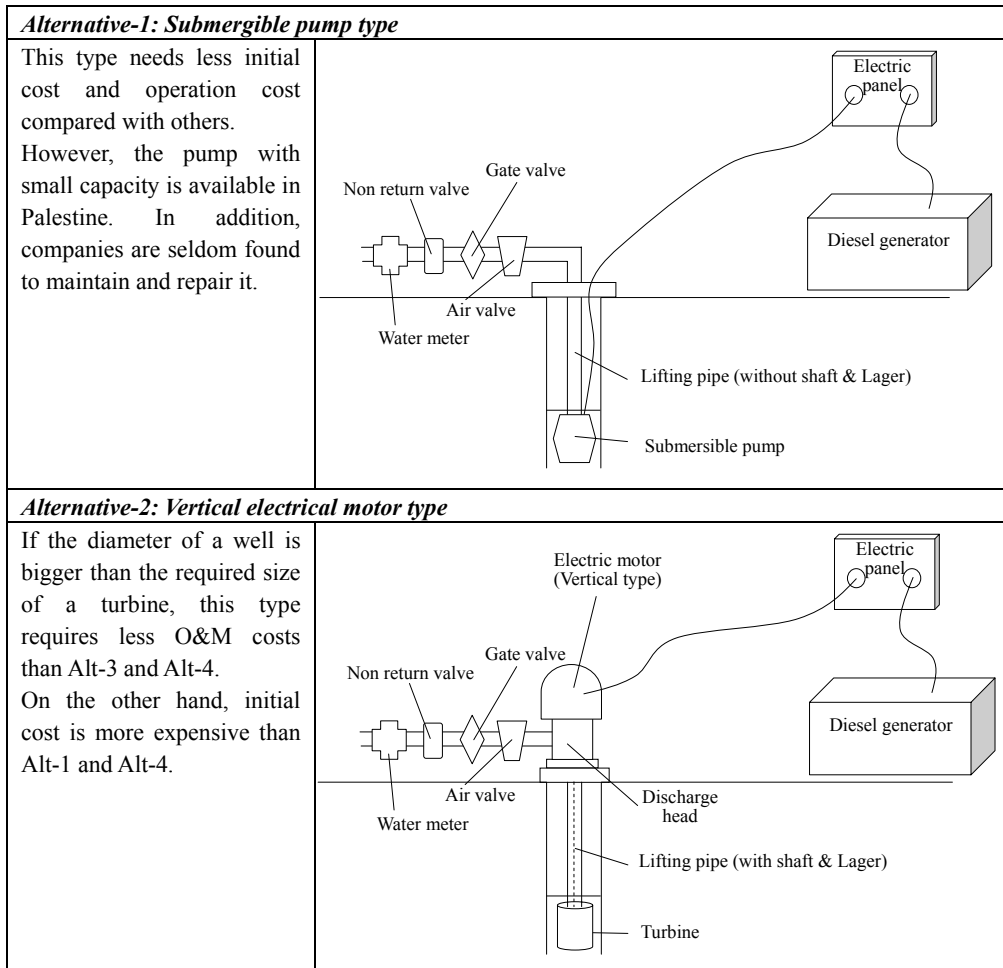
The pumping test is composed from primary test, step-drawdown test, constant-discharge test, and recovery test.

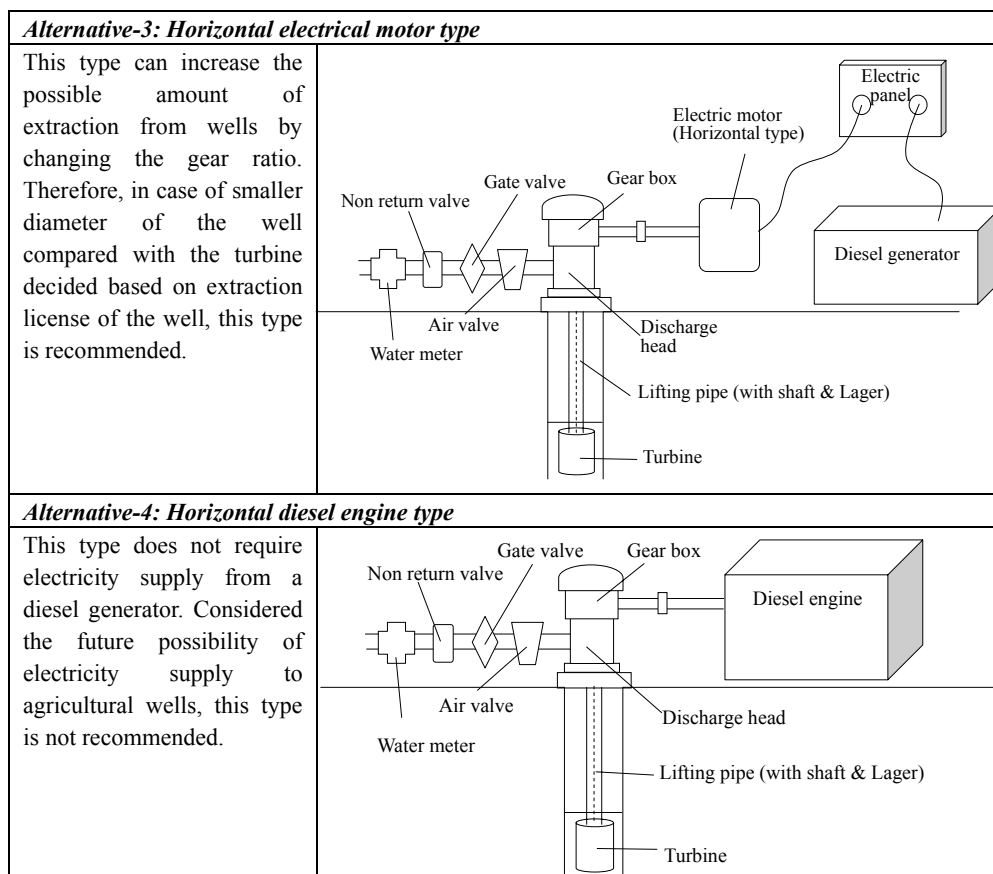
<b>Primary test</b>
After setting all equipment and devices with suitable pump, the pumping equipment is calibrated at various pumping tests in order to ensure that all the properly functioning and to select the pumping rate for the subsequent step-drawdown test. The pumping rates are modified at least four times according to the drawdown of the well. The static water level of the well is measured carefully before any pumping test described below is started.
<b>Step-drawdown test</b>
The well is pumped continuously for at least four increasing discharge rates. The engineer instructs pumping rates and duration for each step to the contractor based on the result of the primary test.
<b>Constant-discharge test</b>
The constant-discharge test is continued for at least 48 hours without any interruption. The engineer instructs to follow the constant discharge rate to the contractor.

<b>Recovery test</b>
Immediately after the constant-discharge test is completed, the pump is turn off. Measurement of the recovery will only stop when the recovery attains to the static water level under the approval by the engineer.

6) Pumping equipment to be installed

Alternatives of pumping types are summarized in Figure 8.1.2. Considered the future possibility of electricity supply to the wells and easiness of operation and maintenance, the Alternative-2 (vertical electrical motor type) is applied to the priority schemes.





Source: JICA Study Team

**Figure 8.1.2 Typical Layout of Pumping Equipment**

7) Capacity of pumping equipment

Specifications of the electric motors of vertical type to be installed are determined based on the hydrogeological assessment result and following equations:

$$\text{Horse power of electric motor} = 10 (Q \times H) / (0.7 \times 3600 \times 0.745)$$

Where,

*Q*: Expected extraction volume

*H*: Head loss (Dynamic water level below ground level + Head loss above ground)

(6) Expected Condition of the Priority Wells after Rehabilitation

Expected condition of the priority wells after the above rehabilitation is summarized in the following table.

**Table 8.1.5 Expected Condition of the Priority Wells after Rehabilitation**

	Well ID	Tapping Aquifer	Well depth (m)	Pumping discharge (m <sup>3</sup> /hr)	Static water level (m bgl)	Dynamic water level (m bgl)	Requirement from Hydro-geological Aspect
1	18-18/016	Eocene	140	60	61	71	No action
		Eocene	140	60	61	71	
2	18-18/019	Upper Beit Kahel	150	80	47	56	Deepening
		Upper Beit Kahel	200	80	45-47	55-57	

	Well ID	Tapping Aquifer	Well depth (m)	Pumping discharge (m <sup>3</sup> /hr)	Static water level (m bgl)	Dynamic water level (m bgl)	Requirement from Hydro-geological Aspect
3	18-18/027A	Neogene	55	0	NA	NA	Deepening
		Upper Beit Kahel	205	100	80-90	120-130	
4	19-14/058B	Quaternary Deposits	80	0	NA	NA	Deepening
		Quaternary Deposits	130	50	60-70	90-100	
5	19-14/062	Quaternary Deposits	110	45	66	75	No action
		Quaternary Deposits	110	45	66	75	
6	19-15/028A	Quaternary Deposits	88	0	NA	NA	Substitute well
		Quaternary Deposits	120	50	40-50	Unknown	
7	19-16/005	Quaternary Deposits	50	60	7	17	No action
		Quaternary Deposits	50	60	7	17	
8	19-17/012	Eocene	67	0	NA	NA	Deepening
		Eocene	97	70	30-40	50-60	
9	19-17/033	Eocene	57	0	NA	NA	Deepening
		Eocene	107	70	50-55	75-85	
10	19-20/001A	Neogene	120	0	NA	NA	Deepening
		Neogene	170	160	40-50	75-85	
11	20-17/022	Eocene	75	0	NA	NA	Deepening
		Eocene	105	60	40-50	65-75	

Upper: present condition, Lower: condition after rehabilitation

bgl: Below ground level, NA: Not Available

Source: Estimation by JICA Study Team using PWA database

#### (7) Preliminary Design for Priority Scheme

The work components and quantities for the rehabilitation of agricultural wells in each priority site are summarized in the following tables.

**Table 8.1.6 Work Components and Quantities for Priority Scheme**

Item	Unit	Quantity											
		18-18/016	18-18/019	18-18/027A	19-14/058B	19-14/062	19-15/028A	19-16/005	19-17/012	19-17/033	19-20/001A	20-17/022	
1	Pumping test phase												
	1) Deepening	m	0	50	145	50	0	32	0	30	50	50	30
	2) Developing	L.S.	0	1	1	1	0	1	0	1	1	1	1
	3) Pumping test	L.S.	1	1	1	1	1	1	1	1	1	1	1
	4) Water quality analysis	L.S.	0	0	0	1	1	1	1	1	0	1	1
2	Procurement and installation of pumping equipment phase												
	1) Vertical turbine pump	L.S.	1	1	1	1	1	1	1	1	1	1	1
	- Extraction discharge	m <sup>3</sup> /hour	60	80	100	50	45	50	60	70	70	70	60
	- Head	m	100	120	150	150	150	130	75	120	120	140	130
	2) Lifting pipes (HDPE-6")	m	130	190	190	120	100	110	40	80	97	160	95
	3) Diesel generator	L.S.	0	1	1	0	0	1	1	1	1	1	1
	4) Others*	L.S.	1	1	1	1	1	1	1	1	1	1	1

\*Following items are included:

i) Electric motor, ii) non return valve, iii) gate valve, iv) air valve, v) water flow meter, vi) pressure gauge, vii) pressure switch

Source: JICA Study Team

## **8.1.2 Development Plan for the Rehabilitation of Agricultural Wells**

### **(1) Objectives of the Development Plan**

The objectives of the development for the priority schemes are to realize:

- (i) Effective water abstraction from agricultural wells through the rehabilitation;
- (ii) Proper management of pumping equipment as well as water distribution system through establishment of WUA; and
- (iii) Efficient water use at farm level through training of on-farm water management.

### **(2) Location of the Target Wells**

Locations of the target wells are shown in Figure 8.1.1.

### **(3) Implementation Period**

Implementation period is assumed to be two years, including 14 months for actual implementation and 10 months for monitoring and evaluation. Breakdown of the implementation schedule and work items for the expected rehabilitation of the priority wells is shown in Table 11.1.1 in Chapter 11.

### **(4) Expected Outputs**

Following outputs are expected through the implementation:

- (i) Wells and pumping equipment are rehabilitated appropriately;
- (ii) WUA is established to manage water distribution system appropriately;
- (iii) WUA maintains records on water management and its financial condition periodically;
- (iv) Efficient on-farm water management by farmers is realized at the farm lands; and
- (v) Periodical monitoring is conducted and appropriate guidance is provided by PWA and MoA, for smooth implementation and project evaluation.

## **8.1.3 Operation and Maintenance (O&M) Plan**

As mentioned in the Basic Plan, types of ownership of rehabilitated equipment differ depending on donor's policy or regulation after the project period for the priority schemes. O&M of the rehabilitated wells shall be conducted by WUA under the technical support and guidance of PWA. Included in the O&M to be carried out by WUA are: a lifting pipe, a gear head, a diesel engine, an electric motor with generator, valves, and main water supply pipe and discharge valves from a main piping system. O&M of other facilities and equipment, such as secondary piping systems, water ponds, small pumps, on-farm irrigation equipment, are not included in WUA's responsibility. In addition, efficient on-farm water management shall be practiced by farmers in cooperation with the extension workers in MoA. WUA has to maintain all the necessary records for O&M, which can be disclosed upon the request of WUA members and authorities.

The list of required activities and responsible units are described in the following table.

**Table 8.1.7 Activity List for Operation and Maintenance Phase**

Category	Actions to be taken	Responsibility of the actions	Assisted and monitored by
Pumping equipment	1. To prepare annual water distribution plan and pumping plan 2. To operate pumping equipment based on the plans 3. To maintain pumping equipment 4. To keep records on operation and maintenance cost	WUA	PWA
Groundwater monitoring	1. To keep records on water extraction and distribution	WUA	PWA
	1. To advise WUA about the preparation of the annual water distribution plan and pumping plan 2. To monitor water extraction and distribution based on the records kept by WUA 3. To monitor groundwater level and water quality	PWA	Donors, if necessary
	1. To keep records about WUA activities including collection of water fee and account of WUA. 2. To hold a regular meeting of WUA to monitor the O&M	WUA	PWA
WUA and its financial status	1. To monitor WUA's activities based on the record kept by WUA 2. To provide advice and guidance to WUA	PWA & MoA	Donors, if necessary
	1. To conduct training on on-farm water management	MoA	Donors, if necessary
On-farm water management	1. To conduct efficient on-farm water management based on the training	Farmers	MoA
	1. To monitor the efficient on-farm water management 2. To provide technical advices to the farmers, if necessary	MoA	Donors, if necessary

Source: JICA Study Team

WUA appoints an operator from among the WUA members or outside of WUA. The operator supplies water according to the time table approved by WUA. The operator also has to inspect the well equipment periodically and maintain the equipment in good condition. The operator shall document the details of the works carried out, in respective record books.

WUA appoints more than two persons, who will be in charge of accounting, either among the WUA members or from others. They will be tasked to calculate water fee (or O&M cost) based on the tariff approved by WUA, and issue corresponding bills to all water users. They will also periodically collect the charged water fee. The fees and payments will then have to be recorded. Furthermore, accounting record, including revenue and expenses, has to be continuously recorded and updated by the personnel in-charge.

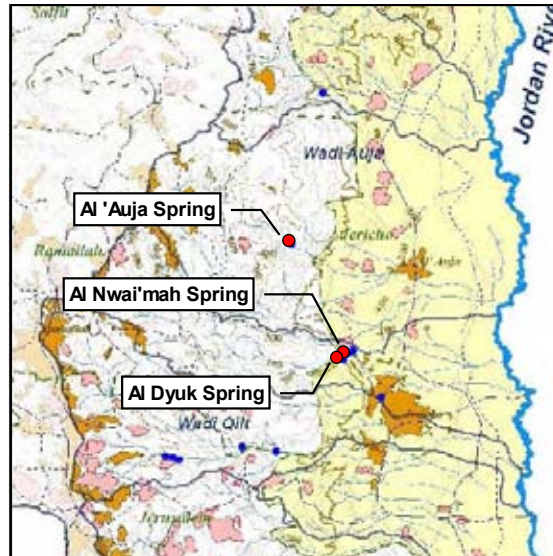
The board of WUA periodically checks the above records of both the O&M and accounting.

## 8.2 Development Plan for Improvement of Spring Water Conveyance System

### 8.2.1 Site Location of Priority Schemes

Priority schemes for improvement of spring water conveyance system were selected through the selection criteria set as mentioned in Chapter 6. The site locations of the priority schemes are shown in the following figure. Al 'Auja spring source is situated in Area C while natural reserve area is adjacent to the upper Wadi Al 'Auja. Al Nwai'mah and Al Dyuk spring sources are at the same location as well as the Shusah Spring, which is one of the private springs.





**Figure 8.2.1 Location of Priority Schemes for Spring Improvement**

**8.2.2 Development Plan for Priority Schemes**

(1) Present Condition of Priority Site

1) Outline of Priority Site

The outlines of each site for the priority schemes are shown in the following table.

**Table 8.2.1 Outline of Priority Site for Spring Improvement**

Spring Name	Al Nuwai'mah	Al Dyuk	Al 'Auja
Locality Name	Al Nuwai'mah	Dyuk Al Foqa, Dyuk Al Tahta	Al 'Auja
Population			
Population (2005) *1	1,128	1,726	3,886
Farmers Population (2005) *2	840	1,286	2,896
Spring Water Allocation *3			
Agricultural Purpose	2.53MCM/yr 97.35%	4.73MCM/yr 97.41%	9.55MCM/yr 100.00%
Domestic Purpose	0.01MCM/yr 0.40%	0.13MCM/yr 2.59%	0.00MCM/yr 0.00%
Others	0.06MCM/yr 2.25%	0.00MCM/yr 0.00%	0.00MCM/yr 0.00%
Land *4			
Area Category	Area A	Area A	Area A&C
Arable Land Area	2,506 dunum	1,997 dunum	9,921 dunum
Cultivated Land Area	1,585 dunum	1,017 dunum	4,642 dunum
Meteorological Condition *1			
Annual Rainfall		149mm	
Annual Average Temperature		23.5 °C	
Annual Evaporation		2,110mm	

Source: \*1 PCBS

\*2 MoA

\*3 PWA, Spring Inventory Survey (JICA Study Team)

\*4 Provisional figures estimated by JICA Study Team based on MoA data, aero-photo analysis and the result of Detailed Survey on Agricultural Water Use for Priority Project conducted by JICA Study Team

## 2) Characteristics of Water Resources

The characteristics of each spring discharge are summarized by month based on an hourly average for the last 40 years, as shown in the following table.

**Table 8.2.2 Average Discharge of Priority Spring**

Spring Name	(m3/hr)		
	Al Nwai'mah	Al Dyuk	Al 'Auja
Jan	305	568	1,218
Feb	319	590	1,578
Mar	330	604	1,624
Apr	311	587	1,529
May	314	575	1,450
Jun	312	560	1,176
Jul	306	564	1,013
Aug	301	557	827
Sep	291	548	794
Oct	288	526	634
Nov	288	523	645
Dec	293	544	773
Min	288	523	634
Max	330	604	1,624
Avr	305	562	1,105

Source: PWA Database

## 3) Outline of Spring Conveyance Facilities

The following table shows the components and conditions of existing spring conveyance facilities for each site, which were obtained by the survey works conducted by JICA Study Team.

**Table 8.2.3 Outline of Spring Conveyance Facility**

Spring Name	Al Nuwai'mah	Al Dyuk	Al 'Auja
Intake	Masonry Box	Masonry Box	Concrete Box and Intake Weir
Canal			
Material	Concrete & Earth	Concrete & Earth	Concrete & Earth
Cross Section *1	Rectangle (0.1-0.3 m2)	Rectangle (0.1-0.6 m2)	Rectangle/Trapezoid/ Semicircle (0.3-1.0 m2)
Estimated Length of Concrete Canal *2	11 km	15 km	22 km
Estimated Length of Earth Canal *2	More than 1 km	More than 3 km	More than 8 km
Farmers Pond			
No. of Pond (Under used) *3	29	56	38
Average Capacity of Pond *3	2,000 m3/pond	1,700 m3/pond	7,200 m3/pond
Sum of Pond Capacity	58,000 m3	95,000 m3	274,000 m3
Estimated Water Loss in Main Canal			
Loss in Percentage *3	34%	48%	44%
Loss out of Average Discharge	0.90 (MCM/year)	2.33 (MCM/year)	4.20 (MCM/year)

Source: \*1 Inventory Survey (JICA Study Team)

\*2 Site Reconnaissance (JICA Study Team)

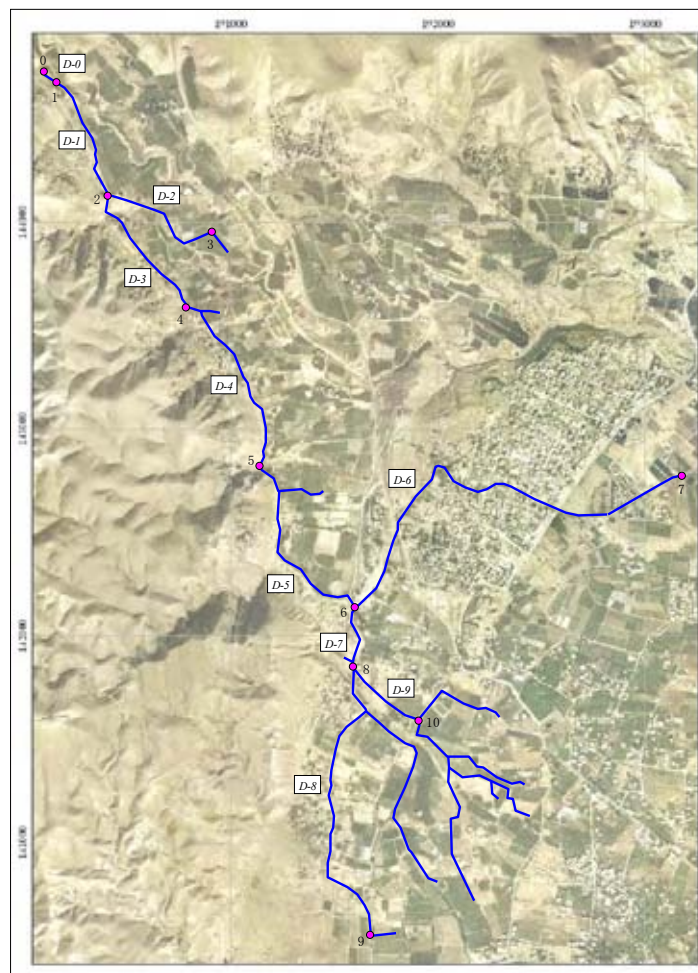
\*3 Detailed Survey on Agricultural Water Use for Priority Project (JICA Study Team)

The layouts of existing spring conveyance facilities for each site are shown in the following figure.



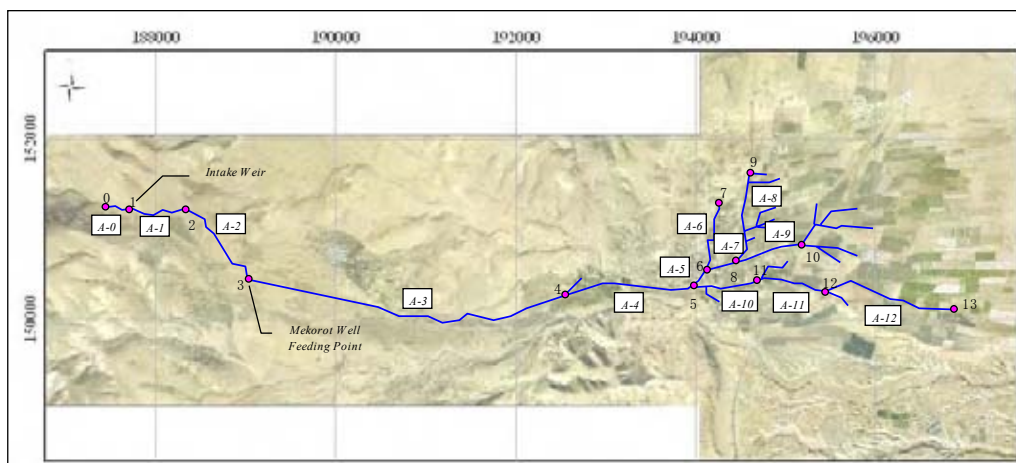
Source: JICA Study Team

**Figure 8.2.2 Existing Spring Conveyance System (Al Nwai'mah)**



Source: JICA Study Team

**Figure 8.2.3 Existing Spring Conveyance System (Al Dyuk)**



Source: JICA Study Team

**Figure 8.2.4 Existing Spring Conveyance System (Al 'Auja)**

#### 4) Water Use

Rights for spring water allocated to certain residents at each site were acquired through traditional rules or from inheritances. The patterns of water use from spring conveyance systems are categorized as shown in the following table.

**Table 8.2.4 Spring Water Users Category**

No.	User Category	Description
1.	Pond User for Drip/Sprinkler Irrigation	Taking water from a spring canal and storing into a concrete storage system, or earth ponds, to be utilized for irrigation by drip system or sprinkler using a pump
2.	Direct User for Fallow Irrigation	Taking water from a spring canal for direct distribution into fallows, intended for irrigating tree crops
3.	Pump User for Domestic Purposes	Installing a small pump and using spring water for domestic purposes
4.	Bedouin User	Taking water from spring without any water rights, using a small pump, for Bedouins' domestic use or livestock

Source: JICA Study Team

Normally, spring water is distributed to the users who have water rights to take water from the spring conveyance canals, by means of time scheduling. This shall be in accordance with the water rights schedule maintained by the village councils and water users committees in each spring site. Under this time scheduling system, a water rights holder is given minutes or hours to draw or pump water to supply his farm or household. In a certain period, only one water rights holder can take water. The current water rights allocation in the spring conveyance canals are estimated as shown in the following table, based on survey on agricultural water use conducted by JICA Study Team.

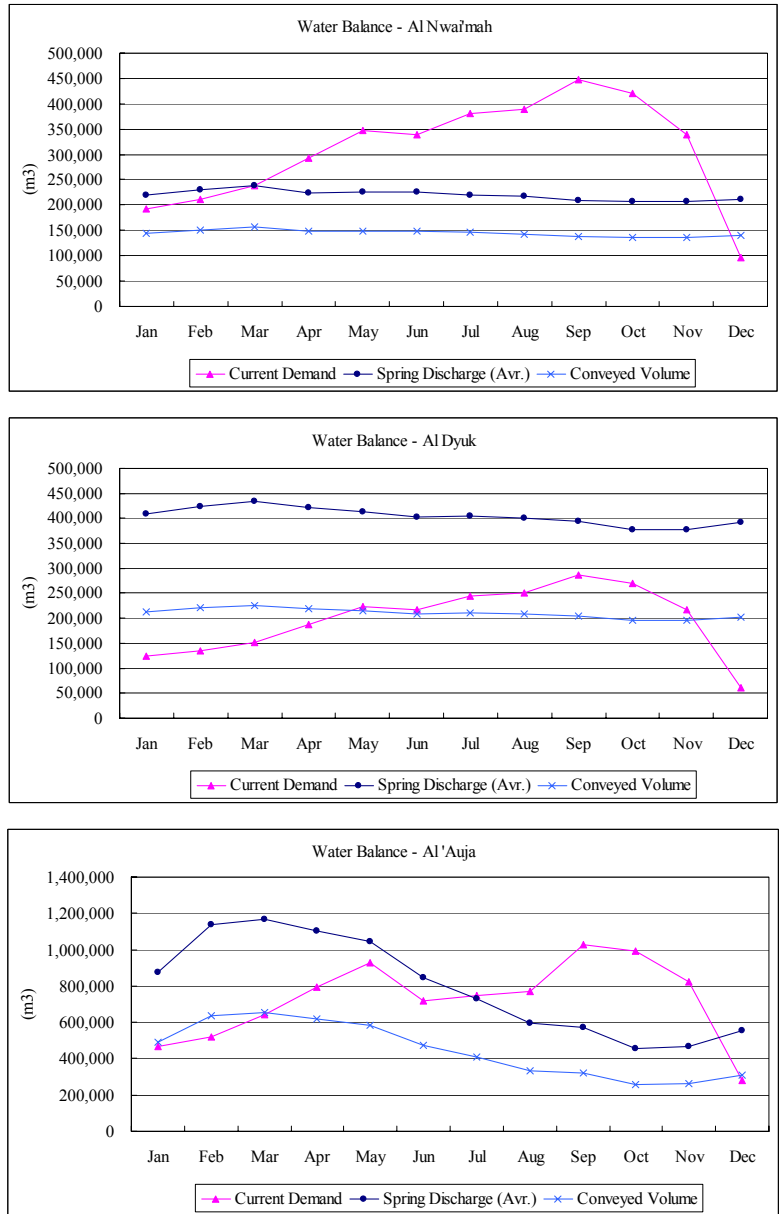
**Table 8.2.5 Spring Water Right Allocation by Conveyance Blocks**

Spring Site	Line No.	Water Right	
		Annual Average (m <sup>3</sup> /year)	% of hours in time schedule
Al Nwai'mah	N1	0	0%
	N2	386,000	15%
	N3	653,000	25%
	N4	522,000	20%
	N5	630,000	24%
	N6	408,000	16%
	Total	2,599,000	100%
Al Dyuk	D0	0	0%
	D1	39,000	1%
	D2	136,000	3%
	D3	136,000	3%
	D4	306,000	6%
	D5	997,000	21%
	D6	1,143,000	24%
	D7	423,000	9%
	D8	1,420,000	29%
	D9	263,000	5%
Total	4,864,000	100%	
Al 'Auja	A0	0	0%
	A1	0	0%
	A2	0	0%
	A3	0	0%
	A4	739,000	8%
	A5	0	0%
	A6	1,732,000	18%
	A7	661,000	7%
	A8	1,811,000	19%
	A9	616,000	6%
	A10	1,419,000	15%
	A11	1,666,000	17%
	A12	904,000	9%
Total	9,548,000	100%	

Note: *Estimated by JICA Study Team based on the interviews for water right holders and village councils in the Survey on Agricultural Water Use*

#### 5) Water Balance for Irrigation

All the spring water is mostly used for irrigation. The water balances between the current water requirement and spring discharge, taking into consideration the conveyance loss for each site as shown in the following figures.



Source: PWA and JICA Study Team

- Note:
- The spring discharge data are taken from the PWA database.
  - Conveyed volume means actual distribution water volume, excluding water losses estimated by JICA Study Team based on the result of Survey on Agricultural Water Use
  - The current demand is estimated by JICA Study Team based on the aero-photos, MoA database and water requirement of crops, with an on-farm water use efficiency assumed to be 70%.

**Figure 8.2.5 Irrigation Water Balance of Al 'Auja Spring**

6) O&M of Spring Conveyance Facilities

In the main facilities including the intake and open canals, there are no mechanical or electrical equipment used to convey spring water, and thus operation works are only through the opening/closing steel gate panels installed for each water rights holder. Said water rights holders are aware of the scheduled operations. They know when to close the gate panel of the main canal to stop the water flowing downstream. This will be done as soon as they open their tertiary gate panel to direct the water flow from the main line to their ponds or farm lands. These gate

panels and tertiary canals are maintained by each water rights holder.

The village councils are responsible for the maintenance of the water intake facilities and main canals. However, they normally do not set up the budget for the maintenance works.

Other than the water rights holders, Bedouins also use water, although they have no responsibility for its O&M.

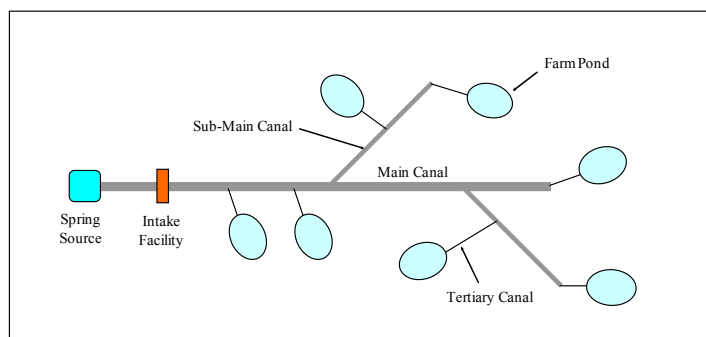
## (2) Objectives of the Development Plan

The objectives of the development for the priority schemes are:

- 1) To improve the water conveyance system in order to prevent water loss and water contamination, by adopting the pipeline system;
- 2) To improve the water control system through the establishment of metering system as a means of controlling and monitoring volumetric water utilization; and
- 3) To strengthen O&M activities for the water conveyance and water rights controls.

## (3) Target Facilities for Improvement

As mentioned in Chapter 6, the domestic water supply system is not included in the development plan. The current facilities for spring water conveyance for agricultural purposes are comprised of: i) Spring source; ii) Intake facility; iii) Main canals; iv) Secondary canals; v) Tertiary canals; and vi) Farm ponds, as schematically illustrated in the following figure.



Source: JICA Study Team

**Figure 8.2.6 Outline of Existing Spring Water Conveyance System**

The development plan for improvement of spring water conveyance system aims at main canals and secondary canals. Improvement of spring sources and intake facilities are not included in the plan due to the following reasons:

- (i) It is located in the natural reserve area (Al 'Auja Spring); and
- (ii) The improvement works were already done by the other donors (Al Nwai'mah and Al Dyuk Springs).

However, clearance of rocks and stones from the intake facility for Al 'Auja Spring will be included in the plan. It is assumable that this work will not cause environmental changes.

The tertiary canals and farm ponds are farmers' private facilities. Therefore, these parts are out of target for improvement of spring conveyance system.

#### (4) Design Considerations for the Improvement of Spring Water Conveyance Facilities

The development plan for the improvement of spring water conveyance facilities for each site is formulated, with due considerations of the following:

- 1) The new conveyance system is designed in accordance with current water right rules and manners taking into consideration of usability of farmers from social aspects, as not to bring any confusion in farmers' O&M activities.
- 2) The new conveyance alignment is planned in line with the existing open canal lying as farmers' intake points or operation points will not be changed.
- 3) Concerning the abovementioned consideration, the design flow is determined on water resource discharge basis instead of demand basis because the discharge volume is basically shared by the water right holders independently of water demand for each.
- 4) For Al Dyuk and Al Nwai'mah villages, the design flow is determined considering the future demand of domestic water, which is supplied through other systems. However, in Al 'Auja village, the design flow is determined under the condition that the domestic water is supplied through the existing system, which is taking water from Mekorot source. This was opted since Al 'Auja Spring is not reliable for supplying the domestic water due to sharp fluctuation.
- 5) In Al 'Auja village, the farmers depend on the Mekorot source to supply water to the existing canals during only the dry seasons with the duration of three or four months in a year at 100m<sup>3</sup>/hr, which is utilized for irrigation. The design of new conveyance system considers continuing utilization of this existing Mekorot water source.
- 6) The new facility is designed taking into consideration the Bedouins' use. However, any distribution facilities for Bedouin's uses are not designed.
- 7) The new conveyance system is made as a complete gravity conveyance system as well as the current system, with no equipment for pumping water.
- 8) The pipe materials are selected taking into consideration the cost, durability and workability.
- 9) Settling basins are installed to prevent sedimentation in the pipes, to allow for easy maintenance.
- 10) Concerning of water resource management, water flow metering or monitoring system is introduced in the new system.

#### (5) Design Criteria

##### 1) Design Flow

##### Design Flow for Al Nwai'mah and Al Dyuk Springs

The design flows for Al Nwai'mah and Al Dyuk Springs is calculated based on the following formula, using the discharge records for the last 20 years.



$$\begin{aligned} \text{Design Flow} &= \text{Design Discharge} - (\text{Domestic Demand} + \text{Industrial Demand}) \\ \text{Design Discharge} &= \text{Annual Peak Rate} \times \text{Monthly Peak Rate} \times \text{Average Discharge} \\ \text{Annual Peak Rate} &= \text{Monthly Max. Discharge} / \text{Average Discharge} \\ \text{Monthly Peak Rate} &= \text{Monthly Max. Discharge} / \text{Average Discharge of the Month} \end{aligned}$$

The results of the calculation are shown below.

**Table 8.2.6 Design Flow for Al Nwai'mah and Al Dyuk Springs**

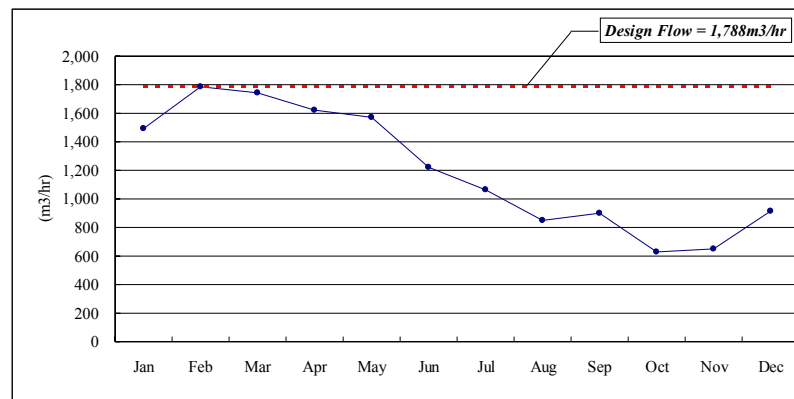
Item	Al Nwai'mah	Al Dyuk
(1) Average Flow (m <sup>3</sup> /hr)	334	537
(2) Maximum Flow (m <sup>3</sup> /hr)	412	753
(3) Minimum Flow (m <sup>3</sup> /hr)	101	351
(4) Annual Peak Rate	1.15	1.19
(5) Monthly Peak Rate	1.14	1.21
(6) Design Peak Rate (4)x(5)	1.31	1.44
(7) Design Peak Flow (1)x(6)	440	772
(9) Other Demand (Max. in 2015)	36	28
<b>Design Flow (7)-(9) (m<sup>3</sup>/hr)</b>	<b>404</b>	<b>744</b>

Source: Last 20-year data in PWA Database (1987-2006)

Note: Other demands, like domestic and industrial demands, are estimated by JICA Study Team in terms of daily peak rate of 2.0.

#### Design Flow for Al 'Auja Spring

As mentioned in the design considerations, the discharge fluctuation of Al 'Auja Spring is very sharp, and thus, the design flow will be too high while the facility design will be excessive. In this regard, the maximum monthly discharge average based on the last 20-year discharge record, is taken as the design flow, indicated in the following figure.



Source: Last 20-year data in PWA Database (1987-2006)

**Figure 8.2.7 Monthly Spring Discharge and Design Flow of Al 'Auja Spring**

#### 2) Pipe Hydraulics

Hazen-Williams' equation is applied for the hydraulic calculations in designing the pipelines. The following coefficients are applied for each pipe material.

**Table 8.2.7 Coefficient for Hydraulic Calculation**

Pipe material	Coefficient (C)
Iron pipes (no-painted)	100
Mortal lining pipes (steel or ductile iron pipes)	130
Concrete pipes	130
PE or HDPE pipes	150
uPVC pipes	150

Source: *The Japanese Society of Irrigation, Drainage and Reclamation Engineering, 1998*

The flow speeds in the pipeline are allowed to be in the range as shown in the following table, in accordance with the Design Criteria for Land Improvement Projects-Pipeline (The Japanese Society of Irrigation, Drainage and Reclamation Engineering, 1998).

**Table 8.2.8 Design Flow for Al Nwai'mah and Al Dyuk Springs**

Pipe Material	Minimum Flow	Maximum Flow
Concrete, Mortal Lining Steel or Ductile Iron Pipes	0.3 m/s	3 m/s
Others	0.3 m/s	5 m/s

Source: *The Japanese Society of Irrigation, Drainage and Reclamation Engineering, 1998*

However, these allowable maximum flow speeds are for inspection of local flow speed in a hydraulic unit, and the Design Criteria recommended the allowable average flow speed in the hydraulic unit to be 2 m/s in normal cases or 2.5 m/s in cases that high hydraulic gradient can be taken. Therefore, 2.5 m/s flow speed is applied for the design of the development plan. In case that the calculated flow speed is beyond the acceptable speed in a hydraulic unit, pressure reducing tanks or valves will be designed to be installed.

### 3) Pipe Materials and Installation

The pipes are basically installed underground in the design. However, exposed pipe installation will be accepted at locales where it seems to be difficult to excavate pipe trenches.

In Palestine, high density polyethylene (HDPE) and steel pipes with mortar lining (SP) are normally available for irrigation pipelines. The design for priority schemes adopts these two materials under the conditions shown in the following table.

**Table 8.2.9 Pipe Materials to be Adopted**

Diameter	< 16 inch (400mm)	> 20 inch (500mm)
Pipes installed underground	HDPE	SP
Pipes installed with exposure	SP	SP

Source: *JICA Study Team*

### 4) Settling Basin Designing

A settling basin, included in the plan, is to be constructed at the beginning of conveyance line to remove unwanted particles from the spring water. The system does not require filtration process since all the springs have clear water with low turbidity. However, there is also a possibility that some particles like sand may enter the pipes. In order to prevent this, the settling basin is designed as follows.

a) The Stokes Equation below is applied for the calculation of sand settling.

$$V_c = (g \times (\rho_s - \rho) \times d^2) / (18 \times \mu)$$

Where,

- $\rho_s$  : Specific gravity of sand (to be 1.5)
- $\rho$  : Specific gravity of water (to be 1)
- $g$  : Acceleration due to Gravity (9.8m/s<sup>2</sup>)
- $d$  : Diameter of sand (to be 0.25mm)
- $\mu$  : Viscidity of water (to be 1.027)

b) Width of settling basin is to be 1/2 of the length.

c) The sand removal rate is to be 100%.

d) The structure is to be of concrete, with a steel cover.

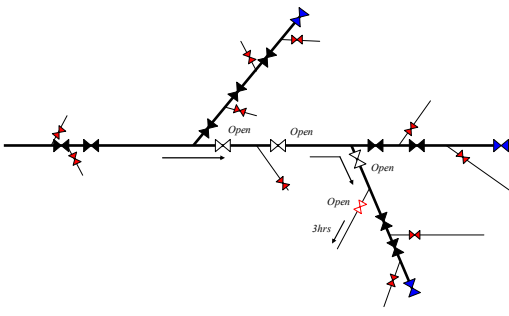
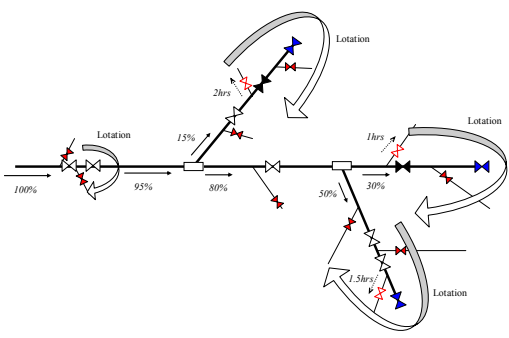
5) Other structures

For designing the other structures such as distribution boxes and valve chambers, typical structures in either Palestine or Japan are considered.

(6) Design Alternatives

1) General Design Concept for Conveyance and Distribution System

The three alternatives of conveyance and distribution control system as shown in the following figure were reviewed by JICA Study Team.

<p><b>Alternative-1: Open type with current time scheduling</b></p> <ol style="list-style-type: none"> <li>1) This system will convey water to a particular user during specific hours, as well as in consideration of the existing water rights allocation system.</li> <li>2) Water will be distributed based on the existing rotation system.</li> <li>3) Turns of water distribution will be taken by means of valve operation instead of sluice gate operation.</li> <li>4) All valve operation will be done by the users.</li> <li>5) Locations of proposed valves will be the same as those of the existing sluice gates.</li> </ol>	
<p><b>Alternative-2: Open type with modified time scheduling</b></p> <ol style="list-style-type: none"> <li>1) This system will convey water to all the branches at the same time.</li> <li>2) Water will be distributed to all the branches in terms of distribution boxes with weirs, of which width will be determined based on the total water rights allocation volume for each branch.</li> <li>3) Turns of water distribution at each branch will be done based valve operation by farmers.</li> <li>4) The proposed distribution rotations will be closed in each branch. This means that it is necessary to prepare the rotation schedule for each branch.</li> <li>5) Distribution hours to each user will become longer than the existing water rights allocation hours since the flow rates for each will be smaller.</li> </ol>	

<b>Alternative-3: Closed type with volumetric controlling</b>	
<ol style="list-style-type: none"> <li>1) This system will convey water to all the users for 24 hours.</li> <li>2) However, actual operation will control water distribution by means of closing the transmission valves and/or setting the hydro-meters which functions to measure the water volume and control the water flow.</li> <li>3) The village council will be responsible for water distribution control such as open/close of transmission valves and setting of hydro-meters.</li> <li>4) Adjustment of distribution schedule will be required during the dry seasons, when spring discharge decreases.</li> </ol>	

Source: JICA Study Team

**Figure 8.2.8 Alternatives of Spring Water Conveyance/Distribution System**

The advantages/disadvantages of each alternative are summarized in the following table.

**Table 8.2.10 Advantage/Disadvantage of Alternatives**

Alternative Type	Advantage	Disadvantage
Alternative-1	<ul style="list-style-type: none"> <li>• The new system will be easier to learn since the distribution control method is almost the same.</li> <li>• Less costly O&amp;M.</li> <li>• O&amp;M activities are simpler.</li> </ul>	<ul style="list-style-type: none"> <li>• The initial cost is higher because the diameter of all the pipelines is the same.</li> <li>• Requires more number of valves.</li> <li>• Valve operation is not easy due to its large diameter.</li> </ul>
Alternative-2	<ul style="list-style-type: none"> <li>• The initial cost is lower than alternative-1 since branches have smaller diameters.</li> <li>• This system is easier to learn because the distribution control method is almost same.</li> <li>• O&amp;M activities are simpler.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires more number of valves.</li> <li>• It is necessary to change the current distribution schedule.</li> </ul>
Alternative-3	<ul style="list-style-type: none"> <li>• It is not necessary for users to operate the valves for distribution.</li> <li>• The initial cost is lower than the alternative-2 since branches and distribution lines have smaller diameters</li> <li>• Transmission and distribution control can be centralized.</li> </ul>	<ul style="list-style-type: none"> <li>• There is a possibility that this system cannot distribute water according to the water rights allocation because the water flow is controlled at the end of each distribution pipes.</li> <li>• Operation procedures are complicated, and will require more staff for operations.</li> <li>• It is necessary to change the rotation schedule in case the water flow becomes smaller.</li> <li>• Operation procedures are complicated because pipe pressure is changed by valve open/close, which leads to unfair distribution.</li> <li>• There is a possibility that the users become confused since the distribution method is quite different.</li> </ul>

Source: JICA Study Team

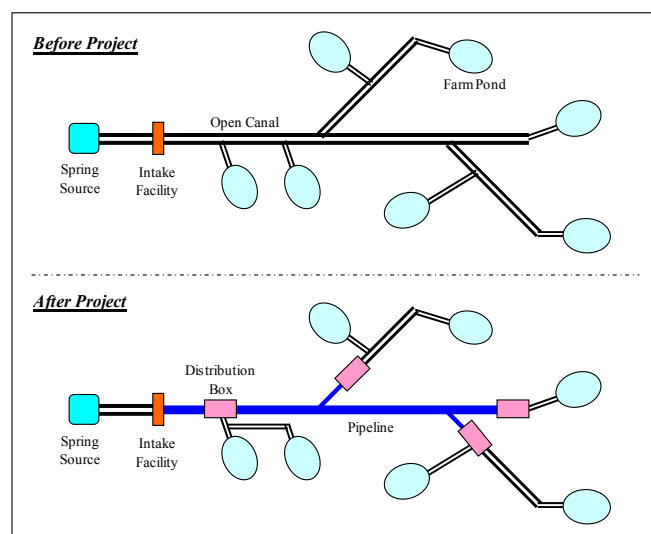
JICA Study Team explained the alternatives to the farmers and village councils in all the sites. Through the discussions held, these alternatives were evaluated as follows:

- Alternative-3 is not acceptable because the distribution method is quite different from the current method. The distribution method is also very difficult to operate without any centralized control system.
- Alternative-2 is not acceptable because: i) adjustment and controlling of time scheduling is difficult; ii) some users are presently taking water directly from the main canals without branches or tertiary lines, which are required in this alternative; and iii) it is difficult to correspond water rights changes because distribution rates are fixed by distribution boxes Structures.
- Alternative-1 is determined most suitable for the farmers because this conforms to the existing distribution system and will not lead to any confusion on operations.

Alternative-1 is conceptually applied for the priority sites, emphasizing usability for operation. However, the costs for pipe installation including valve installation will be higher. Therefore, the design concept for distribution method is modified as follows.

- A distribution box with sluice gate is installed replacing a valve in the original concept of Alternative-1.
- Open canals are remained in part of secondary lines and tertiary lines to minimize the pipe length.
- Rehabilitation of canals in secondary lines is included in the design.
- Distribution boxes are assigned to make distribution blocks with a new open canals connecting to the existing tertiary canals, in which distribution rotation will be closed as a sub-rotation in time scheduling. This system aims to completely separate the current conveyance system into main conveyance, secondary conveyance and tertiary distribution to make a complete hierarchy in the system.

In this concept, the conveyance system will be changed as shown in the following figure.

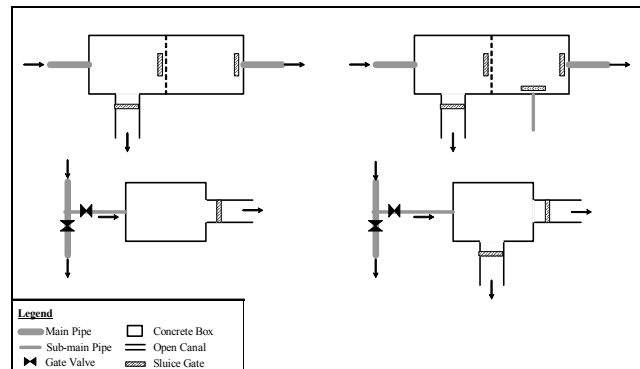


Source: JICA Study Team

**Figure 8.2.9 Image of Changing Spring Conveyance System**

## 2) Distribution Box

In the new conveyance system mentioned above, a distribution box will be installed with the functions of: i) Distribution of water to secondary conveyance lines (branch lines); ii) distribution of water to open canals; iii) conveyance of water to main line in straight; iv) change of branching; and v) reduction of pressure, in accordance with the distribution rotation rules. In addition, there is another rules in this structure for Bedouins taking water. The typical structures of distribution box are schematically illustrated as shown in the following figure, and they will be selected in response to locations or distribution manners in each branch or distribution block.

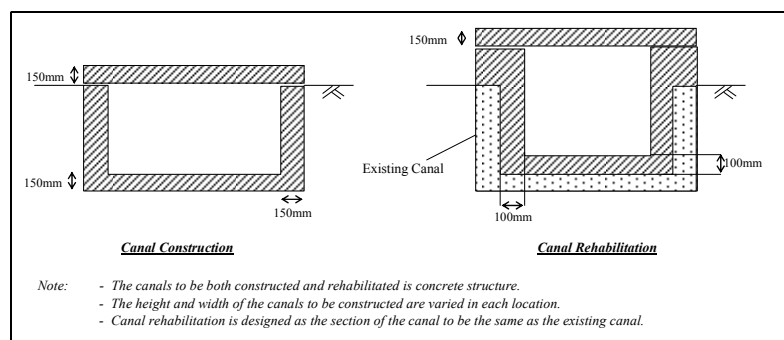


Source: JICA Study Team

**Figure 8.2.10 Proposed Distribution Box Alternatives**

## 3) Canal Rehabilitation and Construction

Following the new conveyance system proposed above, canal rehabilitation and construction will be needed in designing. The purposes of the canals in the new system are: i) to convey water as secondary lines; and ii) to connect conveyance lines from proposed distribution boxes to existing tertiary canals. The proposed structures of open canals for rehabilitation and construction are shown in the following figure with variable dimensions to be suitable for existing dimensions each location. To prevent water from foreign agents or contamination, concrete covers will be installed on the target canals.



Source: JICA Study Team

**Figure 8.2.11 Proposed Canal Construction and Rehabilitation**

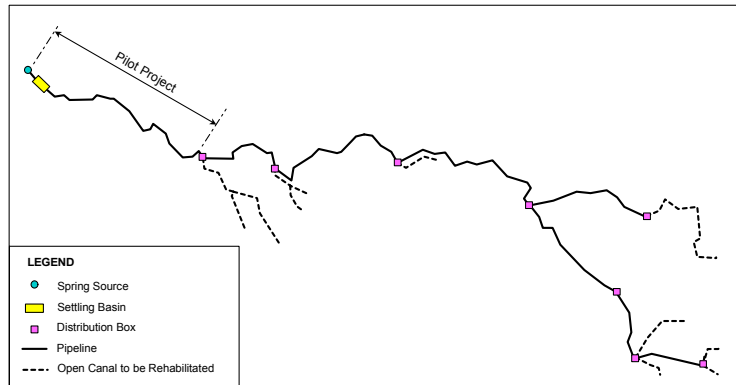
## (7) Preliminary Design for Priority Scheme

The work components and quantities for improvement of spring conveyance system in each priority site identified during the Study, are summarized in the following table and figures.

**Table 8.2.11 Work Components and Quantities for Priority Scheme**

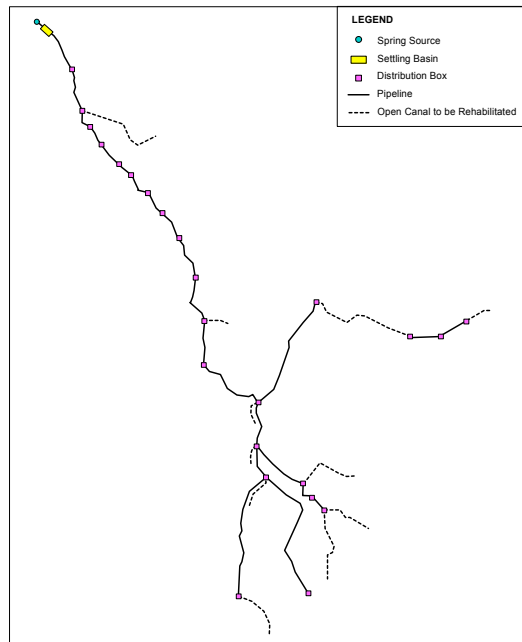
NWA'MAH			DYUK			AUJA		
Item	Unit	Quantity	Item	Unit	Quantity	Item	Unit	Quantity
<b>Pipe Installation</b>	<b>m</b>	<b>4,680</b>	<b>Pipe Installation</b>	<b>m</b>	<b>6,930</b>	<b>Pipe Installation</b>	<b>m</b>	<b>15,010</b>
HDPE-355mm	m	1,720	SP-22"	m	480	SP-26"	m	1,590
HDPE-280mm	m	1,620	SP-18"	m	1,230	SP-22"	m	200
HDPE-225mm	m	1,340	SP-16"	m	760	SP-20"	m	3,720
			SP-12"	m	760	SP-18"	m	4,160
			HDPE-450mm	m	1,080	HDPE-450mm	m	4,280
			HDPE-400mm	m	250	HDPE-400mm	m	1,060
			HDPE-355mm	m	1,420			
			HDPE-280mm	m	950			
<b>Construction</b>			<b>Construction</b>			<b>Construction</b>		
Settling Basin	pcs	0	Settling Basin	pcs	1	Settling Basin	pcs	1
Distribution Box	pcs	8	Distribution Box	pcs	24	Distribution Box	pcs	16
<b>Rehabilitation</b>			<b>Rehabilitation</b>			<b>Rehabilitation</b>		
Intake Rehabilitation	L.S.	0	Intake Rehabilitation	L.S.	0	Intake Rehabilitation	L.S.	1
Canal Rehabilitation	m	2,000	Canal Rehabilitation	m	2,900	Canal Rehabilitation	m	3,750

Source: JICA Study Team



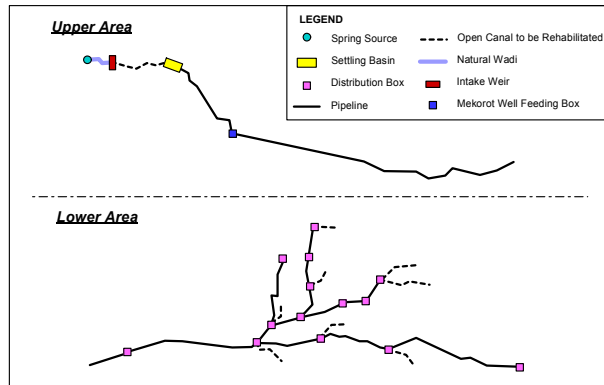
Source: JICA Study Team

**Figure 8.2.12 Proposed Conveyance System (Al Nwai'mah)**



Source: JICA Study Team

**Figure 8.2.13 Proposed Conveyance System (Al Dyuk)**



Source: JICA Study Team

**Figure 8.2.14 Proposed Conveyance System (Al 'Auja)**

The preliminary drawings are shown in Annex 4.8, which were prepared in accordance with the abovementioned design concepts and criteria based on the following outputs.

- (i) Topographic Survey of Al Dyuk Existing Spring Conveyance System (JICA Study Team, 2008)
- (ii) Conceptual Study and Detailed Design for the Irrigation System in the Village of Nuweimeh - Jordan Valley (ANERA, 2001)
- (iii) Design Study for Rehabilitation of Al 'Auja Spring (ANERA, 1992)

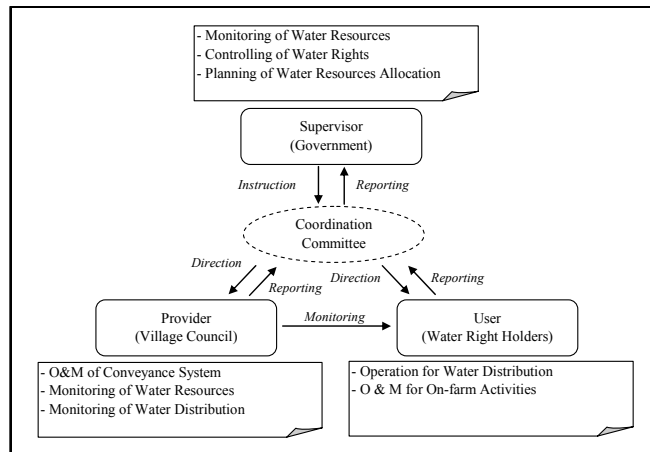
### 8.2.3 Operation and Maintenance (O&M) Plan

#### (1) Related Organization for O&M and Water Resources Management

Currently, in all the priority sites, O&M activities are insufficient. The village councils have no budget for the O&M works. The government as well has no activities intended for monitoring the water usage practices. The farmers meanwhile are operating the current system of distribution themselves by applying the traditional rules, without any control or supervision.

After the completion of the improvement works, as O&M of the conveyance system need to be properly executed, water resource monitoring and management will be strengthened, and water usage practices are expected to be improved. This is upon realization that the system is a public property. Hence, this will be achieved after establishing a better relationship between the government, local authority and water right holders as shown in the following figure.





**Figure 8.2.15 Roles and Responsibility for O&M**

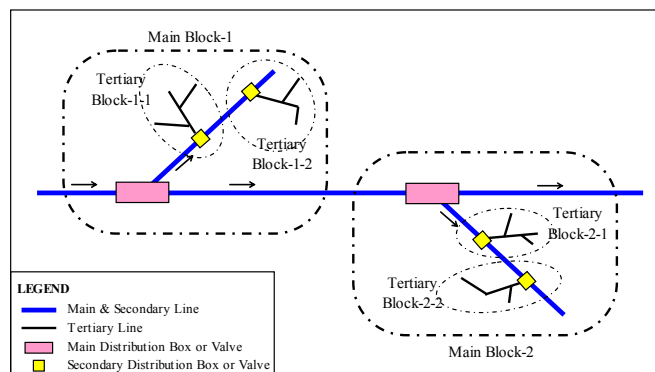
In order to strengthen the relationship, a coordination committee will be established, in which village councils and farmers will be involved. Farmers can participate in the committee if necessary.

(2) Ownership of Facility

The proposed facilities for spring conveyance system will be owned by the village council except tertiary lines owned by water right holders. The village council will act as a main body for O&M, and the main and secondary lines will be under their control, while they will have no responsibility for O&M of the tertiary lines.

(3) Water Distribution Methodology

The new system will make a hierarchy in conveyance, i.e. main, secondary and tertiary conveyance lines. Based on this hierarchy, distribution blocks to be categorized into main and secondary blocks will be formulated as shown in the following figure.



Source: JICA Study Team

**Figure 8.2.16 Image of Proposed Distribution Blocks**

Based on the water right system, distribution rotations will be scheduled by the village council under this blocking theory. However, operation of distribution gates opening/closing in main and secondary lines will be taken by water right holders basically following the current operation manner, as well as operation for tertiary gates. In this distribution system, the water rights and rotation schedule should be managed and maintained in a table like the one as shown below.

**Table 8.2.12 Proposed Form for List of Water Right Holders**

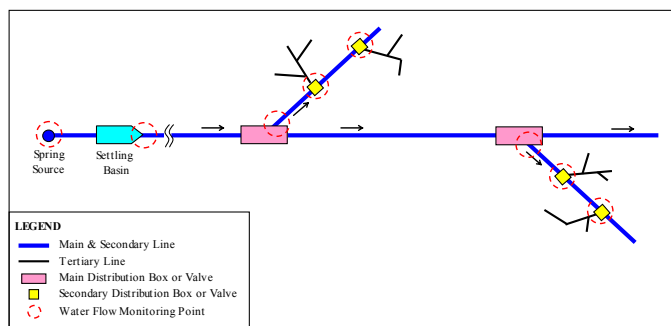
Main Block No.	Tertiary Block No.	Name of Water Right Holder	Water Right Amount	
			hh:mm	m3/year
1 (hh:mm) (m3/year)	1-1 (hh:mm) (m3/year)	1		
		2		
		3		
		4		
		5		
	1-2 (hh:mm) (m3/year)	6		
		7		
		8		
		9		
		10		
		11		
2 (hh:mm) (m3/year)	2-1 (hh:mm) (m3/year)	12		
		13		
		14		
		15		
		16		
	2-2 (hh:mm) (m3/year)	17		
		18		
		19		
		20		

Source: JICA Study Team

Currently, only distribution hours are recorded. However, in the new system, the water volume for each water right holder in m<sup>3</sup>/year also will be calculated based on the annual and monthly water discharge and flow rate in the conveyance system.

(4) Water Flow Monitoring Methodology

From the viewpoint of water resources management, the O&M activities to be performed by the village council include water flow monitoring in the conveyance system. The main purpose of water flow monitoring is to find water losses. In the proposed conveyance system, the water flow monitoring points will be established as shown in the following figure.



Source: JICA Study Team

**Figure 8.2.17 Water Flow Monitoring Point**

In the new system, the village council will monitor water flow regularly at each point. The number of monitoring points of the proposed system is shown in the following table.

**Table 8.2.13 Number of Water Flow Monitoring Points**

Site	Spring Source	Settling Basin	Main & Tertiary Lines
Al Nwai'mah	1	1	10
Al Dyuk	1	1	13
Al 'Auja	1	1	16

Source: JICA Study Team

A bulk meter will be installed at the settling basin and the village council will read the meter. For the other points, a current meter will be used for measuring water flow. The monitoring will be taken on daily basis. The village council will keep the records on the

monitoring result, and report them to the coordination committee and PWA on monthly basis. PWA will monitor the spring discharge flow for countercheck as they are currently acting.

(5) Water Charging System

Currently, there is no water charging in the water right system though the domestic water supply system has it. The village council, as a water provider, will have responsibility for O&M of water conveyance in the proposed system. In order to make the activities sustainable, a water charging system will be required. The charge amount for each water holder is proposed to be set out according to the following formula.

$$\text{Annual water charge per holder} = \text{Annual O\&M costs} / \text{Water right amount}$$

The O&M costs consist of: i) personnel cost; ii) administrative cost; and iii) depreciation cost for facilities, which are announced in the regular board meetings of coordination committee. The O&M costs for each site is shown in Chapter 11 calculated based on the estimated construction costs. Payment will be made on the annual basis like an annual subscription.

(6) O&M Activities

The activities for O&M of the spring water conveyance system are listed in the following table.

**Table 8.2.14 Activity List for O&M**

Acting Body	Category	Actions to be taken
Village Council	Administration	1. Preparation of annual O&M plan 2. Preparation of financial plan 3. Accounting 4. Maintenance of water right 5. Tariff collection 6. Holding board meetings 7. Monthly and annually reporting on activities
	Monitoring of Water Resources	1. Monitoring of water flow from spring sources by current meter 2. Monitoring of water quality of spring sources by observation
	Supervising of Water Conveyance and Distribution	1. Monitoring of water flow in the main and secondary conveyance system by bulk meter or current meter 2. Supervising of farmer's operation activities 3. Monitoring of water quality in the conveyance system by observation 4. Keeping records of monitoring results
	Maintenance of Conveyance System	1. Inspection and patrol of facilities 2. Cleaning of intake, settling basin and pipeline 3. Procurement and replacement of materials deteriorated 4. Rehabilitation of facilities deteriorated 5. Keeping of maintenance records
Water Right Holders	Operation for Water Distribution	1. Control of gates and valves for distribution 2. Operation of on-farm equipment
	O&M of Distribution System	1. Maintenance of distribution pipe and pond 2. Maintenance of on-farm equipment

Source: JICA Study Team

(7) Staff Required in O&M Body

For the proposed facility, an O&M team will be established in the village council. Taking the necessary activities tabulated above into consideration, the following staff will be required in the O&M team to be organized in the village councils.

**Table 8.2.15 Necessary Staff and Tasks of O&M Team in Village Council**

Position (No. of Staff)	Task
O&M Leader (1)	<ul style="list-style-type: none"> <li>• Supervision of all activities</li> <li>• Financial and technical management</li> <li>• Secretariat for board of coordination committee</li> </ul>
Inspector (variable)	<ul style="list-style-type: none"> <li>• Inspecting of facilities</li> <li>• Supervising of water right holders' manners for distribution</li> <li>• Instruction of distribution manners to water right holders</li> <li>• Monitoring of water flow and water quality</li> </ul>
Worker (1)	<ul style="list-style-type: none"> <li>• Cleaning of facilities</li> <li>• Minor rehabilitation works</li> </ul>

Source: JICA Study Team

The number of inspectors can be assumed to be two for each Al Nwai'mah and Dyuk spring conveyance system, and three for Al 'Auja spring conveyance system concerning the facilities scale. The logistics for O&M including water charge collection and accounting will be taken by the administration unit of village council, which will be dealt as well as logistics for the domestic water supply and others.

(8) Software Component for Development

The priority schemes will include software components for capacity building and awareness of water saving agriculture from the viewpoint of on-farm management sustainability.

The work items in the software components are planned as shown in the following table.

**Table 8.2.16 Work Item of Software Component Program**

Major Item	Trainee	Assistant Program
1. Assistant for Formulation of Related Organization	Village Council and Representatives of Water Right Holders	1) Preparation of draft rules and regulations
		2) Preparation of draft organization structures
		3) Preparation of draft roles and responsibility of related Organization
		4) Preparation of draft management manuals including forms
		5) Modification of management manuals
		6) Planning of training on management
		7) Assistant for formulation of management organization
		8) Training on management
		9) Monitoring of activities
		10) Workshop and discussion
2. Assistant for Formulation of O&M Organization	Village Council and Representatives of Water Right Holders	1) Preparation of draft water right allocation rules
		2) Preparation of draft roles and responsibility for O&M
		3) Preparation of draft O&M activities and staff arrangement
		4) Preparation of draft O&M manuals including O&M forms
		5) Preparation of draft water distribution schedule

Major Item	Trainee	Assistant Program
		6) Modification of O&M manuals
		7) Planning of training on O&M
		8) Assistant for formulation of O&M team
		9) Training on structures and functions of water conveyance system
		10) Training on facility inspection
		11) Training on water flow monitoring and recording
		12) Training on water quality monitoring and recording
		13) Monitoring of activities
		14) Workshop and discussion
3. Awareness of Water Saving Agriculture	Water Right Holders and other farmers	1) Preparation and modification of training manuals
		2) Planning of training program
		3) Explanation of new water conveyance system
		4) Training and evaluation on on-farm water management
		5) Workshop and discussion

Source: JICA Study Team

## **CHAPTER 9 ENVIRONMENTAL ASSESSMENT**

### **9.1 General**

Environmental impacts caused by the pilot projects and the priority projects were evaluated through Initial Environmental Evaluation (IEE) under the JICA Study. At the IEE level, environmental impacts caused by these projects resulted in negligible levels except for the project on storm water harvesting.

The IEE results, as well as tentative environmental assessment on the storm water harvesting component, are discussed in this chapter. In connection with this, the Palestinian environmental assessment policy and environmental standards are described as well.

### **9.2 Legal Basis on Environmental Assessment**

#### **9.2.1 Palestinian Environmental Assessment Policy**

The Palestine Environmental Law was enacted in 1999 and showed the basic stance for environmental management in Palestine. The objectives of the law are:

- (i) Protection of the environment against all forms and types of pollution;
- (ii) Protection of public health and welfare;
- (iii) Insertion of the bases of environmental protection in social and economic development plans; and encouragement of sustainable development of vital resources in a manner that preserves the rights of future generations;
- (iv) Protection of bio-diversity and environmentally-sensitive areas, as well as improvement of environmentally-harmed areas;
- (v) Encouragement of collection and publication of environment-related information to raise public awareness of environmental problems.

Based on the law, the “Palestinian Environmental Assessment Policy” was approved by the Ministerial Council in Resolution No: 27-23/4/2000 in April, 2000. This policy is positioned as a guideline for environmental management. The detailed information concerned about Environmental Approval, IEE and EIA are described as follows.

#### **(1) Outline of Environmental Assessment (EA)**

Article 3 of the policy stipulates the principles underlying the policy and it clearly mentions that “environmental assessment should begin as early as possible since it is a means for both planning and evaluation development activities through all stages including decommissioning,” and “Proponents of development activities should pay the costs of carrying out environmental assessment studies. Preparation of the studies and reports must be carried out by specialists qualified to carry out the work.”

#### **(2) Procedure of EA**

According to the responsible person of environmental assessment in EQA, any development study and action including technical cooperation project must follow the EA procedure, which is illustrated in Figure 9.2.1, in order to receive environmental approval of the project implementation.

Two kinds of EA studies may be required such as the Initial Environmental Evaluation (IEE) and Environmental Impact Assessment (EIA). The policy mandates the



Category	√	Environmental Component
	√	Wildlife resources and use
	√	Aquatic resources and use
	√	Recreation and tourism resources and use
	√	Forest resources and use
	√	Agricultural resources and use
	√	Mineral resources and use
	<b>Economic Components</b>	√
√		Indirect/induced employment and income
√		Labor market conditions
√		Sources of supplies, materials and services
√		Transportation requirements
√		Infrastructure development requirements and costs
√		Government revenues/costs
√		Indirect/induced economic development opportunities
<b>Cultural and Heritage Components</b>	√	Archaeological sites
	√	Traditional use sites
	√	Historic sites and landscape features
<b>Social Components</b>	√	Social/demographic profile
	√	Population
	√	Housing and accommodation
	√	Land and water use
	√	Transportation and traffic
	√	Community service delivery
	√	Local government revenues/costs
	√	Social support services
	√	Community stability, cohesion and well being
	√	Gender equity
<b>Health Components</b>	√	Supply of health facilities and services
	√	Community water supply and watersheds
	√	Waste treatment and discharge
	√	Ambient air and water quality
	√	Public health risks
	√	Worker health and safety
	√	Noise
	√	Local community health

Source: EQA

#### (4) Environmental Laws and Regulations in Different Jurisdiction

Depending on the site location (Area A, B, or C), the applied environmental laws and regulations vary as shown in Table 9.2.2.

**Table 9.2.2 Environmental Laws and Regulations**

Area	A	B	C
International Agreement	Oslo II Agreement		
Laws to be Applied	PNA Law		PNA Law + Israeli Law*
Regulations to be Applied	PNA Regulation		PNA Regulation +Israeli Regulation* + Israeli Military Orders*

PNA: Palestinian National Authority

\* In case of obtaining constructing permission in Area C from Israel, these laws and regulations are basis for their judgment.

Source: Revised by JICA Study Team based on the information collected by interview to EQA

## 9.2.2 Water-related Laws

### (1) History of Water-related Laws

The present water law enacted on 17 July, 2002 consists of 44 articles. The Water Law



repeals the previous laws and any other legislation irrelevant to this law and reaffirms the PWA’s mandate and its full responsibility for the management of water resources and wastewater in Palestine.

The other water-related laws are complicated because of the long history of occupation by different countries. An outline of past series of laws is summarized in Table 9.2.3.

**Table 9.2.3 Water-related Laws Introduced to Palestine**

	Epoch	Laws Introduced
1	Jordanian Legislation (1948-1967)	<ol style="list-style-type: none"> <li>1. Land and Water Settlement Law No.40/1952</li> <li>2. Water Control Law No.31/1953</li> <li>3. Municipalities Law No.29/1955</li> <li>4. Law on the Organization of Matters of Drinking Water in the Jerusalem District No.9/1966</li> </ol>
2	Israeli Military Orders (1967-1995)	<ol style="list-style-type: none"> <li>1. Military Order on Powers Concerning Water Laws No.92/1967</li> <li>2. Military Order Amending Law No.31/1953 on Water Control No.158/1968</li> <li>3. Military Order on Land and Water Settlement No.291/1969</li> <li>4. Military Order Amending the Law on the Regulation of the Natural Resources No.457/1972</li> </ol>
3	Palestinian Legislation (1995-To Date)	<ol style="list-style-type: none"> <li>1. Presidential Decree No.5/1995</li> <li>2. Law No.2/1996</li> <li>3. Presidential Decree No.66/1997</li> <li>4. Palestine Water Law No.3/2002</li> </ol>

*Source: Water Legislation in Palestine provided by PWA*

(2) Water-related Laws and Regulations by Jurisdiction

Depending on the site location (Area A, B, or C), the applied water-related laws and regulations vary as shown in Table 9.2.4.

**Table 9.2.4 Water-related Laws and Regulations**

Area	A	B	C
International Agreement	Oslo II Agreement		
Laws to be Applied	PNA Law		PNA Law + Israeli Law*
Regulations to be Applied	PNA Regulation		PNA Regulation + Israeli Regulation* + Israeli Military Orders*

*PNA: Palestinian National Authority*

*\* These law and regulations are applied in Area C by Israel.*

*Source: Revised by JICA Study Team based on the information collected by interview to EQA*

*Article 40 Water and Sewage of Oslo II Bilateral Agreement* stipulates that all development of water resources and systems by either side shall require the prior approval of the Joint Water Committee (JWC). In case of the development in Area C, approval by Civil Administration (CA) at Bet El is additionally required. After all approvals issued by PWA, JWC and CA (in case of Area C) are received, development activities can proceed to the detailed survey or design phase.

(3) Palestinian Standard of Water-related Regulation

Environmental standard provides a framework for sustainable environmental growth. It also minimizes risk associated with potential environmental hazard and consequently its

adoption as technical regulations are justified for their ability to protect the environment. Palestine has already made a great stride in coming up of few standards that focus mainly on public health. Most of these standards are based on the values from neighboring countries like Jordan, Israel and international organizations like the World Health Organization (WHO).

1) Regulations for groundwater pollution control

These regulations were prepared through the cooperation between EQA and PWA, and enacted on January 16, 2006, in order to regulate groundwater pollution by contamination of ground water or restoration of polluted water and obtain an acceptable water quality in accordance with prevailing standards. Especially, in case of either boring of new wells and obtaining a new license or taking actions around/at well head, proponents shall comply with the regulations. Additionally, expected pollutants by activities and regulated substances are listed as appendices.

2) Palestinian guideline for drinking water

Water quality of drinking water is regulated under this guideline of the Palestinian Standardization Institutes. The indicator and value are shown in the following table.

**Table 9.2.5 Palestinian Guideline for Drinking Water**

<b>Chemical Properties</b>			
Indicator	Value	Indicator	Value
Ca	< 100 mg/L	Mn	< 0.1 mg/L
Mg	< 100 mg/L	NO3	< 70 mg/L
Na	< 200 mg/L	SO4	< 200 mg/L
K	< 10 mg/L	PO3	< 0.6 mg/L
Fe	< 0.3 mg/L	Phenol	< 0.002 mg/L
Zn	< 5 mg/L	F	< 1.5 mg/L
Pb	< 0.01 µg/L	Cl	< 250 mg/L
Cd	< 0.005 mg/L	HCO3	< 350 mg/L
Cu	< 1 mg/L	CaCO3	< 500 mg/L
<b>Physical and Biological Properties</b>			
Indicator	Value	Indicator	Value
Temperature	25 degree Celsius	Total coliform	0-3
Turbidity	< 5 NTU	PH	6.5 – 7.5
Faecal coliform	0	Color, taste, odor	To be acceptable

Source: Palestinian Standardization Institutes

3) Palestinian guideline for wastewater quality

The following table shows the treated wastewater quality by basic indicators and maximum acceptable values.

**Table 9.2.6 Treated Wastewater Quality by Basic Indicators**

Indicator	Discharge to sea	Groundwater recharge by infiltration	Dry foddors	Green foddors	Gardens, play grounds, parks	Industrial and cereal crops	Forests	Fruiting trees
COD	200	150	200	150	150	200	200	150
DO	> 1	> 1	> 0.5	> 0.5	> 0.5	> 0.5	> 0.5	> 0.5
TDS	-	1,500	1,500	1,500	1,200	1,500	1,500	1,500
pH	6 - 9	6 - 9	6 - 9	6 - 9	6 - 9	6 - 9	6 - 9	6 - 9
Fat oil & grease	10	0	5	5	5	5	5	5

Indicator	Discharge to sea	Groundwater recharge by infiltration	Dry foddors	Green foddors	Gardens, play grounds, parks	Industrial and cereal crops	Forests	Fruiting trees
Phenol (mg/L)	1	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MBAS	25	5	15	15	15	15	15	15
NO3 (mg/L)	25	15	50	50	50	50	50	50
NH4 (mg/L)	5	10	-	-	50	-	-	-
Org-N (mg/L)	10	10	50	50	50	50	50	50
Cl (mg/L)	-	600	500	500	350	500	500	400
SO4 (mg/L)	1,000	1,000	500	500	500	500	500	500
Na (mg/L)	-	230	200	200	200	200	200	200
Mg (mg/L)	-	150	60	60	60	60	60	60
Ca (mg/L)	-	400	400	400	400	400	400	400

Source: Palestinian Standardization Institutes

**Table 9.2.7 Number of Barriers Required for Different Crops and the Types of Treated Wastewater**

High Quality (Class A)	Good (Class B)	Medium (Class C)	Low (Class D)	Usage	Inedible cover or protection **	Under- ground irrigation **	Plastic ground cover **	Distance from drippers **	Sterilization of treated wastewater **	Sand filter or prolonged detention or 10% treated wastewater (1 of 3) **
20/30	20/30	40/50	60/90	Gardens, Parks and Playgrounds						
<200	<1,000	<1000	<1000							
Number of barriers required										
0	Banned	Banned	Banned	Artificial recharge of groundwater						
0	0	0	Banned	Disposal to the sea at a distance of 500m						
0	0	0	0	Seed producing crops						
0	3	3	4	Wild areas		++	+	++	+	+
0	3	3	4	Corn		++	+	++	+	+
0	0	0	Banned	Green fodder						
0	0	0	0	Dry fodder						
0	2	2	3	Citruses irrigated by drip irrigation	+			++	+	+
0	3	3	4	Citruses irrigated by other methods	+			+	+	+
0	2	2	3	Crops with inedible shell (ex. Walnuts, almonds, pomegranate)	+			++	+	+
0	2	2	3	Deciduous trees (ex. Apple, Pear, Peach)				++	+	+
0	2	2	3	Year-round crops (ex. Avocado, mango)	+	+		+	+	+
0	2	2	3	Grapes with high vines				++	+	+
0	2	2	3	Grapes with normal vines		+		+	+	+
0	2	2	3	Cactus	+	+		++	+	+
0	2	2	3	Dates		+		+++	+	+
0	2	2	3	Olives		+		++	+	+
0	2	2	3	Flowers	+	+		+	+	+
0	0	0	0	Wild forests						
0	0	0	0	Industrial crops						

\*Fecal Coliform

\*\* The + sign indicates one barrier

Source: Palestinian Standard Institute

### 9.2.3 Land-related Laws

The land-related laws and regulations to be referred to would differ depending on the land jurisdiction (Area A, B, or C) as shown in the following table.

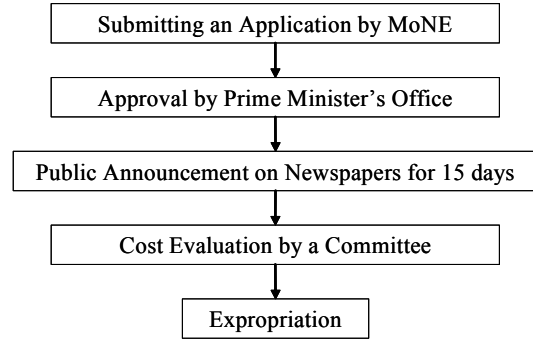
**Table 9.2.8 Land-related Laws and Regulations**

Area	A	B	C
Laws to be Referred to	PNA		PNA + Israeli Law*
Regulations to be Applied	PNA		PNA + Israeli Military Orders*

\* In case of obtaining permission in Area C from Israel, these laws and regulations are basis for their judgment.

Source: Interview survey to PLA (2007)

Land expropriation and related matters are specified in the Expropriation Law (No.2/1953). In case that land expropriation is to be executed for private lands, the procedure of expropriation will follow the flow shown in Figure 9.2.2.



MoNE: Ministry of National Economy

Source: PLA

### 9.2.4 Organizations Concerned with Agricultural Water Use

**Figure 9.2.2 Typical Procedure of Land Expropriation**

Organizations concerned with agricultural water use mainly consist of four Palestinian organizations, one Israeli organization and one bilateral committee between the Palestinians and Israelis. The summary of the organizations is described in the following table.

**Table 9.2.9 Organizations Concerned with Agricultural Water Use**

	Name	Main Responsibility
1	Palestinian Water Authority (PWA)	Water resources development and management in Palestine
2	Ministry of Agriculture (MoA)	Food security and poverty alleviation through sustainable agricultural development in Palestine
3	Environmental Quality Authority (EQA)	Overall environmental management, including environmental management planning, implementation, monitoring and evaluation as well as environmental education Final decision maker to issue environmental approval
4	Environmental Assessment Committee (EAC)	Inter-organizational unit to discuss about environmental approval
5	Joint Water Committee (JWC)	Bilateral committee and final decision maker of water resource management and development in Palestine
6	Civil Administration (CA)	Management and regulation of all activities in and through Area C

Source: JICA Study Team

### 9.3 Initial Environmental Evaluation

Under the above environmental management policy in Palestine, an Initial Environmental Evaluation (IEE) study was conducted through the JICA Study. Results of the IEE study were summarized as IEE report in December 2007 to be submitted to EQA. As of August 2008, the report is under the final process to be issued the environmental approval. The IEE report is summarized as follows:

### **9.3.1 Purpose of Initial Environmental Evaluation**

The main purposes of the Initial Environmental Evaluation (IEE) study were:

- (i) To determine the current natural and socio-economic environmental conditions in the Jordan River Rift Valley;
- (ii) To evaluate likely environmental and social impacts to be caused by the implementation of the candidate project components; and
- (iii) To clarify scope of work for the projects components which need Environmental Impact Assessment (EIA) study.

### **9.3.2 Methodology of IEE**

#### **(1) Data Collection**

Data for the IEE study was based on secondary data and interview survey. The data and information was verified and/or supplemented through the field reconnaissance.

#### **(2) Project Description**

Projects listed in the IEE report were categorized into two parts. One was a set of candidate pilot project components which was scheduled to be implemented during the Study period. The other was a set of candidate priority projects and alternatives for the Feasibility Study.

#### **(3) Identification and Evaluation of Conceivable Impacts**

Conceivable impacts to be caused by the implementation of the candidate pilot project components and priority projects were identified and evaluated especially on the following points of view:

- (i) Importance of impacts;
- (ii) The number of people / area to be affected;
- (iii) Spatial extent and duration of the impacts;
- (iv) Reversibility of the impacts; and
- (v) Possibility to cause secondary impacts.

Based on the valued environmental components described in the Palestinian Environmental Assessment Policy, scoping matrices were prepared to identify and evaluate conceivable impacts by the components. Conceivable impacts were technically judged and rated by the Environmental Consultant of the JICA Study Team based on the JICA Guidelines for Environmental and Social Considerations. Similar guidelines are utilized by World Bank and the Japan Bank for International Cooperation.

### **9.3.3 Identification of Conceivable Impacts of Priority Projects for Feasibility Study**

Two types of projects were proposed in the Study: i) Rehabilitation of agricultural wells; and ii) Improvement of spring water conveyance system. In addition, Storm water harvesting was also studied even though the ideas were still at the potential level. The description of each project is mentioned in the basic plan of each type.

#### **(1) Conceivable Impacts of Candidate Priority Projects**

Conceivable impacts to be caused by the implementation of alternatives above were examined thorough the IEE study. The scoping matrices to identify the impacts in each project component are listed in Tables 9.3.1, 9.3.2 and 9.3.3.

**Table 9.3.1 Scoping Matrix for Rehabilitation of Agricultural Wells**

Category		Rating by Phase				Without project	Brief Description
		Pump test, WUA formulation	Installation of pumping units	Operation and maintenance			
Biophysical Resources and Land-Use Components	1	Climate and Air Quality	D	D	D	D	No impact
	2	Surface Water Hydrology and Quality	D	D	D	D	No impact
	3	Groundwater Hydrology and Quality	D	D	D	D	Deterioration of water quality and quantity might be accelerated negligibly by the project, because very limited number of wells will be rehabilitated to abstract small amount of additional water compared with the present abstraction volume.
	4	Terrain and Natural Hazards	D	D	D	D	No impact
	5	Soils and Vegetation	D	D	D	D	Negligible impact might be caused by expansion of agricultural lands since the project scale is small.
	6	Wildlife Resources and Use	D	D	D	D	No impact because the target areas are located in agricultural lands and the scale is small.
	7	Aquatic Resources and Use	D	D	D	D	No impact because the target areas are located in agricultural lands and the scale is small.
	8	Recreation and Tourism Resources and Use	D	D	D	D	No impact
	9	Forest Resources and Use	D	D	D	D	No impact because the target areas are located in agricultural lands.
	10	Agricultural Resources and Use	D	D	D	D	Negligible increase of agricultural land is expected after the rehabilitation since the scale is small.
	11	Mineral Resources and Use	D	D	D	D	No impact
Economic Components	12	Direct Employment and Income	D	D	B*	D	Farmers' and well owners' income will increase after the rehabilitation.
	13	Indirect/ Induced Employment and Income	D	D	D	D	People who belong to the agricultural sector will be the beneficiaries after the rehabilitation. But the impact is negligible.
	14	Labor Market Conditions	D	D	B*	D	Refer to 12 and 13.
	15	Sources of supplies, materials, and services	D	D	D	D	No impact
	16	Transportation Requirements	D	D	D	D	No impact because the access road condition is good enough. The only difficulty is the limitation of transportation by Israel.
	17	Infrastructure Development Requirements and Costs	D	D	D	D	No impact
	18	Government Revenues and Costs	D	D	D	D	No impact is expected on the government revenues and costs if the rehabilitation is implemented by donor agencies under grant aid scheme.
	19	Indirect/ Induced Economic Development Opportunities	D	D	B*	D	Refer to 13.
Cultural and Heritage Components	20	Archeological Sites	D	D	D	D	No impact because the target areas are located in agricultural lands.
	21	Sites for Traditional Use	D	D	D	D	Refer to 20.
	22	Historic Sites and Landscape Features	D	D	D	D	Refer to 20.

Category			Rating by Phase				Without project	Brief Description
			Pump test, WUA formulation	Installation of pumping units	Operation and maintenance			
Social Components	23	Social/ Demographic Profile	D	D	D	D	No impact	
	24	Population	D	D	D	D	No impact	
	25	Housing and Accommodations	D	D	D	D	No impact	
	26	Land and Water Use	B	D	B*	D	Difficulty is expected in the phase of formation of WUA and water sharing system. On the other hand, increase of agricultural lands is expected after the rehabilitation. In addition, water saving irrigation is also expected to be disseminated around the target area.	
	27	Transportation and Traffic	D	D	D	D	Negligible impact will be caused by the increase of transportation of agricultural products.	
	28	Community Services Delivery	D	D	D	D	No impact	
	29	Local Government Revenues/ Costs	D	D	D	D	No impact because O & M is the well owners' and WUA's responsibility	
	30	Social Support Services	D	D	D	D	No impact	
	31	Community Stability, Cohesion, and Well-Being	D	D	D	D	No impact because the direct beneficiaries are limited within the farmers working in the small target area and well owners.	
	32	Gender Equity	D	D	D	D	No impact	
Health Components	33	Supply of Health Facilities and Services	D	D	D	D	No impact	
	34	Community Water Supply and Watersheds	D	D	D	D	No impact is expected because the abstracted water from the wells will be used only for irrigation.	
	35	Waste Treatment and Discharge	D	D	D	D	No impact	
	36	Ambient Air and Water Quality	D	D	D	D	Refer to 3	
	37	Public Health Risks	D	D	D	D	Drinking water quality abstracted from wells around the target wells might be deteriorated negligibly (Refer to 3).	
	38	Worker Health and Safety	B	B	D	D	Careful operation is required during the phase from pump test including well development and deepening until rehabilitation of pumps and motors.	
	39	Noise	B	B	B	D	There are some impacts during the phase of the pump test and the rehabilitation. In addition, noise from generators might be made after rehabilitation.	
	40	Local Community Health	D	D	D	D	No impact	

Evaluation Categories: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown. (Examination is needed. Impacts may become clear as study progress.) D: No impact is expected. EIA is not necessary. \*: Positive impact is expected.

Scores of the scoping matrix were rated on the basis of the JICA Guidelines for Environmental and Social Considerations.

Source: JICA Study Team



**Table 9.3.2 Scoping Matrix for Improvement of Spring Water Conveyance System**

Category	Rating by Phase					Without project	Brief Description
	WUA formulation, Design stage	Improvement	Operation and maintenance				
Biophysical Resources and Land-Use Components	1	Climate and Air Quality	D	D	D	D	No impact
	2	Surface Water Hydrology and Quality	D	D	D	D	No impact
	3	Groundwater Hydrology and Quality	D	D	D	D	Improvement of water conveyance efficiency is expected through the project. As the result, volume of wells' abstraction might negligibly decrease in the target area and deterioration of groundwater resources might be alleviated.
	4	Terrain and Natural Hazards	D	D	D	D	No impact
	5	Soils and Vegetation	D	D	B*	D	Irrigable land, which is expected to be irrigated by the spring water, would be cultivated after the improvement of water conveyance efficiency.
	6	Wildlife Resources and Use	D	B	B	D	Source of Al 'Auja spring is located in a natural reserve area. Negligible impact might be caused by change of conveyance system from open canals to pipelines. Rare species were not observed in the project areas.
	7	Aquatic Resources and Use	D	B	B	D	Source of Al 'Auja spring is located in a natural reserve area. Negligible impact might be caused because no aquatic lives and endangered aquatic plants are observed in the existing canals.
	8	Recreation and Tourism Resources and Use	D	B	B	D	Source of Al 'Auja spring is located in a natural reserve area and used as a recreation site.
	9	Forest Resources and Use	D	D	D	D	No impact because the target areas are located in unutilized bare ground and agricultural lands.
	10	Agricultural Resources and Use	D	D	B	D	Irrigated lands are expected to expand through the improvement. Water for livestock of Bedouin, who uses water in the open canal, is to be considered.
	11	Mineral Resources and Use	D	D	D	D	No impact
Economic Components	12	Direct Employment and Income	D	D	B*	D	Farmers' income will increase after the improvement.
	13	Indirect/ Induced Employment and Income	D	D	B*	D	People who belong to the agricultural sector will be the beneficiaries after the rehabilitation.
	14	Labor Market Conditions	D	D	B*	D	Refer to 12 and 13.
	15	Sources of supplies, materials, and services	D	D	D	D	Negligible impact might be caused by the improvement under the limited access condition by Israel although the project size is relatively big and the pipeline for the main canal is required.
	16	Transportation Requirements	D	D	D	D	No impact because the access road condition is good enough. Only the difficulty is limitation of transportation by Israel.
	17	Infrastructure Development Requirements and Costs	D	D	D	D	Rehabilitation of farmer's canals is required. However, the rehabilitation is implemented by farmers under present situation. Therefore, no additional impact is expected through the project.
	18	Government Revenues and Costs	D	D	D	D	No impact is expected on the government revenues and costs if the improvement is implemented by donor agencies under grant aid scheme
	19	Indirect/ Induced Economic Development Opportunities	D	B*	B*	D	Refer to 13.

Category			Rating by Phase				Brief Description
			WUA formulation, Design stage	Improvement	Operation and maintenance	Without project	
Cultural and Heritage Components	20	Archeological Sites	D	D	D	D	No impact because the target areas are in agricultural lands.
	21	Sites for Traditional Use	D	D	D	D	Refer to 20.
	22	Historic Sites and Landscape Features	D	D	D	D	Refer to 20.
Social Components	23	Social/ Demographic Profile	D	D	B	D	Life style of Bedouin, who uses water in the open canal, would be changed after the improvement.
	24	Population	D	D	D	D	Negligible increase of population will be expected by activation of agriculture after the improvement.
	25	Housing and Accommodations	D	D	D	D	Refer to 24.
	26	Land and Water Use	B	D	B	D	Difficulty is expected in the phase of the formation of WUA and water sharing system and water use by Bedouin would be changed after rehabilitation. On the other hand, increase of agricultural lands is expected after the rehabilitation. In addition, water saving irrigation is also expected to be disseminated around the target area.
	27	Transportation and Traffic	D	D	D	D	Negligible impact will be caused by the increase of transportation of agricultural products.
	28	Community Services Delivery	D	D	D	D	No impact.
	29	Local Government Revenues/ Costs	D	D	B*	D	Financial condition of local governments will be improved by establishment of collection system of water tariff.
	30	Social Support Services	D	D	D	D	No impact
	31	Community Stability, Cohesion, and Well-Being	B*	D	B	D	Unity of the community is expected to be strengthened through the process of WUA formation. Existing water distribution system is applied after the rehabilitation. Therefore, no impact is expected after the rehabilitation. But changes of Bedouins' lifestyle and livestock should be considered in the WUA formulation and design stage.
	32	Gender Equity	D	D	D	D	No impact
Health Components	33	Supply of Health Facilities and Services	D	D	D	D	No impact
	34	Community Water Supply and Watersheds	D	D	B*	D	Water quality will be kept high after implementation since the main conveyance system will be replaced by pipelines. After the improvement, there might be surplus of the spring water, in which case, the water could contribute to improve domestic water supply.
	35	Waste Treatment and Discharge	D	D	D	D	No impact
	36	Ambient Air and Water Quality	D	D	D	D	Improvement of water efficiency might cause expansion of area of water supply sourced by spring water. In this case, volume of well abstraction would negligibly decrease in the target area.
	37	Public Health Risks	D	D	B*	D	If surplus water could be generated by improvement of water conveyance efficiency, the situation of water supply will be improved around the target areas.
	38	Worker Health and Safety	D	B	D	D	Careful operation is required during the phase of the improvement work.
	39	Noise	D	D	D	D	No impact
40	Local Community Health	D	D	B*	D	Refer to 37.	

Evaluation Categories: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown. (Examination is needed. Impacts may become clear as study progress.) D: No impact is expected. EIA is not necessary. \*: Positive impact is expected.

Scores of the scoping matrix were rated on the basis of the JICA Guidelines for Environmental and Social Considerations.

Source: JICA Study Team

**Table 9.3.3 Scoping Matrix for Potential Storm Water Harvesting**

Category		Rating by Phase				Without project	Brief Description
		WUA formulation, Design stage	Construction	Operation and maintenance			
Biophysical Resources and Land-Use Components	1	Climate and Air Quality	D	D	D	D	No impact.
	2	Surface Water Hydrology and Quality	D	B	A	D	Pattern of surface runoff might be drastically changed after the construction.
	3	Groundwater Hydrology and Quality	D	C	C	D	Impacts during the construction and O & M phases cannot be estimated without water balance study between surface water and groundwater. If the water stored in the water harvesting structures is used for artificial recharge to underground water, water quality will be improved and water level might be recovered.
	4	Terrain and Natural Hazards	D	B	B*	D	Landscape might be changed through the construction. Risk of flood will be alleviated after the construction.
	5	Soils and Vegetation	D	B	B	D	Soils and vegetation would be affected in the surrounding area of the structures.
	6	Wildlife Resources and Use	D	B	B	D	Ecosystem around the structures might be changed. Some of the proposed sites are located in nature reserve areas.
	7	Aquatic Resources and Use	D	B	B	D	If a surface dam is constructed, aquatic life might start activating. Some of the proposed sites are located in nature reserve areas.
	8	Recreation and Tourism Resources and Use	D	B	B	D	The water harvesting site might be a recreation field for Palestinian people. On the other hand, traditional use of the land as a recreation site in nature reserve areas would be affected by the implementation
	9	Forest Resources and Use	D	D	D	D	No impact because the sites are located in agricultural lands, bare ground and residential area.
	10	Agricultural Resources and Use	D	B	B*	D	Some of the target sites for the dams or reservoirs are located in agricultural lands. In these cases, impacts would be caused by land acquisition. Expansion of agricultural area is expected after the construction.
	11	Mineral Resources and Use	D	D	D	D	No impact.
Economic Components	12	Direct Employment and Income	D	B*	B*	D	Increase of employment opportunity as civil engineers and labors will increase caused by the construction work. Farmers' income will increase after the construction.
	13	Indirect/ Induced Employment and Income	D	B*	B*	D	Construction company will receive the benefit by the improvement work. People who belong to the agricultural sector will be the beneficiaries after the construction.
	14	Labor Market Conditions	D	B*	B*	D	Refer to 12 and 13.
	15	Sources of supplies, materials, and services	D	B	D	D	Impact might be caused by the construction under the limited access condition of Israel because the project size is relatively big and relatively great volume of construction materials is required.
	16	Transportation Requirements	D	B	D	D	Access road for O&M is required to be constructed in some of the sites.
	17	Infrastructure Development Requirements and Costs	D	B	B	D	Construction of water conveyance system from the water harvesting structures to the beneficiaries is required. Preparation of farmer's canals and canal rehabilitation roads is required as well.
	18	Government Revenues and Costs	B	D	D	D	If acquisition of private land is required, its budget should be arranged by a governmental organization. No additional impact is expected on government revenues and costs if the construction is implemented by donor agencies under grant aid scheme
	19	Indirect/ Induced Economic Development Opportunities	D	B*	B*	D	Refer to 13.

Category			Rating by Phase				Without project	Brief Description
			WUA formulation, Design stage	Construction	Operation and maintenance			
Cultural and Heritage Components	20	Archeological Sites	D	D	D	D	No impact because the target areas are located in agricultural lands or bare ground.	
	21	Sites for Traditional Use	D	B	B	D	Some impacts might be caused by land acquisition.	
	22	Historic Sites and Landscape Features	D	D	D	D	Refer to 20.	
Social Components	23	Social/ Demographic Profile	D	B	B	D	Social profile might be slightly changed by improvement of water supply.	
	24	Population	D	D	D	D	Population might increase slightly by improvement of water supply.	
	25	Housing and Accommodations	D	D	D	D	Refer to 24.	
	26	Land and Water Use	B	B	B*	D	Land acquisition is required for construction of the structures and access roads. Total amount of water resources will increase and the agricultural lands will be expanded after construction.	
	27	Transportation and Traffic	D	D	D	D	Negligible impact will be caused by the increase of transportation of agricultural products.	
	28	Community Services Delivery	D	D	D	D	No impact.	
	29	Local Government Revenues/ Costs	D	D	B*	D	Financial condition of local governments will be improved by increase of tax revenue and establishment of collection system of water tariff although O&M cost will increase.	
	30	Social Support Services	D	D	D	D	No impact	
	31	Community Stability, Cohesion, and Well-Being	B	B	B	D	Through the process of land acquisition, negative impacts on the community are expected. Continuous explanation to the stakeholders is vital.	
	32	Gender Equity	D	D	D	D	No impact	
Health Components	33	Supply of Health Facilities and Services	D	D	D	D	No impact	
	34	Community Water Supply and Watersheds	D	D	B*	D	New water resources will be developed through the construction. The water could contribute to improve domestic water supply if water purification facilities are provided with the water harvesting structures.	
	35	Waste Treatment and Discharge	D	D	D	D	No impact	
	36	Ambient Air and Water Quality	D	D	B*	D	Development of new water resources will cause expansion of the area of water supply. In this case, volume of well abstraction will decrease in the target area, and finally, it may cause deterioration of underground water quality, and cause the water level of underground water to drop.	
	37	Public Health Risks	D	D	B*	D	Refer to 34 and 36.	
	38	Worker Health and Safety	D	A	B	D	Some of the proposed water harvesting structures are a first experience for the Palestinians. Therefore, the contractor's risk would be higher than the other projects such as: rehabilitation of agricultural wells and improvement of water conveyance system. Skilled and experienced supervisors are necessary.	
	39	Noise	D	B	D	D	Working period for some of the alternatives is expected to be long and the sites are located near to communities. During the period, noise measurement is to be undertaken.	
	40	Local Community Health	D	D	B*	D	Refer to 34 and 36.	

Evaluation Categories: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown. (Examination is needed. Impacts may become clear as study progress.) D: No impact is expected. EIA is not necessary. \*: Positive impact is expected.

Scores of the scoping matrix were rated on the basis of the JICA Guidelines for Environmental and Social Considerations.

Source: JICA Study Team

### 9.3.4 Mitigation Measures for Major Environmental and Social Impacts

#### (1) Rehabilitation of Agricultural Wells

Expected major environmental and social impacts in relation with rehabilitation of agricultural wells are summarized as: i) Conflicts on water tariff and water management; ii) Accidents during pump tests and rehabilitation of the agricultural wells; and iii) Noise.

The mitigation measures for the above impacts are as follows:

##### 1) Conflicts on water tariff and water management

Under the present situation, the water tariff is decided by well owners and most of the water users do not form WUA. However, to improve water management of agricultural wells, formation of WUA is necessary. This includes the well owners and other water users with special reference to water tariff issues, as this process might cause conflicts among WUA.

To avoid the conflicts, the following mitigation measures should be applied for the project:

- (i) To obtain agreement on the whole project activity from stakeholders before implementation;
- (ii) To obtain agreement for formation of WUA among well owners and water users;
- (iii) To facilitate WUA to register with the PWA;
- (iv) To conduct training on water management; and
- (v) Careful monitoring of WUA activities conducted by PWA and MoA.

##### 2) Accidents

Workers for the pumping tests and the rehabilitation will be fraught with danger since heavy equipment is utilized for the work. Qualified and skillful experts and a senior supervisor are required to be employed. In addition, it would be required to prepare a safety control system for the work and to enforce this system to the workers.

##### 3) Noise

Noise should be taken care of throughout the process of rehabilitation if the wells are located in/near community areas. The work period should not only be minimized but it is also essential that the rehabilitation work be explained to the neighbors. Approval of the work from the neighbors is required, particularly the purpose, the duration of the work period, what kind of heavy equipment to be used, etc.

In addition, noise from a generator should also be avoided or minimized. Thus, the generator should be put in a sound-proof room such as pumping house, if the pump station is located in/near community areas.

#### (2) Improvement of Spring Water Conveyance System

Expected major environmental and social impacts in relation to improvement of spring water conveyance system are summarized as: i) Wildlife and aquatic life near the source of Al 'Auja spring, ii) Water supply for the Bedouins, iii) Disturbance of recreation site at

Nwai'mah spring, iv) Conflicts on water tariff and water management, and v) Accidents. The mitigation measures for these impacts are as follows:

1) Wildlife and aquatic life near the source of Al 'Auja spring

Al 'Auja spring originates from a natural reserve area, which has a natural ecosystem of both wildlife and aquatic life. In addition, the area is currently used as a recreation site for communities near the spring source.

Therefore, the project should be planned such that not any activity at and around the source of Al 'Auja spring is conducted.

2) Water supply for Bedouins

Water in the existing open canal is sometimes used as drinking water for livestock as well as the Bedouins. Therefore, to improve the conveyance system, agreement from the Bedouins is essential.

As a countermeasure for this issue, outlets for the Bedouins should be set along the improved pipelines. The location and volume of water to be supplied should be discussed with and decided by the Bedouins, officers of relevant village councils, and a design team during the detailed design stage of the improvement.

3) Disturbance of a recreation site along Nwai'mah spring conveyance system

The Al Nwai'mah spring water conveyance system flows through a recreation site named as Banana Land. If all existing open canals are replaced by pipelines, the value of the recreation site will be lessened.

To avoid this issue, the existing open canal should be utilized in the recreation site. In addition, since rubbish might be put into the open canal, a filter to remove it should be put in place.

4) Conflicts on water tariff and water management

In parallel with the improvement of spring water conveyance system, the water users committee would be strengthened through facilitation of the JICA Study Team. However, the targeted spring water conveyance systems have their original water distribution rules based on the consensus among water rights holders. The water rights holders usually do not want to change the present water distribution rule.

To avoid the conflicts caused by water distribution, the following approaches should be applied:

- (i) Obtaining agreement on project activities from stakeholders before implementation;
- (ii) Enhancement of water management committees among water right holders;
- (iii) No change of the present time-based water distribution system to water right holders;
- (iv) Conduct of training on water management to water users; and
- (v) Monitoring of water management committees' activities conducted by PWA and MoA.

#### 5) Accidents

Workers for the improvement of the systems may encounter danger since heavy equipment is utilized for the work. Qualified and skillful experts and a senior supervisor are thus required to be employed. In addition, it would be required to prepare and implement a safety control system for the works.

### (3) Storm Water Harvesting

To clarify the impacts caused by storm water harvesting, the size of structures and their locations are to be identified. However, these could not be decided due to the lack of wadis' discharge data. Major conceivable impacts and mitigation measures are identified in general and under the most serious case, as follows:

#### 1) Surface water and groundwater hydrology and quality

Surface water condition will be completely changed by the construction of dams or large scale structures in/along wadis. It is recommended that discharge of wadis is measured for duration of at least 5-10 years. After obtaining the complete record of the discharge, a water balance study on surface water as well as between surface water and groundwater is recommended to be undertaken.

Moreover, the sediment balance in the wadis will be changed if the scale of the structures is large. The concentration of suspended solids in flood water is recommended to be measured in parallel with the discharge measurement.

#### 2) Ecosystem

The ecosystem, including aquatic life, wildlife and vegetation, might be changed even if the water harvesting structures are located in the agricultural lands, community areas or bare ground, because surface water conditions will be completely changed by the construction of dams or large scale structures. Environmental Impact Assessment shall be carried out after the completion of the above discharge measurement.

#### 3) Land acquisition

Without determination of the exact location and size of the structures, it is difficult to discuss about land acquisition. However, in general, if construction sites are selected in Area A or Area B, there is a high possibility of the need for land acquisition because unused and large areas could not be found through the Study. Considering the limited government budget, it is required for donors to support land acquisition.

#### 4) Government expenditure

Depending on the scale, government expenditure for land acquisition, detailed design of the facilities, and construction will be much higher than the annual revenue. Donors' support is inevitable to realize the storm water harvesting in large scale.

#### 5) Accidents

Although storm water harvesting may include large scale construction work such as

construction of dams, subsurface dams and weir in wadis, there is very limited experience for storm water harvesting in Palestine. Serious accidents could be caused by the construction work.

To avoid accidents, it is strongly recommended that foreign consultants with enough experiences and skills are employed during the design stage as well as supervision stage. It is also necessary that foreign construction companies with enough experiences and skillful staff are involved as the main contractor. Local engineers and labor should implement the construction under such foreign consultants' and companies' supervision and guidance.

#### 6) JWC approval

In addition to the above issues, it seems difficult to get the approval from JWC compared with the rehabilitation of agricultural wells and improvement of spring water conveyance system. Since water harvesting is development of new water resource, the impacts caused by the construction are not widely known.

To convince the JWC, measurement of the actual discharge and a study of the expected change by using hydraulic and hydrological simulation model will be required.

### 9.3.5 Identification of Conceivable Impacts of Pilot Projects

Two components of the pilot projects are scheduled to be implemented under the Study as mentioned in the Chapter 8. The conceivable impacts of the pilot projects and mitigation measures taken against major environmental and social impacts are as follows:

**Table 9.3.4 Mitigation Measures Taken for Major Environmental and Social Impacts in the Implementation of the Pilot Projects**

	Conceivable impacts	Measures taken in the past and to be taken in the future
Rehabilitation of agricultural wells		
1	Conflicts on water tariff and water management	All well owners agreed on the project concept and formation of WUA before implementation. Under supervision of the JICA Study Team, WUA were formed and trained on water management by contracted facilitators. Registration of WUA with PWA was completed.
2	Accidents	In the pilot project, experienced and competent contractor was selected for pumping test and will be selected for the replacement of pump, motor and other equipment under the supervision of JICA Study Team. No accidents happened throughout the whole project activities.
3	Noise	The purpose, expected work period and what kind of equipment to be used were explained by the contractor as well as the JICA Study Team and agreed by the well owners. No problems were observed until August 2008.
4	Deterioration of groundwater	Water quantity and quality were carefully examined through a pumping test and water quality test, respectively. Based on the result of the pumping test, the necessity of further rehabilitation was assessed. If the quantity is not enough and the pumping will cause serious impacts to the surrounding areas, further rehabilitation, such as replacement of pump, motor or other equipment, would be cancelled. The above conditions were agreed between the JICA Study Team and owners of the targeted wells.  As the result of water quality test during pumping test, it was found that a well (ID: 19-15/008) was not useful for irrigation without water purification because the water quality has deteriorated. Through discussions with the well owners, they agreed to cancel the rehabilitation.  In parallel with the above hardware component, capacity of the WUA in each targeted well was enhanced in the software component. Particularly, record



	Conceivable impacts	Measures taken in the past and to be taken in the future
		keeping of water distribution schedules was improved. The daily record of water use will be an important indicator for the PWA to supervise, guide and control the water usage of farmers or well owners.
Improvement of spring water conveyance system		
1	Water supply for Bedouin	There is no Bedouin affected by the pilot project.
2	Conflict in communities	Through discussions with water right holders, it was decided that no activity would be implemented in the recreation site named as Banana Land.
3	Conflicts on water tariff and water management	Through frequent discussions with the Nwai'mah village council, drawings for the rehabilitation were prepared and agreed by the village council. It was also agreed that the village council shall have the responsibility for operation and maintenance after the hand-over of the rehabilitated conveyance system. Additionally, WUA's empowerment was conducted by the contractor under supervision of the JICA Study Team to achieve equitable water distribution to the farmers. This activity was one of the measures to avoid any conflict. No conflicts were observed until the end of the Study.
4	Accidents	In the pilot project, an experienced and competent contractor was selected for the rehabilitation work under the supervision of the JICA Study Team. There were no accidents observed during pilot project activities.

Source: JICA Study Team

### 9.3.6 Conclusion of IEE

Through the IEE study discussed in this section, the necessity of EIA was concluded as follows:

#### (1) Rehabilitation of Agricultural Wells

The impacts caused by the rehabilitation were expected to be managed and mitigated by the measures mentioned above. Therefore, an EIA was not necessary to be conducted in this component.

However, the results of the pumping tests shall be carefully checked by the PWA, MoA and EQA. Safety control and impacts of noise shall be taken into consideration through the rehabilitation activities as well. WUA activities shall also be monitored carefully by PWA.

Environmental monitoring was recommended to be enhanced and the monitoring report to be published regularly after the rehabilitation.

#### (2) Improvement of Spring Water Conveyance System

The impacts caused by the improvement were likewise expected to be managed and mitigated by the measures mentioned above. Therefore, an EIA was not necessary to be conducted in this component.

However, careful monitoring is strongly recommended during and after project implementation. Especially, water management by water users was expected to be the crucial issue. PWA and MoA have the responsibility on this matter. Through periodical surveys, water management could be monitored carefully.

#### (3) Storm Water Harvesting

Impacts caused by the storm water harvesting were expected to be serious. However, without any decision on the size based on the wadis' discharge record, the detailed environmental study could not be completed. In parallel with the discharge measurement,

other basic information, such as geology, concentration of suspended solids in the wadis' discharge, etc., should be also collected in order to conduct a feasibility study on the storm water harvesting structures. Therefore, it was concluded that the EIA study shall be conducted in parallel with the feasibility study after discharge measurements have been conducted for at least 5–10 years.

The Terms of Reference (TOR) for the storm water harvesting project was attached in the IEE report in Annex.

#### **9.4 Tentative Environmental Assessment on Storm Water Harvesting**

As concluded above, the storm water harvesting component requires further study in order to conduct environmental assessment. In addition, a pilot project is required to assess the possibility of storm water harvesting.

After conducting the IEE study and its report preparation, potential sites for the pilot project on storm water harvesting were decided. Therefore, a tentative IEE study was conducted for the pilot project as described as follows:

##### **(1) Description of the Pilot Project Sites**

The pilot project on storm water harvesting is assumed to be implemented along Wadi Qilt. The information of the pilot project is described in Chapter 8.

##### **(2) Identification of Conceivable Impacts**

Conceivable impacts to be caused by the implementation of the candidate pilot project components and priority projects were identified and evaluated the same way as the procedure taken in the IEE. Scoping matrix to identify the impacts is listed in Table 9.4.1.

##### **(3) Mitigation Measures for Major Environmental and Social Impacts**

Expected major environmental and social issues in relation to storm water harvesting are summarized as: i) Excavation of river bed and banks, ii) Arrangement of pumping fee, iii) Land acquisition, iv) Accident caused during construction period in rainy season, and v) Noise. The mitigation measures for these impacts are as follows:

###### **1) Excavation of river bed and banks**

After construction of concrete structures in the wadi flow, degradation of the river bed and erosion of the river banks may be observed. In order to prevent these, the river bed and banks shall be protected during construction.

###### **2) Arrangement of pumping fee**

Stored water in the storm water harvesting structures is necessary to be pumped up. However, users of the water could not be identified because the level of planning of the pilot project is still in the preliminary stage. After implementation of the pilot project is confirmed, water users shall be identified in the detailed survey or design phase. In parallel, the pumping fee shall be estimated and discussed with water users on how to cover its cost.

###### **3) Land acquisition**

Most of the land along Wadi Qilt is categorized as private land. Public lands, which

mean lands owned by the Jericho municipality, were found in the limited areas of the wadi. A small portion of waqf lands were observed in the potential sites. Therefore, in order to implement the pilot project, the government should exert efforts to acquire the private lands. Taking into consideration the limited revenue of the Palestinian government, it is strongly recommended that detailed design be prepared to minimize land acquisition from private owners.

#### 4) Accident caused during construction period in rainy season

Commonly for river works, construction during the rainy season should be avoided. In addition, this type of project is the first experience of Palestine. Therefore, in the preparation of the implementation plan, all the works should be planned to be completed within a dry season. In addition, mobilization of qualified and competent experts, preparation of safety control system and its enforcement should likewise be considered.

#### 5) Noise

Noise should be taken care of in the implementation phase if the pilot project site is located in/near residential areas. In the detailed survey or design phase, public consultation should be held to explain the pilot project to, and gain the agreement on the implementation from, stakeholders.

**Table 9.4.1 Scoping Matrix for Pilot Project of Storm Water Harvesting (As of July 2008)**

Category	Rating by Phase					Without project	Brief Description
	WUA formulation, Design stage	Construction	Operation and maintenance				
Biophysical Resources and Land-Use Components	1	Climate and Air Quality	D	D	D	D	No impact.
	2	Surface Water Hydrology and Quality	D	B	D	D	In the construction phase, discharge of wadi's flow will be changed if water harvesting structures are constructed during rainy season.
	3	Groundwater Hydrology and Quality	D	D	D	D	There will be negligible impact on groundwater because the size of the pilot project is much smaller (5,000 m <sup>3</sup> at maximum) compared with assumed annual discharge of Wadi Qilt (around 1.4 m <sup>3</sup> /year)
	4	Terrain and Natural Hazards	D	D	B	D	Impacts are negligible because the size of the pilot project is almost the same as the size of agricultural ponds. However, degradation of wadi bed and erosion of wadi banks may happen without some protection.
	5	Soils and Vegetation	D	D	B	D	Without protection of wadi banks, available land for agriculture and building construction might be affected due to erosion. Less vegetation was observed in the area.
	6	Wildlife Resources and Use	D	D	D	D	No impact is expected because construction is planned to be in/around residential areas. Negligible impact will be caused in the downstream area because the size is small
	7	Aquatic Resources and Use	D	D	D	D	No aquatic resources in/around the area
	8	Recreation and Tourism Resources and Use	D	D	D	D	No recreation site in/around the area
	9	Forest Resources and Use	D	D	D	D	No impact because the sites are located around agricultural lands, residential areas, bare ground.
	10	Agricultural Resources and Use	D	D	D	D	No agricultural activities are observed in the area. After completion of water harvesting structures, water stored by the structure is expected to be used for agriculture but in negligible amount.
	11	Mineral Resources and Use	D	D	D	D	No impact.
Economic Components	12	Direct Employment and Income	D	B*	D	D	Increase of employment opportunity of civil engineers and laborers is expected during the construction phase. Negligible contribution is expected to direct employment after construction because the size is small.
	13	Indirect/ Induced Employment and Income	D	B*	D	D	A construction company will reap the benefit due to the construction work. People who belong to the agricultural sector will be the beneficiaries after the construction even though the impact is negligible.
	14	Labor Market Conditions	D	B*	D	D	Refer to 12 and 13.
	15	Sources of supplies, materials, and services	D	D	D	D	No impact will be caused by the construction. Most of the materials are available in Palestine and the required quantities are small.
	16	Transportation Requirements	D	D	D	D	No impact.
	17	Infrastructure Development Requirements and Costs	D	D	B	D	Water distribution network is to be prepared in parallel with the construction even though the length of the network is short. Pumping fee is required for the stored water to irrigate agricultural lands.
	18	Government Revenues and Costs	B	D	D	D	If acquisition of private land is required, the budget should be arranged by governmental organization. No additional impact is expected on the government revenues and costs if the construction is implemented by donor agencies under grant aid scheme
	19	Indirect/ Induced Economic	D	B*	D	D	Refer to 13.

Category		Rating by Phase				Without project	Brief Description
		WUA formulation, Design stage	Construction	Operation and maintenance			
		Development Opportunities					
Cultural and Heritage Components	20	Archeological Sites	D	D	D	D	No impact because the target areas are located in residential areas, agricultural lands or bare ground.
	21	Sites for Traditional Use	D	D	D	D	No impact.
	22	Historic Sites and Landscape Features	D	D	D	D	Refer to 20.
Social Components	23	Social/ Demographic Profile	D	D	D	D	No impact is expected because the size is small.
	24	Population	D	D	D	D	No impact is expected because the size is small.
	25	Housing and Accommodations	D	D	D	D	No impact is expected because the size is small.
	26	Land and Water Use	B	D	D	D	Land acquisition is required for construction of the structures and access roads. Total volume of water resources will slightly increase and agricultural lands will be expanded after construction.
	27	Transportation and Traffic	D	D	D	D	No impact.
	28	Community Services Delivery	D	D	D	D	No impact.
	29	Local Government Revenues/ Costs	D	D	D	D	No impact is expected because the size is small.
	30	Social Support Services	D	D	D	D	No impact
	31	Community Stability, Cohesion, and Well-Being	B	D	D	D	Through the process of land acquisition, negative impacts on the community are expected.
	32	Gender Equity	D	D	D	D	No impact
Health Components	33	Supply of Health Facilities and Services	D	D	D	D	No impact
	34	Community Water Supply and Watersheds	D	D	D	D	No impact is expected because small amount of water is stored for agricultural use.
	35	Waste Treatment and Discharge	D	D	D	D	No impact
	36	Ambient Air and Water Quality	D	D	D	D	Stored water will include silt and clay. Without purification, the water cannot be available for domestic use. In the pilot project, the water is expected to be used only for agriculture.
	37	Public Health Risks	D	D	D	D	Refer to 34 and 36.
	38	Worker Health and Safety	D	B	D	D	Proposed water harvesting structures are a first experience for Palestine. Therefore, the risk of contractor would be higher than the other projects, such as: rehabilitation of agricultural wells and improvement of water conveyance system. Competent and experienced supervisors are vital.
	39	Noise	D	B	D	D	Work period of some of the alternatives is expected to be long and the sites are located near communities. During the period, countermeasure for noise is to be carried out.
	40	Local Community Health	D	D	D	D	Refer to 34 and 36.

Evaluation Categories: A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown. (Examination is needed. Impacts may become clear as study progress.) D: No impact is expected. EIA is not necessary. \*: Positive impact is expected.

Scores of the scoping matrix were rated on the basis of the JICA Guidelines for Environmental and Social Considerations.

Source: JICA Study Team

(4) Conclusion of Environmental Assessment of Pilot Project on Storm Water Harvesting

The IEE study of the pilot project discussed in this section was concluded as follows:

- The impacts caused by the pilot project were expected to be managed and mitigated by the measures mentioned above, except for issues on land acquisition and pumping fee;
- Land acquisition by governmental organizations would be necessary in any site of pilot project along Wadi Qilt in Area A even though the private land could be minimized through the detailed survey;
- Because of the small scale of the project, the number of beneficiaries would be limited. Identification of beneficiaries by PWA and MoA would be required before the design phase; and
- All issues identified in the above tentative IEE study might be changed at the implementation phase. Therefore, before or during the detailed survey, IEE study should be conducted in reference to the above study.

**9.5 Environmental Monitoring and Management Plan**

In accordance with the Water Law enacted on 2002, the PWA shall have full responsibility for managing the water resources and wastewater in Palestine, including monitoring of water resource quantity and quality, regulation and cessation water supply if water resources are polluted.

On the other hand, local communities, well owners or the relative organizations have a responsibility on adequate water resources management as mentioned in the National Water Policy and Strategy.

Based on the above consensus, the environmental monitoring and management plans are recommended in Table 9.5.1 for the rehabilitation of agricultural wells, and Table 9.5.2 for the improvement of spring water conveyance system. The environmental management and monitoring plan for storm water harvesting was not mentioned in this report since such preparation should be done after the discharge of the wadis had been measured and the decision of the size of the structures are made.

**Table 9.5.1 Environmental Monitoring and Management Plan**  
(Rehabilitation of Agricultural Wells)

Type of impacts	Source of impacts	Impact parameters	Actions to be taken	Responsibility of the actions	Supervisor
<b>a) Pre-rehabilitation Phase</b>					
1) Ground water deterioration	Well development and deepening	- Depth of groundwater level - Water salinity (TDS) - Other water quality indicators mentioned in regulated substances	To report the result of pump tests and the water quality to the supervisor	Contractor of pumping tests	Project managers of MoA&PWA
			To judge whether the water quantity and quality is enough to proceed to the next step	Project managers of MoA&PWA	Head of MoA&PWA
2) Conflicts in WUA	Formation of WUA (Misunderstand on WUA)	Water rights of well owners	To obtain agreement from well owners on project activities before implementation	Project managers of MoA&PWA	Head of MoA&PWA
			To obtain agreement for formation of WUA among well owners and water users	Contractor of WUA formation	Project managers of MoA&PWA
			To facilitate WUA to register with PWA	Contractor of WUA formation	Project managers of MoA&PWA
3) Accidents	Heavy equipment used by the contractor	Number of casualties	- To supervise all activities by the contractor - To inform the work progress to the supervisor	Contractor of pumping tests	Project managers of MoA&PWA
4) Noise	Heavy equipment used by the contractor	Noise level	To explain and obtain understanding from the neighbors	Contractor of WUA formation	Project managers of MoA&PWA
5) Overall	Any kind of activities in pre-rehabilitation phase	Any types of environmental and social impact parameters even if the impact was not expected in the IEE stage	- To research environmental and social impact through the pre-rehabilitation activities - To advise project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA
<b>b) Rehabilitation Phase</b>					
1) Accidents	Heavy equipment used by the contractor	Number of casualties	- To supervise all activities by the contractor - To inform the work progress to the supervisor	Contractor of rehabilitation of agricultural wells	Project managers of MoA&PWA
2) Noise	Heavy equipment used by the contractor	Noise level	To explain and obtain understanding from the neighbors	Contractor of rehabilitation of agricultural wells	Project managers of MoA&PWA

Type of impacts	Source of impacts	Impact parameters	Actions to be taken	Responsibility of the actions	Supervisor
3) Overall	Any kind of activities in rehabilitation phase	Any types of environmental and social impact parameters even if the impact was not expected in the IEE stage	-To research environmental and social impact through the rehabilitation activities -To advice project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA
<b>c) Operation and Maintenance Phase</b>					
1) Groundwater deterioration	Over pumping	- Depth of groundwater level	To monitor depth of groundwater regularly	Planning Directorate, PWA	Head of PWA
		- Water salinity (TDS)	To monitor groundwater quality regularly	Water Resources Directorate	Head of PWA
		- Other water quality indicators mentioned in regulated substances	-To provide the guidance on adequate groundwater usage -To regulate the over-pumping or invalidate water license	- Water Control Directorate - Regulatory Directorate	Head of PWA
2) Conflicts in WUA	Non-function of WUA	Records to be kept by WUA such as account book, pumping hour etc.	To keep records on WUA's activities	WUA	Planning Directorate, PWA
			-To monitor WUA's activities through: 1. Checking records of WUA's activities 2. Interview survey and questionnaire survey to WUA -To provide administrative and technical guidance to WUA	- Water Control Directorate - Regulatory Directorate	Head of PWA
3) Noise	Generators and pumps	Noise level	To monitor the noise level and provide the guidance on noise mitigation	- Water Control Directorate - Regulatory Directorate	Head of PWA
			To construct noise mitigation wall, if necessary	WUA	Water Control Department, PWA
4) Overall	Any kind of activities in operation and maintenance phase	Any types of environmental and social impact parameters even if the impact was not expected in the IEE stage	-To research environmental and social impact through the operation and maintenance activities -To advise project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA

Source: JICA Study Team



**Table 9.5.2 Environmental Monitoring and Management Plan**  
*(Improvement of Spring Water Conveyance System)*

Type of impacts	Source of impacts	Impact parameters	Actions to be taken	Responsibility of the actions	Supervisor
<b>a) Pre-improvement Phase</b>					
1) Conflicts in communities	Fear of insecurity of future water supply	Amount of water planned to be allocated to water right holders and Bedouins	To explain and obtain understanding and agreement on volume and rule of water supply from water right holders	Contractor of WUA formulation	Project managers of MoA&PWA
			To plan arrangement of outlets for water supply to Bedouins	Design engineer of the conveyance system	
2) Deterioration of nature reserve area at the source of Auja spring	Development activities in the nature reserve area	Number and species of wildlife and aquatic life in nature reserve	To monitor that no activity is planned in the nature reserve	Project managers of MoA&PWA	Head of MoA&PWA
			To check design report of the project	Environmental Assessment Department, EQA	General Directorate for Environmental Protection, EQA
3) Disturbance of a recreation site at Nwai'mah spring	Replacement of an existing open canal to a pipeline	Amenity of the recreation site	To monitor that no activity is planned in the recreation site	Project managers of MoA&PWA	Head of MoA&PWA
4) Overall	Any kind of activities in pre-improvement phase	Any type of environmental and social impact parameters even if the impact was not expected in the IEE stage	-To research environmental and social impact through the pre-improvement activities -To advise project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA
<b>b) Improvement Phase</b>					
1) Conflicts in communities	Fear of insecurity of future water supply	Amount of water planned to be allocated to water right holders and Bedouin	To monitor the implementation based on the decided volume and rule of water supply	Project managers of MoA&PWA	Head of MoA&PWA
			To arrange outlets for water supply to Bedouins	Contractor of improvement of spring water conveyance system	Project managers of MoA&PWA
2) Deterioration of nature reserve area at the source of Auja spring	Development activities in the nature reserve area	Number and species of wildlife and aquatic life in nature reserve	To monitor the nature reserve periodically	Environmental Monitoring Department, EQA	General Directorate for Environmental Protection, EQA
			To monitor that no activity is planned in the nature reserve	Project managers of MoA&PWA	Head of MoA&PWA

Type of impacts	Source of impacts	Impact parameters	Actions to be taken	Responsibility of the actions	Supervisor
3) Disturbance of a recreation site at Nwai'mah spring	Replacement of an existing open canal to a pipeline	Amenity of the recreation site	To monitor that no activity is implemented in the recreation site	Project managers of MoA&PWA	Head of MoA&PWA
4) Accidents	Heavy equipment used by the contractor	Number of casualties	- To supervise all activities by the contractor - To inform the work progress to the supervisor	Contractor of rehabilitation of agricultural wells	Project managers of MoA&PWA
5) Overall	Any kind of activities in improvement phase	Any type of environmental and social impact parameters even if the impact was not expected in the IEE stage	To research environmental and social impact through the improvement activities  To advise project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA
<b>c) Operation and Maintenance Phase</b>					
1) Conflicts in communities	Deficit of water supply to the farmers  Deficit of water supply to Bedouins	- Water discharge in pipelines - Amount of water distributed to the farmers and Bedouins	To monitor the water discharge in pipelines and amount of water distributed to the farmers	WUA	Water control directorate, PWA
			To guide and regulate the water distribution based on the monitoring result, if necessary	Water control directorate, PWA	Head of PWA
2) Overall	Any kind of activities in operation and maintenance phase	Any type of environmental and social impact parameters even if the impact was not expected in the IEE stage	To research environmental and social impact through the operation and maintenance activities  To advise project manager to take action for mitigation of environmental and social impacts	Environmental Monitoring & Inspection Department, EQA	General Directorate for Environmental Protection, EQA

Source: JICA Study Team

## 9.6 Information Disclosure

At the governmental level, the JICA Study Team has implemented the survey in close communication and deep discussion with main counterpart organizations, namely MoA and PWA. The Study result was summarized as a series of study reports and approved by the Steering Committee, which consisted of the above organizations, EQA and MoP. Additionally, the JICA Study Team has published brochures in Arabic, English and Japanese to explain about the study. The brochures have been distributed to the relevant organizations.

At the local level, the Study Team collected the farmers' and communities' needs through baseline survey and site visits to discuss about their present situation, needs and difficulties. After the decision on the sites where the Project is to be implemented has been made, the Study Team explained about the project activities and obtained the agreement of the rehabilitation and improvement works from village councils and well owners. In parallel with the above, farmers understanding on the work was deepened and their agreement was confirmed through formation and enhancement of WUA.

Activities for information disclosure in this Study are listed as follows:

- (i) To hold Steering Committee meetings on i) Inception Report in Apr.2007, ii) Progress Report (1) in Aug.2007, iii) Interim Report in Feb.2008;
- (ii) To hold workshops for formulation of water users associations (WUA) in pilot projects at selected eight agricultural wells and Nwai'mah spring during Nov.2007 - Aug. 2008;
- (iii) To prepare and distribute brochures (Arabic and English) to concerned governmental organizations, donors, NGOs and individuals starting from Aug.2007;
- (iv) To prepare and distribute the Study reports to governmental organizations concerned;
- (v) To hold the 1st seminar for explanation of the Study progress in May 2008 (Refer to Subsection 13.2.3);
- (vi) To enhance WUA and clarify their roles and responsibilities;
- (vii) To hold a final Steering Committee meeting for Draft Final Report; and
- (viii) To hold the 2nd seminar for explanation of the final Study results in November 2008 (Refer to Subsection 13.2.3).

## CHAPTER 10                      UPDATING AND IMPROVEMENT OF GIS DATABASE

### 10.1            Objectives and Approaches to Update and Improve GIS Database

Geographic Information System (GIS) is utilized for organizations in PNA to monitor the progress of the land development. However, GIS data is not consolidated among its holders since these data was individually developed by different organizations under the support of donor agencies. Therefore, the data and knowledge sharing on GIS is limited, considering that said data may have been formatted differently by each organization and may consist of various topology errors.

In addition, the latest basic GIS data in Palestine was prepared based on 1997 satellite images. However, since land development has already progressed since it was prepared, actual situation especially on land use/land cover is not reflected on the GIS data. Moreover, data for planning of water resources management and development is not available.

Based on the above, the objectives and approaches of the study on GIS activity were determined as follows:

- (i) Support for formulation of organizational structure for data, skills and knowledge sharing;
- (ii) Improvement and updating of GIS database among organizations concerned; and
- (iii) Technology transfer on GIS and database management through on-the-job training.

### 10.2            Review of Present Data Management Structure

Interview survey on data management structure was conducted to persons in charge of GIS data management in organizations concerned. The survey result is summarized in the following section.

#### 10.2.1        Data Management in Ministry of Agriculture (MoA)

MoA is in charge of collection, updating and management of data concerned on agricultural planning and monitoring. The data can be classified into two types namely, spatial data and tabular data. These data are managed under different departments in MoA as shown in the following table.

**Table 10.2.1    Roles and Responsibilities on Data Management in MoA**

	Spatial Data	Tabular Data
Responsible Department	GIS Department in Planning and Policy Directorate	Statistics & Information System Department in Planning and Policy Directorate
Main Tasks	<ol style="list-style-type: none"> <li>1. Spatial data collection from the other organizations</li> <li>2. Spatial data development and updating based on satellite imageries or other data source for data management</li> <li>3. Provision of spatial data as digital format and/or maps based on the requests from the other directorates and departments in MoA</li> <li>4. Provision of spatial data as digital</li> </ol>	<ol style="list-style-type: none"> <li>1. Preparation of questionnaire on agricultural</li> <li>2. Scheduling, monitoring and data collection of village basis agricultural statistics conducted by field extension workers</li> <li>3. Verifying, summarizing and analyzing of the collected data for preparation of internal used agricultural statistics</li> <li>4. Sending the summarized data to Palestinian Central Bureau of</li> </ol>

	Spatial Data	Tabular Data
	format and/or maps to the external users based on the official request letter	Statistics (PCBS) for publication of official agriculture statistics 5. Provision of tabular data as digital format and/or hardcopy based on the requests from the other directorates and departments in MoA 6. Provision of tabular data as digital format and/or hardcopy to the external users based on the official request letter

Source: Interview survey conducted by JICA Study Team

### 10.2.2 Data Management in Palestinian Water Authority (PWA)

PWA is in charge of collection, updating and management of data concerned on water resources management and allocation. Data management in PWA is similar to MoA's case.

**Table 10.2.2 Roles and Responsibilities on Data Management in PWA**

	Spatial Data	Tabular Data
Responsible Department	GIS Department in Planning Directorate	Data Bank Department in Planning Directorate
Main Tasks	1. Spatial data collection from the other organizations 2. Spatial data management 3. Provision of spatial data as digital format and/or maps based on the requests from the other directorates and departments in PWA 4. Provision of spatial data as digital format and/or maps to the external users based on the official request letter	1. Scheduling and monitoring of data collection activities concerned about water management such as water quality and quantity at wells and springs 2. Data input into water management database 3. Provision of tabular data as digital format and/or hardcopy based on the requests from the other directorates and departments in PWA 4. Provision of tabular data as digital format and/or hardcopy to the external users based on the official request letter

Source: Interview survey conducted by JICA Study Team

### 10.2.3 GIS Data Management in Ministry of Planning (MoP)

MoP is responsible for the development and updating of the fundamental GIS data, known as the base map. In addition, sending letters to organizations concerned informing them on data updating and distribution, form part of MoP's responsibility. Remote Sensing and Photogrametry Department under the GIS Directorate mainly execute the above responsibilities.

MoP planned to establish a new agency for geographic information data center, named as Mapping Agency Palestine (MAP). The program document was prepared in 2006 and its summary is officially announced in the MoP website. The plan is formulated from five main programs, which are:

- (i) Establish MAP and Institutional Framework;
- (ii) Education Program;
- (iii) First Procurement System;
- (iv) Procurement of Geodetic Network and Quality Level II Data; and
- (v) Second Procurement of System (Spatial Data Infrastructure Toolkit).

Although the concept of the program was already agreed among the organizations concerned, it remains in search of funding agencies to finance its implementation.

#### 10.2.4 GIS Data Management in Environment Quality Authority (EQA)

The department in charge of GIS in EQA is the Information Systems Department under the Natural Resources Directorate. Most of all the GIS data processed by the department were authored by other organizations and are collected under the department's responsibility. Small part of GIS data is developed by EQA through the utilization of GPS and sublet works to private consultant companies, especially those related to environmental information in some areas.

#### 10.3 Problem Identification on GIS Activities

To clarify the technical difficulties on GIS data management in MoA, PWA and MoP, their existing GIS data were collected.

##### 10.3.1 Review of Collected GIS Data from Technical Aspect

The collected GIS data was reviewed by the JICA Study Team considering aspects of uniformity, topology and ease of manageability. Findings are as follows:

###### (1) Coordinate System

Coordinate system is the basis of utilization of geographic information since the set of GIS data is linked with location information based on a unique coordinate system. If the coordinate system applied to GIS data is misunderstood and not properly utilized by beginners, data displayed on the screen will represent wrong locations on earth. To avoid such mistakes, MoP recommends using the 1923 Palestinian Grid as the national standard.

However, the coordinated system of the collected GIS data from MoA and PWA were undefined and are different from each other. The reason is insufficient communication among Palestinian organizations regarding the definition of coordinate system.

###### (2) Data Uniformity

Some of the GIS data were not unified among organizations as listed below.

**Table 10.3.1 List of Differences Observed in the Collected GIS Data**

Type of Difference	Compared GIS Data	
	MoA	PWA
Number of features is different.	Features of springs in water_data	springs
	Features of wells in water_data	wells
	Wadies	wadis
Boundary of features is not overlapped completely.	Catchment	Catchments
	District	district
	Geology	geology

Source: JICA Study Team

Such difference results from insufficient communication and unclear delineation of responsibility on data updating among the organizations.

###### (3) Logical Error

Contour lines and stream line of wadis must be orthogonal. Stream line however must run through points with lower elevations. However, a part of polylines of wadis were

sometimes not in accordance with such usual norms. It is assumed that the reasons originated from i) misrecognition of satellite images or aerial photographs (misunderstanding of roads and wadis), ii) inappropriate geometric collection of satellite images, aerial photographs and scanned maps, iii) misunderstanding or insufficient understanding of relation between contour lines and wadis, iv) mistakes in digitizing contour lines or wadis, and etc.

#### (4) Field Name

Field name in the attribute tables of GIS data should be given appropriately to avoid misinterpretation by data users. Moreover, the number of fields should also be minimized to avoid misunderstanding by users unfamiliar with the data, as well as to alleviate work volume on the data management. Since some of the collected GIS data have inappropriate field names and unused fields, it is recommended that these should be consolidated under a data management guideline.

### **10.3.2 Review of Data Management System from Institutional Aspect**

In order to identify the constraints and determine solutions for better data management concerned on GIS, the data management systems on GIS in the organizations was reviewed through interview survey. The findings are described as follows.

#### (1) Human Resources

##### 1) Responsible person on GIS data management

The persons in charge of GIS data management in each department are highly educated and have enough skills in utilizing the GIS software, especially those related to map production. They realize the necessity to further improve their skills and knowledge on GIS and remote sensing since their own skills were mostly obtained through self-study. Since their current tasks involve utilizing GIS data internally, they found no difficulty in map preparation for individual organizations. However, their skills and knowledge on data management are limited due to lack of opportunity in discussing such issues with different organizations, in addition to lack of training. This limitation was presented in the above technical issues. MoP assigns more than five specialists with extensive experiences on GIS, remote sensing and photogrammetry and cartography.

##### 2) GIS utilization for analytical use

GIS utilization in other departments is rarely observed, since only the concerned GIS department plays the sole role in data utilization. The needs for GIS utilization are mainly concentrated on map preparation based on requests from other departments.

On the other hand, analytical and monitoring usage of spatial information was limited due to lack of such information on historical trend analysis, and due to lack of requests on spatial analysis using GIS. Data linkage between GIS data and statistical data was also limited due to technical difficulties.

(2) Organization and Framework for Data Management

1) Internal data linkage system

Organizational structure and institutional procedure was already established for internal GIS data usage in each organization with their task clarified as well. There is no critical problem in the internal data transfer system on GIS from the organizational aspect.

On the other hand, internal data linkage between GIS data and tabular data, which has been collected and managed by different departments, can be enhanced for more analytical usage of GIS through technology transfer as well as through technical support from supporting agencies.

2) External data sharing framework and guidelines

Data sharing has already started among organizations in PNA. However, the framework and guideline for external data sharing system is not fully developed including uniformity of coordinate system, organization responsible on each data, data list processed, and others.

(3) Facilities for GIS Data Management

1) Hardware

Computers and displays are upgraded appropriately in organizations except for EQA whose computer system including server station were severely damaged due to over electric supply in 2006, and are currently under repair. The main problem is observed in the map printing machine (plotter).

2) Software

The number of software for vector data analysis such as ArcView and ArcGIS would be insufficient if the applicable fields of the software are expanded such as those intended for analytical and monitoring use.

On the other hand, image analysis software such as ER Mapper and ERDAS Imagine is rarely utilized in the organizations except by MoP which is responsible for base map preparation and updating.

3) Data

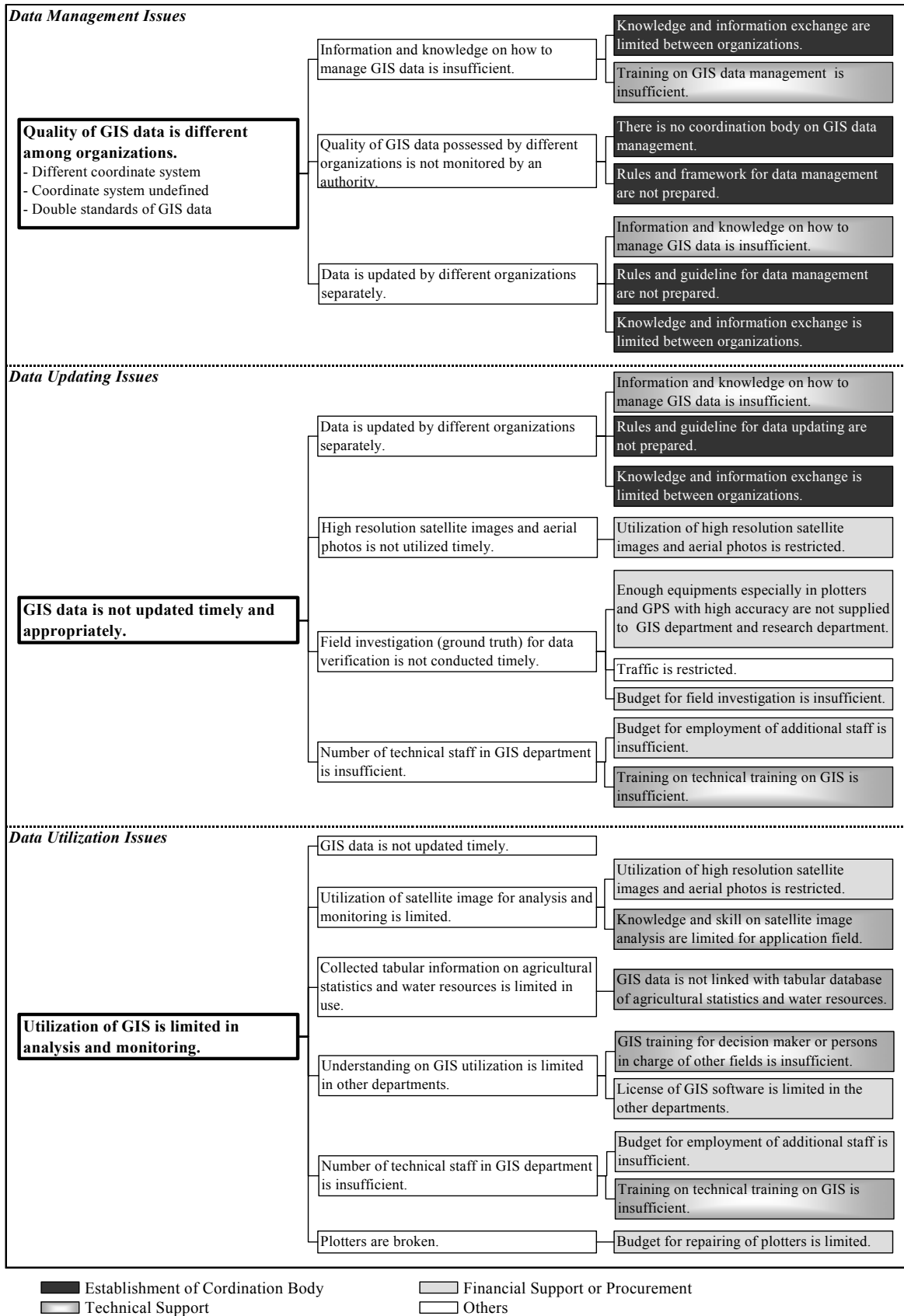
Data is not updated appropriately since 1997 due to lack of financial support for data purchase, limitation of aerial photographs and satellite image utilization, especially high resolution images such as QuickBird and IKONOS. In addition, the most important issue for data updating is the restrictions in transportation. In fact, MoP planned to update the base map using the satellite images acquired in 2003 by SPOT, and the digitizing work has already been completed. However, the data is not distributed to the other organizations because the ground truth cannot be implemented under the present situation.

**10.3.3 1st Joint Meeting on GIS Data Management**

For purposes of sharing the above findings with organizations concerned, 1<sup>st</sup> Joint Meeting on GIS Data Management was held on April, 2007. Through the meeting, the



consensus on difficulties and needs on GIS data management and development were confirmed among the participants, as shown in the following figure.



Source: JICA Study Team

**Figure 10.3.1 Problem Trees on GIS Activities**

## 10.4 Activities for Updating and Improvement of GIS

Based on the above discussions, required activities on the updating and improvement of GIS are summarized as shown in the following table.

**Table 10.4.1 Activities for Updating and Improvement of GIS**

<b>1. Support for base map updating activities</b>	
Background	Latest base map in Palestine was prepared in 1997. MoP planned to update base map by using SPOT satellite images acquired in 2003. Digitizing work based on the images was completed by 2007. However, field investigation (ground truth) required to finalize the land use GIS data still remains, which was one of the key layers of the base map. This is due to difficulty of obtaining passes at check points.
Activities	<ul style="list-style-type: none"> <li>- Support for ground truth of digitized land use GIS data based on SPOT images acquired in 2003</li> <li>- Technical support for review and finalization of the land use GIS data using satellite images and aerial photographs collected under the Study and field investigation conducted by JICA Study team</li> </ul>
Output	Updated land use GIS data prepared by MoP
<b>2. Database development and enhancement of GIS capacity</b>	
Background	Integrated GIS database development for water resources development and management was mentioned in the TOR of the Study.
Activities	<ul style="list-style-type: none"> <li>- Preparation of GIS database for better data management of water resources</li> <li>- Preparation of a GIS manual on the GIS database</li> <li>- Conducting on-the-job GIS training</li> </ul>
Output	<ul style="list-style-type: none"> <li>- GIS database for water resources management and development</li> <li>- GIS training manual</li> <li>- Enhanced capacity on GIS in counterpart organizations</li> </ul>
<b>3. Support for consensus building on better data management</b>	
Background	GIS data was developed and updated independently by organizations in cooperation with development partners. However, the data was not shared with other organizations because data sharing system or responsibility of updating GIS data was not clarified.
Activities	<ul style="list-style-type: none"> <li>- Continuous discussion among counterpart organizations</li> <li>- Preparation of recommended GIS data management rules on water resources development and management</li> </ul>
Output	<p>Document on recommended data management on water resources development and management</p> <p>* This document is aimed to utilize among counterpart organizations.</p> <p>In addition, and is supposed to be a document for acceleration of discussion on establishment of the coordination body in PNA.</p>

Source: JICA Study Team

### 10.4.1 Support for Base Map Updating Activities

MoP commenced base map updating activities in December 2007, in cooperation with MoA and with the support of the JICA Study Team. Main work item of the activities was ground truth on land use in West Bank. Figure 10.4.1 shows the planned and actual schedule of the ground truth.

All the activities were successfully completed, and the updated GIS land use data was integrated into the GIS database as mentioned in the following section.

Work Item	2007	2008							
	12	1	2	3	4	5	6	7	8
1 Trial field visit for land use survey (Two-days survey in Ramallah)	■								
2 Preparation of ground truth	■								
3 Obtaining permissions to pass the checkpoints in West Bank (Except for Jerusalem)	■	■	■						
4 Ground truth in West Bank		■	■	■	■	■			
5 Obtaining permissions to pass the checkpoints to Jerusalem							■		
6 Ground truth in Jerusalem								■	
7 Finalization of latest land use map				■	■				■

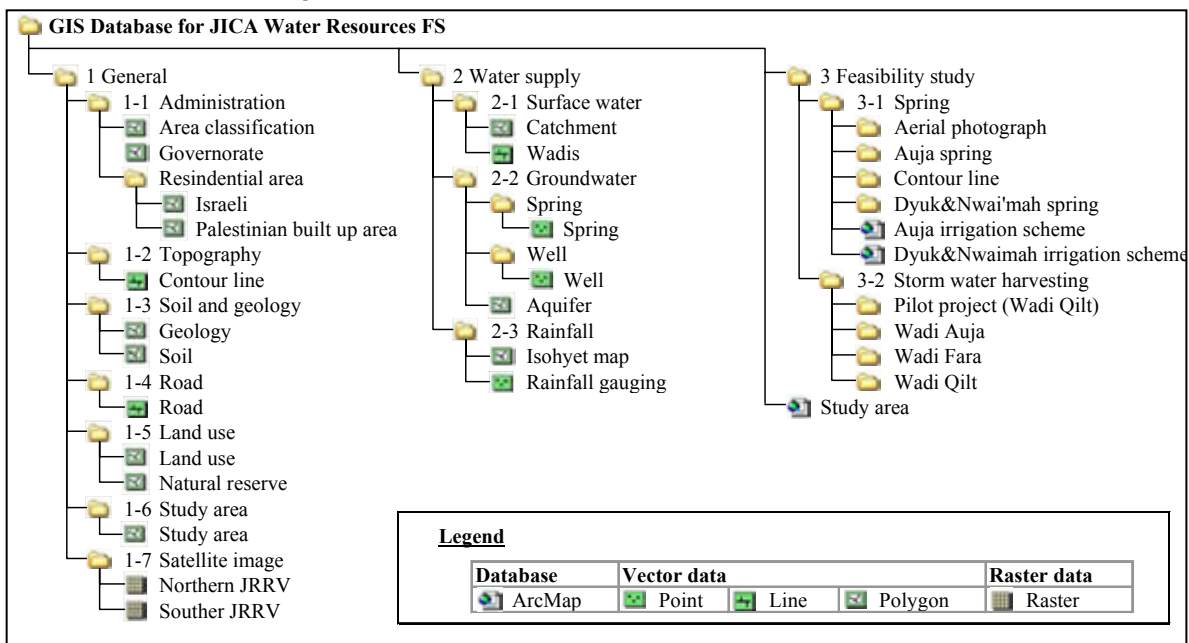
■ Planned schedule as of December 2007      ■ Actual schedule

Source: JICA Study Team

**Figure 10.4.1 Schedule of Ground Truth for Base Map Updating**

### 10.4.2 Database Development and Enhancement of GIS Capacity

During the course of the Study, several types of data were collected. These data was compiled into a database named as GIS database for water resources development and management in the Jordan River Rift Valley. The final contents of the database are illustrated in Figure 10.4.2.



Source: JICA Study Team

**Figure 10.4.2 GIS Database Structure**

The GIS database was finalized in October 2008 and officially handed over to organizations concerned as a DVD-ROM in November 2008.

In parallel with the preparation of the GIS database, an operation manual of the GIS database for beginners was prepared. The main contents of the manual were: i) Introduction; ii) Steps for GIS Database Development; and iii) Contents of GIS database.

The manual was also delivered to the organizations as attachment of the DVD-ROM and included in Annex 10 of the Final Report of the Study.

### 10.4.3 Support for Consensus Building on Better Data Management

Since the 1<sup>st</sup> joint meeting on GIS data management, the JICA Study Team has continuously discussed data management on water issues with organizations concerned with GIS, especially through the supporting of the base map updating activities.

As mentioned in the previous section, data to be shared were developed by concerned ministries themselves and has not been officially disseminated to others. One of the main reasons is the lack of a data management rule. To solve this problem, MoP planned to establish a new GIS data management agency, tentatively named as the Mapping Agency Palestine (MAP). However, the MAP has not been realized yet due to lack of financial and technical support from development partners.

Under this situation, consistency of GIS data in the GIS database developed through the Study will not be secured among the organizations concerned after said database has been handed over. Therefore, in August 2008, a 2<sup>nd</sup> joint meeting on GIS data management was held among responsible personnel of the organizations to discuss and clarify responsibilities of each and establish a consensus on better GIS data management for the future.

Summary of the 2<sup>nd</sup> joint meeting are summarized in the following table.

**Table 10.4.2 Summary of 2nd Joint Meeting on GIS Data Management**

<b>1</b>	<b>Objectives of the 2<sup>nd</sup> Joint Meeting</b>
	<ul style="list-style-type: none"> <li>- To build a consensus on the present situation of GIS data management among the responsible personnel on GIS data</li> <li>- To clarify a future vision for integrated GIS data management</li> <li>- To clarify the responsibilities of each organization to achieve the future vision</li> </ul>
<b>2</b>	<b>Personnel and Organizations Concerned</b>
	<ul style="list-style-type: none"> <li>- Ministry of Agriculture (MoA)</li> <li>- Ministry of Local Government (MoLG)</li> <li>- Ministry of Planning (MoP)</li> <li>- Environmental Quality Authority (EQA)</li> <li>- Palestinian Water Authority (PWA)</li> </ul>
<b>3</b>	<b>General Agreement</b>
3-1	<b>Formation of Task Force</b>
	All the above personnel agreed to form and participate in a provisional task force for information sharing. This task force was tentatively named as GIS Committee.
3-2	<b>Future Vision for Integrated GIS Data Management</b>
(1)	The GIS Committee shall continue its best effort for the realization of establishment of the MAP, which would be the only organization in Palestine to manage, update and distribute GIS data to others.
(2)	The GIS Committee shall explain the importance of the MAP. They are supposed to promote this in their organizations and to other organizations and development partners, who are expected to support the establishment of the MAP.
3-3	<b>Responsibilities of GIS Committee Members</b>
(1)	Each GIS Committee member shall manage and organize the GIS data in his organization. The GIS data to be managed by each organization was tentatively decided as follows: <ul style="list-style-type: none"> <li>- MoA: GIS data on agricultural issues (cropping type, soil, detailed land use</li> </ul>

<p>in agricultural lands, water ponds, etc.)</p> <ul style="list-style-type: none"> <li>- MoLG: Administrative GIS data (administrative boundary of governorate, Joint Service Councils, Local Government Units etc.), Master plan (Land use plan in local government units)</li> <li>- MoP: Base map GIS data (road network, land use, topography including alignment of wadis etc.)</li> <li>- EQA: Environmental GIS data (natural reserve, historical sites, archeological sites)</li> <li>- PWA: Water related GIS data (Locations of wells, springs, wastewater treatment plants, etc. rainfall and stream gauging stations, etc.)</li> </ul> <p>(2) If a member of the GIS Committee changes his position, he shall inform his successor about the GIS Committee and obtain successor's agreement. In addition, he shall inform other members through e-mail, his successor's identification, e-mail address and phone number.</p>
<p><b>3-4 Interim GIS Data Sharing System</b></p>
<p>(1) Within three months after a new project including a GIS component has commenced under an organization which the GIS Committee member belongs, said member must notify other members through e-mail, the following information:</p> <ul style="list-style-type: none"> <li>- Project name;</li> <li>- Project objectives and components;</li> <li>- Target area of GIS data to be updated or newly created; (Name of governorates, local government units or name of the target area)</li> <li>- Types of GIS data to be updated or newly created in the project; and <ul style="list-style-type: none"> <li>1) Raster image (satellite images or aerial photographs) Source of the image, resolution, acquisition date, Color or B&amp;W</li> <li>2) Vector data (Point, Line, Polygon) Data name (e.g. wells location, road network, soil map, etc.)</li> </ul> </li> <li>- Expected work period on GIS activities.</li> </ul> <p>(2) After completion of the GIS activities in the project, said member of the organization must notify other members through e-mail, the completion of GIS activities. If the final GIS outputs are different from the original plan of the project, the member must revise the information and inform other members, accordingly.</p> <p>(3) Data sharing system of the newly created or updated GIS data under the project, among other organizations follows the traditional manner. That is, organizations who want to collect the GIS data shall send an official letter to the data holding organization. The data holding organization can meanwhile decide on sharing the GIS data to other organizations.</p>
<p><b>3-5 Period of Validity of the GIS Committee</b></p>
<p>The GIS Committee shall be automatically demobilized after establishment of the MAP and new data sharing rules.</p>

*Source: JICA Study Team*

Each member of the GIS Committee has started discussion on GIS data management and disclosure of their own GIS data through e-mail since September 2008. This e-mail basis communication is expected to be disseminated to all GIS data developers and data users in Palestine, and finally to be a virtual forum on GIS data management and development. To realize this, further monitoring activities and supports from donor agencies are required continuously.

## **10.5 Recommendations for Further Improvement of Data Management**

### **10.5.1 Issues for Data Management**

During the course of the Study, the following issues were found for further improvement of data management in the future.

#### **(1) Continuous monitoring of wells and springs**

Wells and springs had been periodically monitored by PWA until 2000. Their monitoring results were summarized in the Summary of Palestinian Hydrologic Book 2000, in cooperation with USAID. However, after the 2<sup>nd</sup> Intifada, frequency of monitoring drastically decreased. Main reasons for this change are: 1) physical difficulty of access to the wells and springs caused by establishment of check points; and 2) financial deficit for the daily allowance and transportation fee. Especially on the second reason, it should be taken into consideration that salary of Palestinian officials was delayed for around one year in 2007, due to suspension of financial supports from international supporting agencies to Palestine. Under this situation, it was impossible to arrange their transportation fees and the daily allowances for surveyors.

Baseline survey on wells and springs was conducted in the Study. It must be noted that data collected from the baseline survey should be available any time at central government level.

If Palestinians observe basic human rights which include freedom to access at any place in their country and opportunities to access to international trading markets to improve their revenue, above problems will be either alleviated or solved. To bring back their human rights, many governments and international supporting agencies continue their best efforts even though this could take a long way.

In parallel with the above efforts, financial and technical supports to field investigation for continuous monitoring of the wells and springs are required as a short to mid-term support.

#### **(2) Linkage between water supply and water demand information**

PWA is mainly responsible for collecting information on water supply. The information includes discharge and water quality, operational condition, information on owners of wells and spring (although water users association is supervised by PWA). On the other hand, water users' information such as number of beneficiaries, irrigated and irrigable areas, and agricultural production is collected by field extension workers or researchers in MoA. However, collected data by MoA has less linkage to water supply data, which means that their data is summarized by governorate or localities and not by each water source. This approach is reasonable in the case of preparation of national statistics. However, from the view point of wells and springs management, this data collection and summarization system is not effective.

To solve this issue, strong relationship between PWA and MoA is highly required. In addition, questionnaire sheet for field data collection and database system are also strongly recommended for reconsideration and reformatting under a joint activity.

## 10.5.2 Recommended Actions for Improvement of Data Management

Based on the above issues, the following actions are strongly recommended to PWA and MoA:

### (1) Preparation of project proposals for enhancement of periodical monitoring

In general, budget for routine works shall be arranged by the government itself. However, under the present situation of limited access in the field and international market to improve the revenue, it appears difficult to arrange for such budget. It must be emphasized that the final solution is to recover Palestinian basic human rights as mentioned above, and that supporting agencies perform their best effort for realization.

However, taking into consideration that any plans are to be formulated based on accurate and continuous monitoring data, the following type of project is strongly recommended to be prepared by PWA and MoA as short or mid-term measures:

Project Name (Tentative)	Enhancement of planning and monitoring capacity on water resources management in Palestine
Type of Project	Technical Cooperation with Financial Support (Daily allowances and transportation fees for surveyors)
Project Area	Palestinian National Territory or West Bank (Security issues to be considered in case of including Gaza Strip)
Counterpart Organizations	Ministry of Agriculture Palestinian Water Authority
Expected Project Period	Three years
Project Objectives	To enhance planning and monitoring capacity on water resources management through technical and financial support
<b>Project Activities</b>	
(1) Formation of joint data management team between PWA and MoA (2) Improvement of questionnaire and database for water data management (3) Supporting daily monitoring from financial and technical aspects (4) Formulation of management and development plan for wells and springs water resources in the project area (5) Supporting hydrological monitoring at Wadi Qilt and Wadi Auja (after the monitoring stations proposed in the JICA Study are established.) (6) Supporting and monitoring of formation of water users associations (7) Enhancement of regulations to water users	
Required experts	<ul style="list-style-type: none"> <li>- Team leader / water resources management planner</li> <li>- Senior engineer on well management</li> <li>- Senior engineer on spring management</li> <li>- Hydrogeologist</li> <li>- Hydrologist (if project activity (5) is included.)</li> <li>- Agronomist</li> <li>- Specialist on formulation of water users association</li> <li>- Specialist on water law and regulations</li> <li>- Database specialist</li> </ul>

### (2) Improvement of questionnaire sheet for monitoring

As compared to springs, agricultural wells are mainly managed by private well owners. Therefore, to initiate fund raising for rehabilitation of agricultural wells, information on beneficiaries and areas to be irrigated is inevitable to justify the project benefits after rehabilitation and its publicity. However, such information was not available at central level. In addition, past records on details of well rehabilitation were sometimes missing.

In this case, project justification would be more difficult. However, such information can be obtained through questionnaire surveys conducted with well owners and through the improvement of questionnaire sheets and database.

Database manager and survey manager in PWA previously recognized the above issue and tried to improve the questionnaire sheets and database. However, this trial was not implemented in PWA because of lack of enforcement. Under the above recommended project, the monitoring system should be improved. Sample recommended monitoring sheet for agricultural wells is attached in the following page.

### (3) Realization of establishment of Mapping Agency Palestine

As described above, current GIS data management system is not consolidated. Therefore, GIS data in each organization is developed, updated and managed individually. However, basic information for planning such as statistics and GIS data should be managed under an authority to strengthen persuasiveness of development plans.

Unfortunately, all development activities on water resources are under Israeli control. It means that only water resources development and management plans based on the convincing and objective information can build international consensus for their necessity and finally realized. As a first step for this, strong voice of Palestine for fund raising is recommended to establish Palestine Mapping Agency in corporation with supporting agencies such as utilization of fund in Palestinian Reform and Development Plan.



Well Name: **Abdallah 'Abed Al Hadi**  
 Well ID: **18-18/013**

Date: \_\_\_\_\_  
 Surveyor: \_\_\_\_\_

<b>1. Location</b>	Governorate	Nablus		Coordinate	Easting	187290
	Locality	Al Aqrabaniya			Northing	182440
	Area	B				
<b>2. Beginning Situation of Well</b>	Rehabilitaion Year/ Drilling Year	1980		Pump Capacity Rate	0.0 m3/hour	
	Pumping License	0.0 m3/year		Actual Pumping	0.0 m3/year	
	Well Depth (m)	0.00 m		Ground Level (m)	-36.09 m	
	Pump Setting (m)	0.00 m				
<b>3. Present Situation of Well</b>	Pumping Condition and Reason for Not-pumping	Pumping			Good	
		Not Pumping			0	
	Motivation for Rehabilitation	0		Use of Water	0	
				Pump Capacity Rate	50.0 m3/hour	(0%)
	JWC Approval	0		Actual Pumping	0.0 m3/year	(0%)
	Type of Pump	0		Pumping License	0.0 m3/year	
Power	Diesel		Actual/License	0%		
<b>4. Condition of Groundwater</b>	Annual Abstraction, Water Quality, Static Water Level in Last 4 Records					
	Year					
	Volume (m3/year)					
	Year					
	Quality (TDS)					
	Year					
<b>5. Current Agricultural Situation</b>	No. of Owners			No. of Tenants/Other Farmers except Owners		
	Irrigable Land					
	Irrigation Type			Availability of Alternative Water Source		
	Irrigated Area in Last 4 Records					
	Year					
	Area (donum)					
	Cropping by Seasons					
	Winter Season			Spring Season		
<b>6. Condition of Pumping Units</b>	Items	Condition		Past Rehabilitation		
				Year	Rehabilitated by	
	Pump					
	Electric Panel					
	Raising Pipe					
	Gear Head					
	Motor or Generator					
Current Meter or Gauge						
<b>7. Remarks</b>						

Source: JICA Study Team

**Figure 10.5.1 Sample of Recommended Questionnaire Sheet for Monitoring of Agricultural Wells**

## CHAPTER 11 IMPLEMENTATION PLAN AND COST ESTIMATES OF PRIORITY SCHEMES

This chapter explains the implementation plan and cost estimates of the priority schemes, which have been conducted on the basis of the study results and pilot projects.

### 11.1 Rehabilitation of Agricultural Wells

#### 11.1.1 Proposed Works for the Rehabilitation of Agricultural Wells

Rehabilitation of agricultural wells in the priority schemes are composed from four main work components, namely: i) pumping test including cleaning and deepening of the wells; ii) procurement and installation of pumping equipment; iii) establishment of WUA and its capacity enhancement; and iv) training of on-farm water management. However, breakdown of these work components varies according to the required tasks for each well. The work items for the rehabilitation in each well are listed as follows.

**Table 11.1.1 Work Items for the Rehabilitation of Agricultural Wells**

		18-18/016	18-18/019	18-18/027A	19-14/058B	19-14/062	19-15/028A	19-16/005	19-17/012	19-17/033	19-20/001A	20-17/022
<b>Hardware component</b>												
1	Preparation of pumping test	○	○	○	○	○	○	○	○	○	○	○
	1) Obtaining agreement on rehabilitation from owners	○	○	○	○	○	○	○	○	○	○	○
	2) Preparation of tender document for pumping test	○	○	○	○	○	○	○	○	○	○	○
	3) Tendering and contract	○	○	○	○	○	○	○	○	○	○	○
2	Pumping test (Contract work)	○	○	○	○	○	○	○	○	○	○	○
	1) Site preparation	○	○	○	○	○	○	○	○	○	○	○
	2) Deepening and drilling new substitute well	-	○	○	○	-	○	-	○	○	○	○
	3) Developing	-	○	○	○	-	○	-	○	○	○	○
	4) Pumping test	○	○	○	○	○	○	○	○	○	○	○
	5) Analysis of pumping test result	○	○	○	○	○	○	○	○	○	○	○
	6) Water quality analysis	-	-	-	○	○	○	○	○	-	○	○
3	Supporting, monitoring and supervision of pumping test	○	○	○	○	○	○	○	○	○	○	○
	1) Receiving access permission from C.A.	○	○	○	○	○	○	○	○	○	○	○
	2) Monitoring and supervision of pumping test	○	○	○	○	○	○	○	○	○	○	○
4	Preparation of installation of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	1) Determination of required specification of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	2) Preparation of tender document for installation of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	3) Tendering and contract	○	△	△	△	○	△	○	△	△	△	△
5	Installation of pumping equipment (Contract work)	○	△	△	△	○	△	○	△	△	△	△
	1) Procurement of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	2) Installation of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
6	Supporting, monitoring and supervision of installation work	○	△	△	△	○	△	○	△	△	△	△
	1) Supporting procurement of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	2) Receiving access permission from C.A.	○	△	△	△	○	△	○	△	△	△	△
	3) Monitoring and supervision of installation work	○	△	△	△	○	△	○	△	△	△	△
7	Quality inspection	○	△	△	△	○	△	○	△	△	△	△
8	Handing over the rehabilitated equipment	○	△	△	△	○	△	○	△	△	△	△

		18-18/016	18-18/019	18-18/027A	19-14/058B	19-14/062	19-15/028A	19-16/005	19-17/012	19-17/033	19-20/001A	20-17/022
<b>Software component</b>												
1	Preparation of software component	○	○	○	○	○	○	○	○	○	○	○
	1) Obtaining agreement on rehabilitation from owners and farmers	○	○	○	○	○	○	○	○	○	○	○
	2) Preparation of tender document for software component	○	○	○	○	○	○	○	○	○	○	○
	3) Tendering and contract	○	○	○	○	○	○	○	○	○	○	○
2	Detailed profile survey (Contract work)	○	○	○	○	○	○	○	○	○	○	○
3	Facilitation of establishment of WUA (Contract work)	○	△	△	△	○	△	○	△	△	△	△
	1) Orientation for establishment of WUA	○	△	△	△	○	△	○	△	△	△	△
	2) Clarification of role and responsibility of WUA	○	△	△	△	○	△	○	△	△	△	△
	3) Discussion on water distribution and water tariff	○	△	△	△	○	△	○	△	△	△	△
	4) Election of a leader, board members, administration staff and technical staff	○	△	△	△	○	△	○	△	△	△	△
	5) Registration of WUA	○	△	△	△	○	△	○	△	△	△	△
4	Monitoring and supervision of establishment of WUA	○	△	△	△	○	△	○	△	△	△	△
5	O&M training (Contract work)	○	△	△	△	○	△	○	△	△	△	△
	1) Water distribution planning	○	△	△	△	○	△	○	△	△	△	△
	2) Setting of water tariff	○	△	△	△	○	△	○	△	△	△	△
	3) Maintenance planning of pumping equipment	○	△	△	△	○	△	○	△	△	△	△
	4) Record keeping and accounting	○	△	△	△	○	△	○	△	△	△	△
	5) Follow-up activities for O&M	○	△	△	△	○	△	○	△	△	△	△
6	Monitoring and supervision of O&M training	○	△	△	△	○	△	○	△	△	△	△
7	Training of on-farm water management	○	○	○	○	○	○	○	○	○	○	○
	1) Seasonal cultivating and water requirement planning	○	○	○	○	○	○	○	○	○	○	○
	2) Agriculture input procurement planning	○	○	○	○	○	○	○	○	○	○	○
	3) Management of irrigation facility and equipment	○	○	○	○	○	○	○	○	○	○	○
	4) Water saving irrigation practice	○	○	○	○	○	○	○	○	○	○	○

○: Necessary activities, △: Necessity of activities to be decided in the former activities and to be confirmed in the proceeding study, - : Unnecessary activities

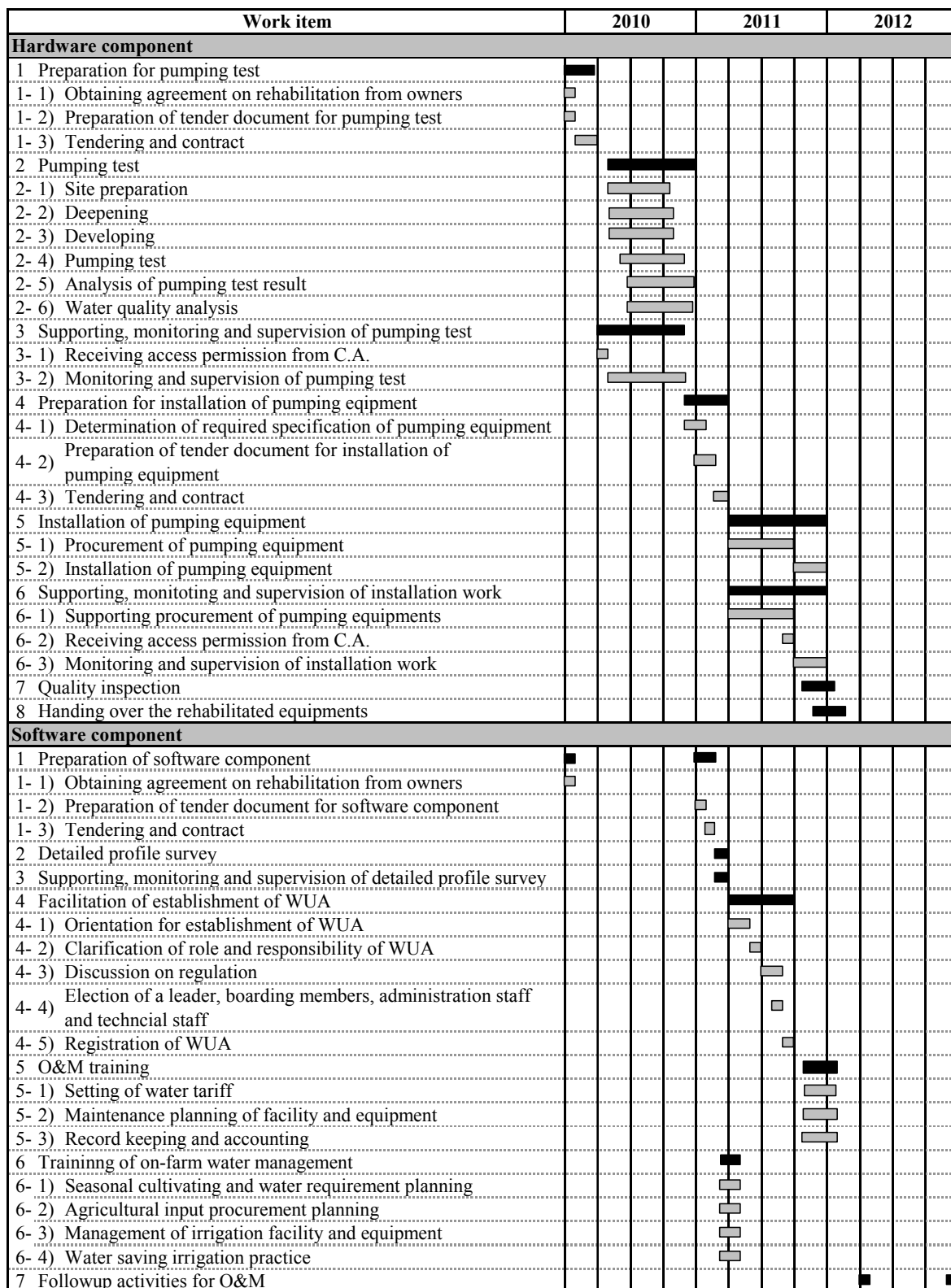
Source: JICA Study Team

### 11.1.2 Implementation Plan for the Rehabilitation of Agricultural Wells

Implementation schedule of the priority schemes is proposed, as shown in Figure 11.1.1.

The prerequisites in preparing the implementation plan are as follows:

- (i) Completion periods of both the hardware and software components are synchronized since lessons learned from the trainings will be applied to actual operations, as soon as possible; and
- (ii) The planned period for software component of one year aims to keep the high motivations of the owners and farmers.



Source: JICA Study Team

**Figure 11.1.1 Implementation Schedule for the Rehabilitation of Agricultural Wells**

### 11.1.3 Cost Estimates for the Rehabilitation of Agricultural Wells

Implementation costs for the rehabilitation of agricultural wells are estimated, as shown in the following table.

**Table 11.1.2 Costs for the Rehabilitation of Agricultural Wells**

Item	Total Amount
	(USD)
<b>1. Construction Costs</b>	<b>1,193,687</b>
(1) Pumping Test	445,730
(2) Procurement and Installation of Pumping Equipment	639,440
(3) Administrative Cost 10%	108,517
<b>2. Engineering Costs</b> (Pumping Test & Procurement and Installation of Pumping Equipment)	<b>358,106</b>
<b>3. Software Component Program</b>	<b>434,665</b>
(1) Foreign Expert	150,000
(2) Local Expert	158,800
(3) Transport	70,600
(4) Documentation of Manuals	1,540
(5) Workshop and Training	14,210
(6) Administrative Cost 10%	39,515
<b>4. Contingency 20%</b>	<b>397,292</b>
<b>Total</b>	<b>2,383,750</b>

Source: JICA Study Team

#### 11.1.4 Costs for Operation and Maintenance (O&M)

Costs for O&M of the agricultural wells after the rehabilitation are estimated, as shown in the following table.

**Table 11.1.3 Estimated Annual Total Costs for O&M**

	Well ID	Name	O&M costs (USD)	
			Present condition	After electrification
1	18-18/016*	Mustafa Abu Khayzaran	48,575	48,575
2	18-18/019	Abdul Kareem Salem	26,442	15,797
3	18-18/027A	Ibrahim Dyab	8,821	6,383
4	19-14/058B*	Yunes 'Abdu	7,775	7,775
5	19-14/062*	Sa'eed 'Ala' Al Deen	17,915	17,915
6	19-15/028A	Al 'Auja	23,000	13,971
7	19-16/005	'Abed Al'azeez Lubbad Sarrees	19,720	11,685
8	19-17/012	Marj Na'ja C5	22,561	13,532
9	19-17/033	Deya' Saleh 'Abdu	12,482	7,932
10	19-20/001A	Khursheed Mbaslat	5,358	4,058
11	20-17/022	Sulayman Saleh	16,969	10,378
	<b>Total</b>		<b>209,618</b>	<b>158,001</b>

\*These wells are supplied electricity under present condition.

Source: JICA Study Team

## 11.2 Improvement of Spring Water Conveyance System

### 11.2.1 Proposed Works for the Improvement of Spring Water Conveyance System

The work components for the improvement of spring water conveyance system are proposed, as shown in the following table.

**Table 11.2.1 Work Components of Priority Scheme**

Al 'Auja	Al Dyuk	Al Nwai'mah
1) Installation of conveyance pipelines 2) Construction of settling basin 3) Construction of Distribution Box 4) Rehabilitation of intake weir 5) Rehabilitation of existing concrete canals	1) Installation of conveyance pipelines 2) Construction of settling basin 3) Construction of Distribution Box 4) Rehabilitation of existing concrete canals	1) Installation of conveyance pipelines 2) Construction of Distribution Box 3) Rehabilitation of existing concrete canals

Source: JICA Study Team

The quantities of construction material for each priority scheme are shown in the following table.

**Table 11.2.2 Quantities of Construction Material for Priority Scheme**

NWA'IMAH			DYUK			AUJA		
Item	Unit	Quantity	Item	Unit	Quantity	Item	Unit	Quantity
<b>Pipe Installation</b>	<b>m</b>	<b>4,680</b>	<b>Pipe Installation</b>	<b>m</b>	<b>6,930</b>	<b>Pipe Installation</b>	<b>m</b>	<b>15,010</b>
HDPE-355mm	m	1,720	SP-22"	m	480	SP-26"	m	1,590
HDPE-280mm	m	1,620	SP-18"	m	1,230	SP-22"	m	200
HDPE-225mm	m	1,340	SP-16"	m	760	SP-20"	m	3,720
			SP-12"	m	760	SP-18"	m	4,160
			HDPE-450mm	m	1,080	HDPE-450mm	m	4,280
			HDPE-400mm	m	250	HDPE-400mm	m	1,060
			HDPE-355mm	m	1,420			
			HDPE-280mm	m	950			
<b>Construction</b>			<b>Construction</b>			<b>Construction</b>		
Settling Basin	pcs	0	Settling Basin	pcs	1	Settling Basin	pcs	1
Distribution Box	pcs	8	Distribution Box	pcs	24	Distribution Box	pcs	16
<b>Rehabilitation</b>			<b>Rehabilitation</b>			<b>Rehabilitation</b>		
Intake Rehabilitation	L.S.	0	Intake Rehabilitation	L.S.	0	Intake Rehabilitation	L.S.	1
Canal Rehabilitation	m	2,000	Canal Rehabilitation	m	2,900	Canal Rehabilitation	m	3,750

Source: JICA Study Team

## 11.2.2 Implementation Plan for the Improvement of Spring Water Conveyance System

### (1) Implementation Schedule

Al 'Auja Spring was selected as the highest priority site. The planned improvement project for Al 'Auja Spring should therefore be carried out in a short term period, to be followed by the improvement of Al Nwai'mah and Al Dyuk Springs. Planned implementation works for Al Nwai'mah and Al Dyuk Springs will be combined into one package, taking into consideration their locations and the expected construction costs and duration.

The implementation schedule of the priority schemes is as shown in the following figure.

Work item	2009	2010	2011	2012	2013	2014	2015
<b>Al 'Auja Spring</b>							
Approval of Relevant Institutions	■						
Basic Design Study		■					
Detailed Design Study & Tendering			■				
<b>Implementation Works</b>							
<b>Construction Works</b>							
Site Preparation & Temporary Works				■			
Rehabilitation of Intake Weir				■			
Construction of Settling Basin				■			
Installation of Main Conveyance Pipeline				■			
Construction of Distribution Box					■		
Rehabilitation of Existing Canal					■		
<b>Software Component</b>							
Assistant for Formulation of O&M Organization			■				
Assistant for Formulation of Users Organization			■				
Preparation of Management Manuals			■				
Preparation of O&M Manuals				■			
Preparation of On-farm Water Management Guideline				■			
Training of O&M				■	■	■	■
Training of On-farm Water Management				■	■	■	■
Monitoring of O&M and On-farm Activities				■	■	■	■
<b>Al Dyuk and Nwai'mah Spring</b>							
Approval of Relevant Institutions	■						
Basic Design Study				■			
Detailed Design Study & Tendering					■		
<b>Implementation Works</b>							
<b>Construction Works</b>							
Site Preparation & Temporary Works						■	
Construction of Settling Basin						■	
Installation of Main Conveyance Pipeline						■	
Construction of Distribution Box						■	
Rehabilitation of Existing Canal						■	
<b>Software Component</b>							
Assistant for Formulation of O&M Organization					■		
Assistant for Formulation of Users Organization					■		
Preparation of Management Manuals					■		
Preparation of O&M Manuals						■	
Preparation of On-farm Water Management Guideline						■	
Training of O&M						■	■
Training of On-farm Water Management						■	■
Monitoring of O&M and On-farm Activities						■	■

Source: JICA Study Team

**Figure 11.2.1 Implementation Schedule of Priority Scheme**

The main works in the implementing period including pre-implementation stages are explained as follows.

1) Basic Design Study

Before implementation works, a basic design study for priority sites will be required. The basic design study will conduct the following items.

Facility Designing

- (i) Review of feasibility study;
- (ii) Topographic survey (part of conveyance routes in necessary);
- (iii) Modification of conveyance routes through discussion with water right holders (if necessary);
- (iv) Identification of locations and number of distribution points through discussion with water right holders;
- (v) Identification of tertiary routes for distribution through discussion with water right holders;
- (vi) Designing of valve chamber box and distribution box structures;
- (vii) Cost estimate for implementation; and
- (viii) Planning of construction schedule.

### Planning of Software Component Program

- (i) Review of feasibility study;
- (ii) Explanation on proposed conveyance system to water right holders;
- (iii) Designing of O&M system;
- (iv) Preparation of water right list and distribution schedule;
- (v) Planning of rules and regulations for water management and O&M including organization structures;
- (vi) Planning of water charging system; and
- (vii) Workshop on water resources management and on-farm water management.

#### 2) Detailed Design Study

The detailed design study will be carried out in order to finalize designing and modify quantities and engineering cost estimates of facilities. Especially, through discussion with water right holders, distribution structures and locations will be finalized. Preparation of tender documents and tendering will be done in this stage finally.

#### 3) Construction Works

The construction works will be started from site mobilization and site office establishment as preparatory works. Before procurement materials and construction at the sites, the construction plan, schedule, specification of materials and equipment to be procured including those origins and mobilization routes, concrete mixing designing and construction drawings should be prepared by the contractors and approved by the construction supervisors. The contractors should plan the construction work schedule taking into consideration of farmers' water sing situation.

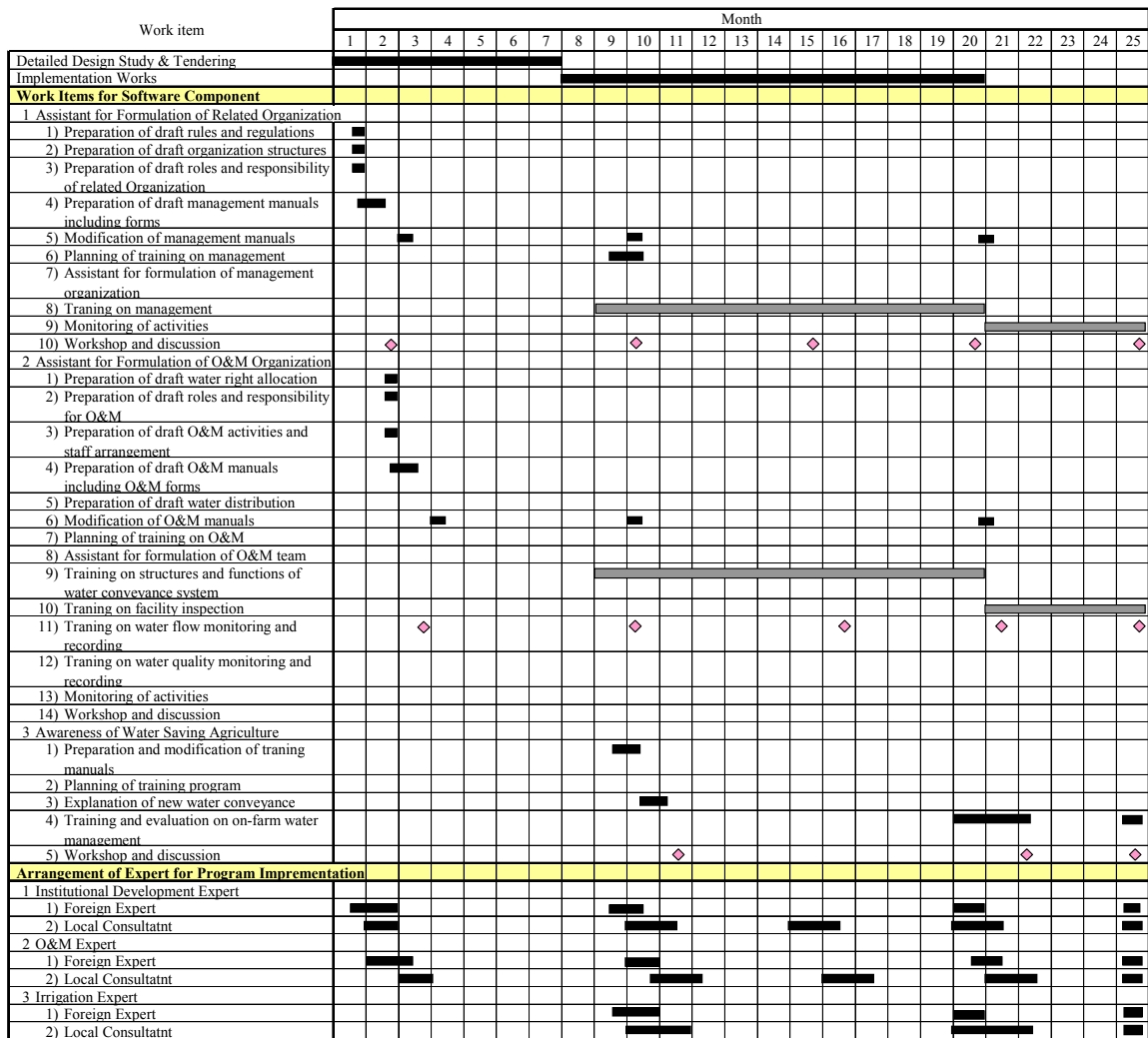
#### 4) Construction Supervision

In this plan, it is assumed that a foreign expert will conduct construction supervision as the Engineer on behalf of the Palestinian Government with local experts as inspectors.

#### 5) Software Component

The software component program will be commenced during detailed design study. As a typical case, the work schedule of software component program is shown in the following figure.





Source: JICA Study Team

**Figure 11.2.2 Typical Works Schedule for Software Component Program**

(2) Availability of Materials

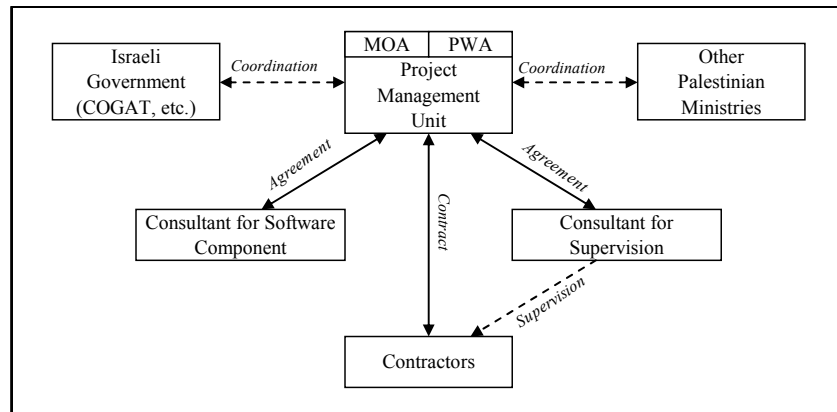
All the materials required in construction for priority schemes are available in Israeli or Palestinian markets.

(3) Security Issues

For mobilization, the contractors for construction will pass through the several check points. It is necessary for any staff in the local contractors and engineers to have permits for each checkpoint to enter Jericho. The Palestinian Government will arrange their permits coordinating with the Israeli side, such as COGAT and Jericho DCL. For material and equipment mobilization during construction, the Government is required for coordination with the Israeli side for each delivery.

(4) Implementing Organization

The project management unit will be formulated in the Palestinian side. The implementing organization is recommended to be established as shown in the following figure.



Source: JICA Study Team

**Figure 11.2.3 Proposed Implementing Organization Structure**

### 11.2.3 Cost Estimates for the Improvement of Spring Water Conveyance System

The cost for pre-implementation and implementation works for the improvement of spring water conveyance system in the priority site is estimated under the following conditions.

- (1) The cost of the temporary works for the construction is 5% of the total cost of construction works.
- (2) The administrative cost for the construction is 10% of the direct construction cost under the assumption that a foreign contractor carries out the construction works.
- (3) Engineering cost is 15% of the direct construction cost, which consists of the cost for detailed design study, assistance for tendering and the construction supervision to be conducted by a foreign consultant.
- (4) The consultancy service for the software component program is provided by a foreign consultant.
- (5) The contingency for the implementation is 20% of the total cost for construction works, engineering services and software component program, which include the price contingency.

Implementation costs for the improvement of spring water conveyance system are estimated as shown in the following table.

**Table 11.2.3 Estimated Costs for Al 'Auja Improvement Scheme**

Item	Total Amount (USD)
<b>[Al 'Auja Spring]</b>	
<b>1. Construction Costs</b>	<b>5,734,900</b>
(1) Direct Construction Costs	5,213,500
- Temporary Works 5%	248,300
- Pipe Installation and Related Works	3,764,200
- Intake Rehabilitation Works	2,100
- Canal Rehabilitation Works	1,198,900
(2) Administrative Cost 10%	521,400
<b>2. Engineering Costs 15%</b> (Detailed Design & Construction Supervision)	<b>860,200</b>
<b>3. Software Component Program</b>	<b>533,500</b>
<b>SubTotal</b>	<b>7,128,600</b>
Contingency 20%	1,425,700
<b>Total</b>	<b>8,554,300</b>

Source: JICA Study Team

**Table 11.2.4 Estimated Costs for Al Nwai'mah and Al Dyuk Improvement Scheme**

Item	Total Amount (USD)
<b>[Al Dyuk &amp; Al Nwai'mah Spring]</b>	
<b>1. Construction Costs</b>	<b>4,343,200</b>
(1) Direct Construction Costs	3,948,400
Al Nwai'mah	1,246,100
- Temporary Works 5%	59,300
- Pipe Installation and Related Works	636,900
- Intake Rehabilitation Works	0
- Canal Rehabilitation Works	549,900
Al Dyuk	2,702,300
- Temporary Works 5%	128,700
- Pipe Installation and Related Works	1,764,000
- Intake Rehabilitation Works	0
- Canal Rehabilitation Works	809,600
(2) Administrative Cost 10%	394,800
<b>2. Engineering Costs 15%</b> (Detailed Design & Construction Supervision)	<b>592,300</b>
<b>3. Software Component Program</b>	<b>541,100</b>
<b>SubTotal</b>	<b>5,476,600</b>
Contingency 20%	1,095,300
<b>Total</b>	<b>6,571,900</b>

Source: JICA Study Team

The breakdown of the costs for software component program is shown in the following table.

**Table 11.2.5 Estimated Costs for Software Component Program**

Item	Total (USD)
<b>[Al 'Auja Spring]</b>	<b>533,522</b>
Remuneration of Foreign Expert	295,000
Remuneration of Local Expert	63,000
Transport	111,000
Documentation of Manuals	1,800
Workshop and Training	14,220
Administrative Cost 10%	48,502
<b>[Al Nwai'mah &amp; Al Dyuk Springs]</b>	<b>541,090</b>
Remuneration of Foreign Expert	295,000
Remuneration of Local Expert	63,000
Transport	111,000
Documentation of Manuals	3,600
Workshop and Training	19,300
Administrative Cost 10%	49,190

Source: JICA Study Team

Before the implementation works including the detailed design study, a basic design study will be required. The costs for the basic design study can be provisionally estimated as shown in the following table for each project in assumption that the foreign experts conduct it.

**Table 11.2.6 Estimated Costs for Basic Design Study for Each Project**

Item	Total (USD)
Remuneration of Foreign Expert	470,000
Site Survey for Designing (to be subcontracted)	20,000
Socio-economic Survey (to be subcontracted)	39,600
Transport	37,500
Documentation of Reports	7,200
Administrative Cost 10%	57,400
<b>Total</b>	<b>631,700</b>

Source: JICA Study Team

#### 11.2.4 Costs for Operation and Maintenance (O&M)

The O&M costs for each spring facilities are estimated as shown in the succeeding tables.

The O&M costs include: 1) Depreciation of the facilities and equipment; 2) Personnel cost; and 3) Administrative cost. The depreciation is estimated based on a direct construction cost considering a 30-year straight-line as shown in the following table.

**Table 11.2.7 Estimated Annual Depreciation Costs**

Item	Al Nwai'mah	Al Dyuk	Al 'Auja
Direct Construction Cost (USD)	1,246,100	2,702,300	5,213,500
Physical Contingency (USD) 20%	249,200	540,500	1,042,700
Total (USD)	1,495,300	3,242,800	6,256,200
Annual Depreciation (USD/yr) 30yrs	49,800	108,100	208,500

Source: JICA Study Team

The personnel costs are estimated as shown in the following table based on the required position and number of staff mentioned in Subsection 8.2.3.

**Table 11.2.8 Estimated Personnel Costs for Operation and Maintenance**

(Unit: USD)

Position	USD/person/yr	Al Nwai'mah	Al Dyuk	Al 'Auja
O&M Leader	10,300	10,300	10,300	10,300
Inspector	7,700	15,400	15,400	23,100
Worker	5,100	5,100	5,100	5,100
Total		30,800	30,800	38,500

Source: JICA Study Team

Considering an assumption that the administrative cost is 20% of the depreciation and personnel costs, the annual O&M costs are then estimated, as shown in the following table.

**Table 11.2.9 Estimated Annual Total Costs for Operation and Maintenance**

(Unit: USD)

Item	Al Nwai'mah	Al Dyuk	Al 'Auja
Depreciation Cost (USD)	49,800	108,100	208,500
Personnel Cost (USD)	30,800	30,800	38,500
Administrative Cost 20%	16,100	27,800	49,400
Total O&M Cost (USD)	96,700	166,700	296,400
Average Discharge for Agr. (Mm <sup>3</sup> /yr)	2.53	4.73	9.55
O&M Cost per m <sup>3</sup> (USD/m <sup>3</sup> )	0.038	0.035	0.031

Source: JICA Study Team

## CHAPTER 12 PROJECT EVALUATION

### 12.1 Approach and Methodology of Evaluation

In this chapter, a project evaluation for the first priority schemes (hereinafter referred to “the Projects”), selected under the priority water resources management schemes has been carried out. The Projects are composed of i) the rehabilitation and integrated management of eleven (11) agricultural wells<sup>1</sup> and ii) the improvement of three (3) spring water conveyance systems.

Implementation of the Projects is expected to bring about various socio-economic effects, both direct and indirect. For instance, it is anticipated that i) improvement of health by reducing incidence of diarrheal disease, ii) securing water for facilitating industrial activities, iii) increase in domestic water supply, iv) increase in agricultural productions, and other minor benefits following the improvement of the water use environment. However, the project evaluation has focused only on analyzing tangible costs and benefits, which are determined in the following section.

Calculations of EIRR (Economic Internal Rate of Return), NPV (Net Present Value), and B/C ratio (Benefit-Cost ratio) are used for evaluating the economic impacts resulting from the Projects. Every numerical figure shown in the economic analysis has been converted into economic term.

At the final part of this chapter, a farm income analysis has been undertaken as financial analysis<sup>2</sup> for evaluating the Projects’ intervention at the level of the farmers, since they are the major beneficiaries of the Projects.

### 12.2 Economic Analysis

#### 12.2.1 Assumptions

A cost - benefit analysis on the Projects has been conducted by calculating the EIRR, NPV, and B/C ratio. The analysis is undertaken by calculating the difference between the “with” and “without” project alternatives. In the process of calculation, the following conditions are considered:

- Evaluation Period: 30 years after completion of construction;
- Discount Rate: 12% at base case;

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<sup>1</sup> Although there are totally 19 agricultural wells in total that have been selected for the priority schemes, the rehabilitation of 8 wells has already been carried out as pilot projects during the WRDM study.

<sup>2</sup> Calculation of FIRR (Financial Internal Rate of Return) is generally employed for the financial evaluation of large scale water supply projects, especially for the loan projects. However, most of the agricultural wells in the Study Area are owned and operated by individual well owners, and water is accordingly used for their own lands. Even supplying water to the tenant (landless) farmers, they do not charge the water fees itself in many cases. Spring water for the agricultural use is also generally distributed without charge due to lack of management capacity for billing. Consequently, calculation of FIRR is unsuitable to evaluate the financial impact of the Projects, in this sense.

- Applied Standard Conversion Factor: 0.95;
- Exchange Rate: USD1 is equivalent to NIS3.5 (as of August 2008);
- No additional rehabilitation work for the facilities is required during the evaluation period, since the duration of the facility is assumed to be 30 years. (Equipment needed for the agricultural wells is assumed to be replaced every 10 years.);
- Residual values of the project assets are not included in the analysis;
- Every priority agricultural wells are presumed to be connected to the electric grid by 2022 (10years after completion of rehabilitation), and thereby the O&M costs would be lessened following this presumption;
- In the case of the “without” project alternative (if the existing decrepit conveyance systems were neglected over the period), an additional water loss at 10% of total water discharge volume is expected over a next decade; and
- Economic costs do not include transfers, such as taxes and price escalation.

### 12.2.2 Economic Costs

A standard conversion factor (SCF) is calculated at 0.95<sup>3</sup>. The SCF is used for converting the financial project costs, which have already been explicated in the last chapter, into economic costs.

The economic costs of the respective Project are divided into investment costs and recurrent costs. The investment costs are composed mainly of i) construction cost, ii) engineering cost including basic and detailed designs and construction supervision works, and iii) software component programs. The recurrent costs stand for the operation and maintenance (O&M) costs. The annual O&M costs have been appropriated through the entire project evaluation period<sup>4</sup>.

#### (1) Improvement of the Spring Conveyance Systems

As mentioned in the last chapter, spring improvement component of the Project is composed of i) Al ‘Auja Spring and ii) Al Dyuk and Al Nwai’mah Springs. The investment costs for the overall priority spring improvement projects are estimated at USD14.4 million in economic price. Out of this total amount, the economic investment costs of Al ‘Auja Spring improvement are USD8.2 million, while those of Al Dyuk and Al Nwai’mah springs improvement are USD6.2 million. The economic recurrent costs for each are also estimated at USD294 thousand for Al ‘Auja Spring, USD258.6 thousand for Al Dyuk Spring, and Al Nwai’mah Spring. The economic costs for the improvement of the spring conveyance systems are summarized in Table 12.2.1.

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<sup>3</sup> SCF is calculated based on the latest import/ export statistic data on Israel, because all the tradable goods both imported and exported from/ to Palestine are inspected and fully controlled by the Israeli customs services (Table A.1, Annex.11). Although Israeli customs collect the import tax instead of Palestinian government, it is heard that this tax collection system does not work effectively (PMA, Annual Report 2006) and the substantial data regarding import & export taxes of Palestine has not been found.

<sup>4</sup> The estimate of the O&M costs for each component is mentioned in the sections 11.1.4 and 11.2.4.

**Table 12.2.1 Economic Costs of the Improvement of the Priority Springs Conveyance Systems**

Price@2008

Item	Amount (USD)		Total Amount (USD)
	L.C.	F.C.	
<b>Investment Costs</b>			
<b>[Al 'Auja Spring]</b>			
<b>1. Construction Cost</b>	<b>5,448,200</b>	<b>0</b>	<b>5,448,200</b>
(1) Direct Construction Cost	4,952,900	0	4,952,900
- Temporary Works 5%	235,900	0	235,900
- Pipe Installation and Related Works	3,576,000	0	3,576,000
- Intake Rehabilitation Works	2,000	0	2,000
- Canal Rehabilitation Works	1,139,000	0	1,139,000
(2) Administrative Cost 10%	495,300	0	495,300
<b>2. Engineering Cost 15%</b> (Detailed Design & Construction Supervision)	<b>172,000</b>	<b>645,200</b>	<b>817,200</b>
<b>3. Software Component Program</b>	<b>209,000</b>	<b>324,500</b>	<b>533,500</b>
<b>SubTotal</b>	<b>5,829,200</b>	<b>969,700</b>	<b>6,798,900</b>
Contingency 20%	1,165,800	193,900	1,359,700
<b>Total Investment Costs</b>	<b>6,995,000</b>	<b>1,163,600</b>	<b>8,158,600</b>
<b>[Al Dyuk &amp; Al Nwai'mah Springs]</b>			
<b>1. Construction Cost</b>	<b>4,126,100</b>	<b>0</b>	<b>4,126,100</b>
(1) Direct Construction Cost	3,751,000	0	3,751,000
Nwai'mah	1,183,900	0	1,183,900
- Temporary Works 5%	56,400	0	56,400
- Pipe Installation and Related Works	605,100	0	605,100
- Intake Rehabilitation Works	0	0	0
- Canal Rehabilitation Works	522,400	0	522,400
Dyuk	2,567,100	0	2,567,100
- Temporary Works 5%	122,200	0	122,200
- Pipe Installation and Related Works	1,675,800	0	1,675,800
- Intake Rehabilitation Works	0	0	0
- Canal Rehabilitation Works	769,100	0	769,100
(2) Administrative Cost 10%	375,100	0	375,100
<b>2. Engineering Cost 15%</b> (Detailed Design & Construction Supervision)	<b>118,500</b>	<b>444,200</b>	<b>562,700</b>
<b>3. Software Component Program</b>	<b>216,600</b>	<b>324,500</b>	<b>541,100</b>
<b>SubTotal</b>	<b>4,461,200</b>	<b>768,700</b>	<b>5,229,900</b>
Contingency 20%	892,200	153,700	1,045,900
<b>Total Investment Costs</b>	<b>5,353,400</b>	<b>922,400</b>	<b>6,275,800</b>
<b>Recurrent Costs</b>			
<b>Al 'Auja Spring</b>	<b>294,000</b>	<b>0</b>	<b>294,000</b>
<b>Al Dyuk &amp; Al Nwai'mah Springs</b>	<b>258,600</b>	<b>0</b>	<b>258,600</b>
-Al Dyuk Spring	164,300	0	164,300
-Al Nwai'mah Spring	94,300	0	94,300

Source: JICA Study Team

(2) Rehabilitation and Integrated Management of the Agricultural Wells

The economic costs of the agricultural wells rehabilitation projects consist of hardware component and software component. The hardware component is a series of rehabilitation works of the existing facilities, which includes deepening & clearing, developing, casing, rig mobilization, pumping test, and installation of the pumping equipment. On the other hand, the software component aims to establish a water user's association (WUA) and also to train the organization for sustainable water resource management of the agricultural wells.



The economic investment costs of the overall agricultural wells rehabilitation are estimated at USD2.3 million. The recurrent economic costs are estimated at USD199.6 thousand per annum before all the agricultural wells are electrified by grid extension. After connected to the electric grid, which is tentatively presumed by 2022, the O&M costs of the wells are lessened at USD150.5 thousand. In addition, the pumping equipment procured by the Projects is assumed to be replaced by a new one every 10 years<sup>5</sup>.

The economic costs of the rehabilitation of the 11 agricultural wells are summarized in the following Table 12.2.2.

**Table 12.2.2 Economic Costs of Rehabilitation and Integrated Management of 11 Agricultural Wells**

Price@2008

Item Description	Amount (USD)		Total Amount (USD)
	L.C	F.C	
<b>Investment Costs</b>			
<b>[HARDWARE COMPONENT]</b>			
1 Construction Cost			
1) Pumping test	423,700	0	423,700
2) Installation of pumping equipments	119,200	514,700	633,900
3) Administrative Cost 10% x 1)+2)	54,300	51,500	105,800
Sub-Total of Construction Cost	597,200	566,200	1,163,400
2 Engineering Cost	104,700	244,300	349,000
<b>Sub Total (I)</b>	<b>701,900</b>	<b>810,500</b>	<b>1,512,400</b>
<b>[SOFTWARE COMPONENT]</b>			
3 Remuneration of Foreign Expert	0	150,000	150,000
4 Remuneration of Local Expert	157,200	0	157,200
5 Transport	67,100	0	67,100
6 Documetation of Manuals and Reports	1,500	0	1,500
7 Workshop and Training	13,500	0	13,500
8 Administrative Cost 10% x (3-7)	23,900	15,000	38,900
<b>Sub Total (II)</b>	<b>263,200</b>	<b>165,000</b>	<b>428,200</b>
<b>Contingency 20% x ((I)+(II))</b>	<b>193,000</b>	<b>195,100</b>	<b>388,100</b>
<b>Total Investment Costs</b>	<b>1,158,100</b>	<b>1,170,600</b>	<b>2,328,700</b>
<b>Recurrent Costs</b>			
A- I) Operation Cost (Electrified by diesel power alternative)	176,300	0	176,300
II) Operation Cost (Electrified by grid alternative)	127,200	0	127,200
B Maintenance Cost	23,300	0	23,300
<b>Total Recurrent Costs (until 2021) (A-I)+B)</b>	<b>199,600</b>	<b>0</b>	<b>199,600</b>
<b>Total Recurrent Costs (after 2022) (A-II)+B)</b>	<b>150,500</b>	<b>0</b>	<b>150,500</b>

Source: JICA Study Team

### 12.2.3 Economic Benefits

#### (1) Methodology for the Calculation of Economic Benefits

It is expected that the water saved by the Projects will benefit regional economy by initiating various socio-economic activities. The water to be secured during the evaluation period is estimated as shown in Table 12.2.3.

<sup>5</sup> Diesel power generators which will be purchased at the initial investment of the Project are not replaced by new ones, as presumed that grid extension might reach all the wells within 10 years.

**Table 12.2.3 Expected Water Volume Secured by the Project Implementation**Unit: thousand m<sup>3</sup>

<i>Improvement of the Spring Conveyance System</i>			
	Al 'Auja Spring	Al Dyuk Spring	Al Nwai'mah Spring
Expected Water Loss	4,202	2,263	857
Saved Water by Rehabilitation	3,247	1,790	605
<i>Rehabilitation of the Agricultural Wells and Integrated Water Management</i>			
Total Incremental Water Volume			473

Source: Estimated by JICA Study Team based upon the Inventory Survey Data

The incremental water volume shown above is estimated based upon the inventory survey. A serious water loss has been confirmed in each of the priority spring conveyance systems. The water loss volume is estimated at 4.2million m<sup>3</sup> (or 44% of the total discharge) for Al 'Auja Spring, 2.3million m<sup>3</sup> (48%) for Al Dyuk Spring, and 0.86million m<sup>3</sup> (34%) for Al Nwai'mah Spring, respectively. Even though an avoidable water loss of 10% is considered, the additional water volume resulting from the rehabilitation is consequently estimated at 3.2million m<sup>3</sup> for Al 'Auja Spring, 1.8million m<sup>3</sup> for Al Dyuk Spring, and 0.6million m<sup>3</sup> for Al Nwai'mah Spring annually.

It is also expected that the agricultural well rehabilitation can also produce a volume of additional water. Although a very rough estimation<sup>6</sup>, the total incremental water volume from the rehabilitation of the 11 agricultural wells is estimated at approximately 473 thousand m<sup>3</sup> per annum.

The economic benefits of the Projects are brought about by utilizing the above mentioned incremental water for the agricultural, domestic, and industrial use. As discussed in Chapter 5, the Study Team has recommended that alleviation of the domestic water supply deficit should be prioritized following the principle of effective water allocation. The current domestic water consumption of the project area remained far less than 150 lpcd, which is the target domestic water supply volume per person set by PWA<sup>7</sup>. Therefore, in this evaluation, it is defined that the necessary volume to meet demand will initially be transferred to domestic water consumption out of the total secured water from the improvement of the conveyance systems. And then the remaining volume of the secured water is utilized for the agricultural activities in the project area. In turn, the additional water pumped by the rehabilitation of the 11 agricultural wells will be utilized for agricultural purposes solely.

## (2) Benefits from Domestic Water Supply

The water discharge of both Al Dyuk and Al Nwai'mah Springs is stable throughout the year. Water from these springs is partially supplied for the domestic water consumers as well as industrial water users under the management of the village council.

<sup>6</sup> The pumping volume from the rehabilitation works was estimated by using PWA's database, MoA's recommendation, and the inventory survey on agricultural wells done by the Study Team. (For details, refer to Table A.8 of Annex.11)

<sup>7</sup> National Water Policy and Strategy (2007) prepared by PWA has aimed to achieve the average domestic water supply at 100 lpcd by 10 years later, and 150 lpcd by 20 years later, respectively.

Following the aforementioned definition, it is presumed that the additional water acquired through the improvement of the conveyance systems (i.e. the “with” project alternative) is preferentially supplied for domestic use in order to reach the target volume. The domestic water demand has been forecasted following the target lpcd volume mentioned in the National Water Policy and Strategy that has been prepared by PWA (See Tables A.3-6, Annex.11).

On the other hand, it is unlikely to supply larger than the current domestic water supply volume if no improvement of the spring conveyance systems were to be done (i.e. the “without” project alternative)<sup>8</sup>. Therefore, the difference between the “with” and “without” project alternatives is considered to be the incremental domestic water resulting from the implementation of the Projects.

In this analysis, the Study Team considered the economic value of domestic water at NIS3.6 per m<sup>3</sup> in accordance with the current situation and discussion with PWA<sup>9</sup>. The following Table 12.2.4 summarizes the economic benefits from domestic water supply, which has been calculated on the basis of the domestic water demand forecast (For details, refer to Tables A3-6 of Annex.11).

**Table 12.2.4 Domestic Water Demand and Economic Benefits**

Year	Al Dyuk Spring		Al Nwai'mah Spring	
	Domestic Water Demand (thousand m <sup>3</sup> )	Economic Benefit (thousand USD)	Domestic Water Demand (thousand m <sup>3</sup> )	Economic Benefit (thousand USD)
2018	13.9	15.6	85.3	96.0
2023	52.8	59.4	124.1	139.7
2028	94.4	106.2	162.0	182.2
2033	118.6	133.4	186.3	209.4
2038	146.2	164.4	213.1	239.8
Total	1,820.6	2,048.2	3,787.5	4,260.9

*Source: Estimated by JICA Study Team based upon the PWA's database*

<sup>8</sup> The agricultural water demand is also in imminent threat of deficit in the project area, which means that it is impracticable to reduce the amount of the agricultural water volume in order to manage the additional domestic water supply.

<sup>9</sup> The consumers' willingness to pay (WTP) is considered to be equivalent to the economic value of water in Contingent Valuation Method (CVM) that is widely used for evaluating the economic value of water. However, since a WTP survey data is not available at moment, the affordability to pay (ATP) for the domestic water, which is ordinarily defined at 4% of disposable income, is considered to be economic price in this study. Average annual household disposable income of project area is assumed at NIS24,000 based on the Socio-economic baseline survey done in 2007 by the Study Team and Population, Housing and Establishment Census 2007 (PCBS).

For reference, a socio-economic survey done in a JICA study “Jericho Regional Development Study” (Aug.2006) has indicated that the average monthly water expenditures per household were around NIS200. Even though some statistic errors are considered, this survey result reveals how important water is for the people in JRRV. Therefore, it is rather likely to consider that the actual economic value of the domestic water is higher than NIS3.6 per m<sup>3</sup>. (See Table.2 Annex.11) In any case, a WTP survey should be conducted in the next stage.

(3) Benefits from Agricultural Water Supply (Increase in Agricultural Land)

Numerous economic benefits from agricultural water supply are expected through the improvement of the spring water conveyance systems as well as rehabilitation and integrated management for agricultural wells. The inventory survey results and related statistic information from MoA have indicated that there are still vast un-irrigated lands in the project area. Most of the farmers seek to expand their field if additional water were secured. The economic benefits from the agricultural water supply are consequently generated by the increase in the farmers' land irrigated by the additional agricultural water. It is quantified by multiplying the size of the increased agricultural land by the value-added generated by the land. According to the calculation based upon the latest agricultural statistics, one dunum of the agricultural land in the project area has currently produced an annual value-added<sup>10</sup> of USD779 for Tubas area, USD659 for Nablus area, and USD375 for Jericho area, in economic term<sup>11</sup>.

Finally, the incremental water volume, the expanded agricultural land, and the economic benefits of the project implementation are summarized in the following Tables 12.2.5-6.

**Table 12.2.5 Incremental Agricultural Water Supply and Economic Benefits by the Improvement of the Spring Conveyance Systems**

Year	Al 'Auja Spring			Al Dyuk Spring			Al Nwai'mah Spring		
	Incremental water ('000 m <sup>3</sup> )	Incremental land (DNM)	Economic Benefit ('000USD)	Incremental water ('000 m <sup>3</sup> )	Incremental land (DNM)	Economic Benefit ('000USD)	Incremental water ('000 m <sup>3</sup> )	Incremental land (DNM)	Economic Benefit ('000USD)
2018	3,247	6,023	2,260	1,654	1,420	533	452	710	267
2023	3,247	6,023	2,260	1,618	1,389	521	415	653	245
2028	3,247	6,023	2,260	1,583	1,359	510	381	600	225
2033	3,247	6,023	2,260	1,566	1,344	505	362	570	214
2038	3,247	6,023	2,260	1,548	1,329	499	342	537	202
Total	97,410	180,704	67,809	47,497	40,766	15,298	11,358	17,851	6,699

Source: Estimated by JICA Study Team based upon the database of PWA & MoA

**Table 12.2.6 Incremental Agricultural Water Supply and Economic Benefits by the Rehabilitation and Integrated Management of Agricultural Wells**

	Tubas area	Nablus area	Jericho area	Area Total
Incremental water ('000 m <sup>3</sup> /Yr)	167	205.9	100	472.6
Incremental land (DNM)	331	408	128	867
Economic Benefit ('000USD/ Yr)	257.6	269.1	48.1	574.8

Source: Estimated by JICA Study Team based upon the database of MoA

(4) Water Loss in "Without" Project Alternative

Another major economic benefit from the implementation of the Projects is the prevention of the additional water losses caused by neglecting to improve or rehabilitate the spring conveyance canals<sup>12</sup>. The additional volume of the water loss of the three (3)

<sup>10</sup> Value-added is calculated as the; *total output minus total cost per dunum*, in economic price.

<sup>11</sup> Mean of the overall project area is estimated at USD468 per dunum. For details, see Table A.11 of Annex 11.

<sup>12</sup> It is assumed that neglect of improvement or rehabilitation of the spring conveyance systems would incur an additional water loss of at least 1% per annum. The overall additional water loss estimates are shown

priority springs in the “without” project alternative during the evaluation period is estimated at about 78 million m<sup>3</sup>. The water loss leads to a decrease of 144.7 thousand dunum of the irrigated land in total through the evaluation period. The economic value of this lost irrigated land is then calculated at USD54.3 million in total. In turn, this economic value can be counted as economic benefit in the “with” project alternative, since the economic loss can be prevented by project implementation.

#### 12.2.4 Evaluation Results of the Economic Analysis

Using the economic benefits and the costs estimated above, three (3) economic factors: i) EIRR, ii) NPV, and iii) B/C ratio are calculated. The economic opportunity cost of capital, which is generally assumed at the range of 10-13% in developing countries, is the target ratio for EIRR. The economic feasibility also requires a positive figure of NPV and B/C ratio exceeding 1.0.

##### (1) Improvement of the Spring Conveyance Systems

The EIRR of the improvement of the overall spring conveyance systems was calculated at 19.5%. The figure exceeds the targeted economic opportunity cost. In addition, the NPV was calculated at USD5.4 million and B/C ratio was 1.43 under the social discount rate of 12% used for the evaluation period (Refer to Table 12.3.2: at the end of this Chapter). Therefore, the calculation results have indicated that the improvement of the spring conveyance systems is economically viable.

Each spring’s evaluation results are also presented in the following table. They have indicated that the economic benefits of AI ‘Auja Spring improvement project were higher than those of the improvement project for AI Dyuk and AI Nwai’mah Springs. Although comparatively modest, AI Dyuk and AI Nwai’mah Springs improvement project has still yielded an acceptable EIRR, as 13.5%.

**Table 12.2.7 Economic Evaluation Results of the Improvement of Spring Conveyance Systems**

	AI ‘Auja Spring	AI Dyuk & AI Nwai’mah Springs	Overall*
EIRR	23.2%	13.5%	19.5%
NPV@12% (USD)	5,663,168	472,252	5,437,381
B/C@12%	1.72	1.08	1.43

\*Note: Since the starting year of the evaluation period for each spring is different, that for the AI ‘Auja Spring project was assumed as the common evaluation period in order to assess the overall economic impact of both the projects.

Source: JICA Study Team

##### (2) Rehabilitation and Integrated Management of the Agricultural Wells

Economic evaluation for the agricultural well rehabilitation is also conducted in the same manner. The EIRR was 14.9%, which exceeds the economic opportunity cost of capital during the evaluation period. Both NPV and B/C ratio figures are also very competitive even considering the social discount rate of 12%. The cost – benefit flow of the well

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in Table A.9, Annex 11.

Additional water loss regarding non-rehabilitation of the agricultural wells is not counted in this analysis, because more than 60% of the selected agricultural wells are currently non-pumping. This means that even in the “without” project alternative, the water loss volume is still negligible.

rehabilitation project is presented in Table 12.3.3, at the end of this Chapter. The evaluation results, which are shown in the following Table 12.2.8, reveal that the implementation of the agricultural wells rehabilitation project will bring substantial economic benefit to the project area.

**Table 12.2.8 Economic Evaluation Results of the Rehabilitation of Agricultural Well Projects**

	Tubas area	Nablus area	Jericho area*	Area Total
EIRR	23.3%	17.4%	-10.2%	14.9%
NPV@12% (USD)	606,822	428,831	-542,723	492,931
B/C@12%	1.52	1.29	0.44	1.14

\*Note: Two of the three priority wells in Jericho area have currently pumped the groundwater even higher volume than the licensed extraction volume. The pumping volume of the two wells would be lessened to comply with the license volume through the project for sustainable water use. Accordingly, the economic benefits cannot be quantified for the two wells, and thereby the EIRR of projects in Jericho area was negative. (For details, see Tables A.8 & 16, Annex.11.)

Source: JICA Study Team

### (3) Sensitivity Analysis

A sensitivity analysis has also been conducted. Even under the worst case scenario, i.e., 20% increase in cost and 20% decrease in benefit, the sensitivity analysis has indicated the EIRR of the priority springs improvement projects still exceed the opportunity cost of capital. These projects are accordingly justified to be economically viable, even considering the extreme political or economic risks.

On the other hand, the analysis also reveals that if the external factors that aggravate the project implementation environment appeared it would be difficult to secure the economic viability for the agricultural wells rehabilitation project. Therefore, smooth implementation of the well rehabilitation project under the cooperation and close coordination among the concerned stakeholders, i.e., Palestinian and donor agencies as well as Israeli authorities, is very important.

**Table 12.2.9 Sensitivity Analysis**

<i>Improvement of Spring Conveyance Systems</i>			Benefit		
			Base	-10%	-20%
Cost	Base	EIRR	19.5%	18.1%	16.1%
		NPV(USD)@12%	5,437,381	3,855,792	2,082,585
		B/C@12%	1.43	1.31	1.17
	+10%	EIRR	18.2%	16.4%	14.5%
		NPV(USD)@12%	4,396,914	2,624,096	850,890
		B/C@12%	1.32	1.19	1.06
	+20%	EIRR	16.7%	15.0%	13.2%
		NPV(USD)@12%	3,164,745	1,391,927	-381,279
		B/C@12%	1.21	1.09	0.97
<i>Rehabilitation of Agricultural Wells</i>			Base	-10%	-20%
Cost	Base	EIRR	14.9%	11.8%	9.1%
		NPV(USD)@12%	492,931	-254,440	-617,492
		B/C@12%	1.14	0.93	0.82
	+10%	EIRR	12.1%	9.6%	7.0%
		NPV(USD)@12%	-243,736	-606,787	-969,838
		B/C@12%	0.94	0.84	0.75
	+20%	EIRR	10.1%	7.7%	5.1%
		NPV(USD)@12%	-595,451	-958,503	-1,321,554
		B/C@12%	0.86	0.77	0.69

Source: JICA Study Team

## 12.3 Financial Analysis

### (1) Direct Impact on Farm Household Income

In order to evaluate financial impact of the Project on a farm household income, a farm income analysis has also been undertaken. How much the incremental agricultural water resulting from the Projects would benefit a farmer's household income was assessed through the farm income analysis.

The average cultivated land size per farmer's household is estimated at approximately 38 dunum<sup>13</sup> over the Study Area, according to the latest agricultural statistics data and the Socio-economic baseline survey. It is then estimated that a beneficiary farmer's household could obtain the additional cultivated land of 5.5 dunum<sup>14</sup> through the implementation of the Projects. Since the annual value-added generated per dunum of agricultural land is estimated at USD493, the farm household income will be increased by USD2,700 per annum. The Socio-economic baseline survey has indicated that majority of farmer's household income over the project area ranges from USD7,000 to USD8,500. Consequently, it can be concluded that the project implementation itself brings about 35% increases in the annual farmers' household income.

### (2) Indicative Analysis of the Financial Impact of High Value-added Cropping

Enhancing the value-added of cropping products eventually facilitates improvement of water use efficiency, as explicated in Section 6.5. Consequently, in order to analyze the successful achievement of high value-added cropping, the Study Team tried to estimate the preferred farmer's income model as an indicative analysis.

Table 12.3.1 exhibits the current production input and output information of the major crops in the Study Area. It is obvious that farmers would obtain much higher earnings and net income by producing protected vegetables than by producing open vegetables<sup>15</sup>. The current agricultural statistics data indicates that approximately 90% of the vegetable cropped lands are still open fields and the remaining 10% are the only protected farm lands.

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<sup>13</sup> The figure is estimated based upon the socio-economic baseline survey done by the Study Team.

Although the arithmetic mean of the farmers' land size is 48.5 dunum per household, this figure included the data of a small number of landlords owning more than 300 dunum land. In order to approximate to the actual situation, the Study Team used a 5% trimmed mean that is calculated at 38 dunum per household.

<sup>14</sup> *Additional irrigated land (by springs & by agricultural wells) / No. of farmer's household\**  
 $\Rightarrow 9,050 \text{ dunum} / 1,632 \text{ households}^* = 5.5 \text{ dunum per HH}$

\*Number of the farmers in Jericho city has not been counted.

<sup>15</sup> As defined previously in this report, the protected vegetable stands for the vegetable produced under low/high plastic tunnels or greenhouse. Open vegetable is an ordinal vegetable grown in the open field.

**Table 12.3.1 Crop Budget (Vegetables)**

														2007 Price	
Item	Unit	Tomato		Tomato(Protected)		Cucumber		Cucumber(Protected)		Eggplant		Eggplant(Protected)*			
		Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value		
Production Cost			4,910		13,330		4,420		7,150		4,200		6,360		
1. Material			3,290		6,120		2,850		4,400		2,940		2,760		
Seed/Seedling	NIS	0.7	1,200	0.75	2,200	0.5	800	0.8	2,200	0.5	1,200	0.1	1,000		
Water Requirement	m <sup>3</sup>	0.8	500	0.8	1,200	0.8	300	0.8	500	0.8	400	0.8	900		
Fertilizer	NIS		1,200		1,630		900		840		900		800		
Chemical	NIS		510		530		730		540		500		900		
Machinery (hired)	Hr		120		240		120		240		120		100		
Other expenses	NIS		220		1,270		460		620		500		140		
2. Labour			900		6,000		900		2,000		600		1,200		
Hired Labour Cost	Man/Hour	10	90.0	10	600	10	90.0	10	200	10	60.0	6	200		
3. Fixed Cost	NIS		720		1,210		670		750		660		2,400		
Gross Income	NIS/DNM		5,250		36,000		5,000		16,000		4,800		12,000		
Yield	Kg		3,500		18,000		2,500		8,000		4,000		6,000		
Farm Gate Price	NIS/kg		1.50		2.00		2.00		2.00		1.20		2.00		
Net Income			340		22,670		580		8,850		600		5,640		

\*Data as of 2006

Item	Unit	Squash		Squash(Protected)		Beans		Beans(Protected)		Others*		Others(Protected)*	
		Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value	Quantity	Financial value
Production Cost			3,350		3,062		2,940		4,120		2,440		7,700
1. Material			2,170		1,522		1,900		2,300		1,630		4,380
Seed/Seedling	NIS	0.5	400	0.35	20	2	50	3	80	1	500	1	1,500
Water Requirement	m <sup>3</sup>	0.8	300	0.8	250	0.8	200	0.8	400	0.8	600	0.8	480
Fertilizer	NIS		780		200		680		680		300		650
Chemical	NIS		390		680		230		750		250		550
Machinery (hired)	Hr		120		150		240		240		100		400
Other expenses	NIS		440		285		490		70		0		800
2. Labour			600		340		500		1,200		600		1,320
Hired Labour Cost	Man/Hour	10	60.0	10	34	10	50.0	10	120	6	100.0	6	220
3. Fixed Cost	NIS		580		1,200		540		620		210		2,000
Gross Income	NIS/DNM		4,000		10,500		4,500		6,000		2,750		9,380
Yield	Kg		2,000		3,000		1,500		1,500		2,200		7,500
Farm Gate Price	NIS/kg		2.00		3.50		3.00		4.00		1.25		1.25
Net Income			650		7,438		1,560		1,880		310		1,680

\*Data as of 2006

Source: PCBS Agricultural Statistic Data 2006/2007 and JICA ASAP's crop budget data 2007/2008

The preferred farmer's income model accordingly presumes that the farmers will shift to cultivate protected vegetables than open vegetables. The following conditions are taken into consideration in the process of calculation:

- (i) A vegetable cultivated land size per a farmer's household is set at 38 dunum and will be consistent;
- (ii) The share of the land for protected vegetable will be increased from the present 10% to 30% of the total land; and
- (iii) The farm gate price of ordinary vegetables cultivated in the open field is increased by 10% in total by enhancing value-added for the crops.

A typical vegetable-producing farmer's household income would be augmented from USD18,900<sup>16</sup> to USD40,000 under the abovementioned conditions. This means that the farmer can earn an extra USD21,100 per annum and their annual household income would be increased by 210% (Refer to Table A.17, Annex 11).

This indicative analysis indicates that introducing high value-added activity would bring much higher financial profits than only securing the additional water through the Projects implementation.

Finally, it is suggested that an intensive on-farm training encouraging a shift into protected crops as well as access to financial support system for farmers be important to this achievement.

<sup>16</sup> The figure is calculated based upon the assumption that the farmer's family is cultivating a land area of 38 dunum. Thereby, this is differed from the average farm household income.





**Table 12.3.3 EIRR, NPV, and B/C of the Rehabilitation of 11 Agricultural Wells**

Period	30 years after the completion of rehabilitation			
	8%	10%	12%	14%
NPV	1,383,926	690,034	<b>190,012</b>	<b>-177,259</b>
EIRR	<b>14.9%</b>			
B/C	1.33	1.18	<b>1.06</b>	0.94

Year		Costs (I)			Benefits (II)	Net Benefits (II) - (I)
		Investment	Recurrent	Total Costs		
1	2010	726,800		726,800		<b>726,800-</b>
2	2011	1,560,000		1,560,000		<b>1,560,000-</b>
3	2012	41,900	199,600	241,500	574,800	333,300
4	2013	0	199,600	199,600	574,800	375,200
5	2014	0	199,600	199,600	574,800	375,200
6	2015	0	199,600	199,600	574,800	375,200
7	2016	0	199,600	199,600	574,800	375,200
8	2017	0	199,600	199,600	574,800	375,200
9	2018	0	199,600	199,600	574,800	375,200
10	2019	0	199,600	199,600	574,800	375,200
11	2020	0	199,600	199,600	574,800	375,200
12	2021	0	199,600	199,600	574,800	375,200
13	2022	477,900	150,500	628,400	574,800	<b>53,600-</b>
14	2023	0	150,500	150,500	574,800	424,300
15	2024	0	150,500	150,500	574,800	424,300
16	2025	0	150,500	150,500	574,800	424,300
17	2026	0	150,500	150,500	574,800	424,300
18	2027	0	150,500	150,500	574,800	424,300
19	2028	0	150,500	150,500	574,800	424,300
20	2029	0	150,500	150,500	574,800	424,300
21	2030	0	150,500	150,500	574,800	424,300
22	2031	0	150,500	150,500	574,800	424,300
23	2032	0	150,500	150,500	574,800	424,300
24	2033	477,900	150,500	628,400	574,800	<b>53,600-</b>
25	2034	0	150,500	150,500	574,800	424,300
26	2035	0	150,500	150,500	574,800	424,300
27	2036	0	150,500	150,500	574,800	424,300
28	2037	0	150,500	150,500	574,800	424,300
29	2038	0	150,500	150,500	574,800	424,300
30	2039	0	150,500	150,500	574,800	424,300
31	2040	0	150,500	150,500	574,800	424,300
32	2041	0	150,500	150,500	574,800	424,300

Source: JICA Study Team

## **CHAPTER 13            TECHNOLOGY TRANSFER**

### **13.1     General**

Technology transfer to the counterpart personnel was carried out by the Study Team throughout the study period, in accordance with the Technology Transfer Program.

### **13.2     Execution of Technology Transfer**

#### **13.2.1    On the Job Training**

Eleven experts of the Study Team were assigned during the study period. The major technology transfers executed by the experts as part of on the job training are as follows:

- (1) Management Works
  - Preparation of working schedule
  - Overall management of field work
  - Discussion with other agencies and organizations
  - Preparation of basic plans
  - Presentation of reports
- (2) Hydrological Analysis/Water Harvesting
  - Collection for necessary information and data on the subject related to hydrology
  - Participation of field reconnaissance
  - Hydrological analysis
- (3) Groundwater Analysis/Hydrogeology & Water Quality
  - Collection for necessary information and data on the subject related to groundwater, hydrogeology & water quality
  - Participation of field reconnaissance
  - Groundwater analysis
- (4) Satellite Image/GIS Database
  - Collection for necessary information and data on the subject related to GIS database
  - Method of integrated management for GIS
- (5) Plan and Design for Spring Water Conveyance System
  - Collection for necessary information and data on the subject related to spring water conveyance system
  - Participation of field reconnaissance
  - Preparation of inventory survey
  - Compilation and analysis of data collected
  - Preparation of basic plan
- (6) Plan and Design for Agricultural Well
  - Collection for necessary information and data on the subject related to

- agricultural well
  - Participation of field reconnaissance
  - Preparation of inventory survey
  - Compilation and analysis of data collected
  - Preparation of basic plan
- (7) Plan and Design for Storm Water Harvesting
- Collection for necessary information and data on the subject related to storm water harvesting
  - Participation of field reconnaissance
  - Selection of water harvesting site
- (8) Water Management
- Collection for necessary information and data on the subject related to water management
  - Participation of field reconnaissance
  - Water saving irrigation methods
- (9) Organization of Water Management/Social Environment
- Collection for necessary information and data on the subject related to organization of water management/social environment
  - Participation of field reconnaissance
  - Preparation of baseline survey
  - Compilation and analysis of data collected
  - Preparation of basic plan
- (10) Environment Impact Assessment
- Collection for necessary information and data on the subject related to environmental impact assessment
  - Preparation of initial environmental examination

Investigation and planning works were conducted through several discussions with the counterpart personnel. Constructive opinions have been often obtained from the counterpart personnel in due course of the study. The counterpart personnel are expressing that same process conducted in this study will be adopted for preparation of future development plan.

### **13.2.2 Training Course in Jordan**

Storm water harvesting is one of the proposed measures for the water resources development in the study area. However, this experience is the first in Palestine. Meanwhile in Jordan, where natural conditions such as geology and climate are similar to Palestine, already has existing facilities related to storm water harvesting. They have familiarity with high techniques and have extensive experiences in planning, design, construction and operation and maintenance in said field.

Under this situation, a training course in Jordan was organized, aiming to develop the skills of the Palestinian counterpart personnel on technologies related to surface water

monitoring for development of storm water harvesting as well as ground water monitoring for better ground water resources management.

The training course was carried out according to the following program attended by eight participants (five from PWA and three from MoA).

**Table 13.2.1 Training Course in Jordan**

Date	Curriculum
June 29, 08	<p><b>Surface Water</b></p> <ul style="list-style-type: none"> <li>- Measurement and analysis of surface water in Wadi catchments area</li> <li>- Floods measurements including how to use and maintain equipment (such as sensors, data logger, etc.)</li> <li>- Field data analysis and hydrograph</li> </ul>
June 30, 08	<p><b>Rainfall</b></p> <ul style="list-style-type: none"> <li>- Rain fall measurements and analysis of the field data</li> </ul>
July 01, 08	<p><b>Groundwater</b></p> <ul style="list-style-type: none"> <li>- New techniques on ground water monitoring and analysis of the field data</li> </ul>
July 02, 08	<p><b>Field Visit of Storm Water Harvesting</b></p>
<div style="display: flex; flex-wrap: wrap;">     </div>	
<p>Scenes of the training</p>	


Source: JICA Study Team

The participants reported that they have taken an image of storm water harvesting and methods of water resources management through the training course. It is expected that basic data arrangement required for preparation of storm water harvesting plan and strengthening of water resources management will be made.

### 13.2.3 Seminar on Water Resources Development and Management



As a part of technology transfer as well as information disclosure, seminars on water resources development and management in the Jordan River Rift Valley were held twice. The summaries of the seminars are described in the following tables.

**Table 13.2.2 Summary of First Seminar**

Date	May 28 <sup>th</sup> , 2008	
Venue	Best Eastern Hotel, Ramallah	
Objectives	<ul style="list-style-type: none"> <li>- To promote awareness on water resources in the Jordan River Rift Valley</li> <li>- To deepen the participants' understanding on the Study and the pilot project</li> <li>- To exchange opinions in order to improve the water resources development and management in the Jordan River Rift Valley</li> </ul>	
List of Attendance (64 persons in total)	<p><b><u>Palestinian government and village council</u></b> MoA, PWA, EQA, MoP, NARC (National Agriculture Research Center), Nwai'mah and Dyuk Village Council</p> <p><b><u>International supporting organizations</u></b> JICA, FAO, UNDP, ICRC, GTZ, GVC, Italian Cooperation, Oxfam, Spanish Cooperation</p> <p><b><u>Palestinian NGOs and companies related to agricultural water issues</u></b> House of Water and Environment (HWE), Palestinian Hydrology Group (PHG), Palestinian Agricultural Relief Committees (PARC), Union of Agricultural Work Committees (UAWC), Center for Engineering and Planning (CEP)</p>	
Agenda	Time	Contents
	9:30 - 9:35	Introduction
	9:35 -10:00	Opening statements from MoA and PWA
	10:00 -10:45	Outlines of the Study and the pilot projects
	10:45 -11:15	Overview of the Study Area
	11:15 -11:30	Coffee break
	11:30 -12:30	Progress of the pilot projects
	12:30 -13:00	Discussions and conclusion including message from JICA
Clarification and Discussion	<p>Following topics were mainly discussed and clarified among the attendances.</p> <p>1. Necessity of diesel generator for rehabilitation of agricultural wells Diesel generators are necessary for the pilot project on rehabilitation of agricultural wells because of insufficient electricity supply and future possibility of rural electrification.</p> <p>2. Promotion of rural electrification To reduce operation costs of agricultural wells, rural electrification should be promoted in cooperation with related organizations. Along with its progress, the rehabilitation plan of agricultural wells should be adjusted.</p> <p>3. Sustainable operation and maintenance of agricultural wells In order to realize the sustainable operation and maintenance of agricultural wells, it is essential to form a joint body among well owners and users, such as WUA.</p>	
		
Scenes of the seminar		

Source: JICA Study Team

**Table 13.2.3 Summary of Second Seminar**

Date	November 19 <sup>th</sup> , 2008	
Venue	Best Eastern Hotel, Ramallah	
Objectives	<ul style="list-style-type: none"> <li>- To promote awareness on water resources in the Jordan River Rift Valley</li> <li>- To deepen the participants' understanding on the final outputs from the Study</li> <li>- To exchange opinions for further improvement of the water resources development and management in the Jordan River Rift Valley</li> </ul>	
List of Attendance (71 persons in total)	<p><b><u>Palestinian government and village council</u></b> MoA, PWA, EQA, MoP, Ministry of Local Government (MoLG), NARC, Palestinian Industrial Estates &amp; Free Zones Authority (PIEFZA), Nwai'mah and Dyuk Village Council</p> <p><b><u>International supporting organizations</u></b> Embassy of Japan, JICA, FAO, UNDP, ICRC, GTZ, Italian Cooperation, Spanish Cooperation, Karlsruhe University-Germany</p> <p><b><u>Palestinian NGOs and companies related to agricultural water issues</u></b> HWE, PHG, PARC, UAWC, CEP, Al-Quds University, Birzeit University,</p>	
Agenda	Time	Contents
	9:30 - 9:35	Introduction
	9:35 -10:05	Opening statements from MoA, PWA and JICA Palestine Office
	10:05 -10:35	Presentation on overview of the Study
	10:35 -11:35	Presentation on the pilot projects
	11:35 -11:50	Coffee break
	11:50 -12:10	Presentation on on-farm water management
	12:10 -12:40	Presentation on environmental examination and data management
12:40 -13:15	Discussion and conclusion	
Clarification and Discussion	<p>Following topics were mainly discussed and clarified among the attendances.</p> <p>Q1. Studies on water harvesting were conducted by some organizations. Did the Study team refer and use their reports in order to formulate the basic plan of storm water harvesting and to examine its feasibility?</p> <p>A1. The reports were referred to formulate the basic plan. However, to conduct the feasibility study and designing of water harvesting structures, the data documented in the reports is insufficient especially on hydrological information. This is the reason why hydrological monitoring of wadis is emphasized and recommended in the Study.</p> <p>Q2. To formulate WUA, which is better, one WUA in each well or in two or more wells?</p> <p>A2. Judged from the efficiency, more wells should be managed under one WUA if the wells are adjacent. However, such decision making should be finally decided by beneficiaries.</p> <p>Q3. There are many organizations working on water resources management. To avoid duplication of the works, did the Study take any measure?</p> <p>A3. No duplication work is conducted in Palestine especially in the Jordan River Rift Valley since all activities are managed under joint coordination between MoA and PWA through information sharing.</p> <p>As a conclusion of the 2nd seminar, chief counterpart personnel of MoA expressed his appreciation to the Study, and explained that two project proposals were submitted to the Japanese government in order to realize the development plans prepared under the Study.</p>	
<div style="display: flex; justify-content: space-around;">   </div>		
Scenes of the seminar		

Source: JICA Study Team

**14.1 Conclusion**

As a result of the feasibility study, the implementation of the proposed priority schemes is technically sound and economically viable. From the institutional and organizational, social and natural environmental aspects, it also shows that the schemes are generally sound. Execution of the schemes could accomplish the principal objective of efficient utilization of water, and increase of agricultural production through harmonized implementation of hardware and software components. Thus, it is concluded that the schemes should be implemented in a manner planned according to this Study.

**14.2 Recommendations**

- (1) The priority schemes for water resources development and management proposed by the Study are essential to achieve the effective use of water resources in Palestine. It should be noted that hardware component (consisting of rehabilitation of agricultural wells and improvement of spring conveyance system as well as development of new water resources) be implemented together with software component (comprising of establishment of water users association for integrated management of agricultural wells, capacity building of O&M organizations and training of farmers on practices related to water saving irrigation).
- (2) During the execution of this study, shortage of data and information, particularly required for the preparation of new water resources development in the Study Area, have been experienced. Moreover, required investigations to support the existing data have also been difficult due to security permit situations. Accordingly, it is recommended that the rehabilitation and improvement of the existing irrigation system should be first executed since more accurate data and information are required for the preparation of new water resources development plan.
- (3) In connection with (2) above, storm water harvesting plan in this study has been prepared with several limited conditions due to insufficient data available for the preparation of the plan. It is recommended that information, such as meteorological and hydrological data, be accumulated during the short and medium term periods for the water resources development. Sufficient budget and the number of staff for those continuous monitoring activities should be secured. After these data are observed and collected sufficiently, the preliminary storm water harvesting plan prepared in this Study will be reviewed and revised accordingly to confirm its feasibility.
- (4) Any water resources development including rehabilitation and improvement of existing facilities in the Study Area require JWC approval, as well as permission from the civil administration of Israel, prior to implementation. It often takes time to obtain such approval and permission. Therefore, it is recommended that PNA shall initiate application of permits to JWC and Israeli civil administration ahead of time, in accordance with the implementation plan.



- (5) After the Study Period, it is recommended that monitoring and evaluation of the pilot project should be continued periodically by the Steering Committee of this Study. In particular, sustainability of WUA activity is the most important element for O&M of water supply facility. Lessons learned from WUA activity would be helpful for formation process in the priority schemes.
- (6) For the rehabilitation of agricultural wells, joint management through WUA by well owners and water users is important for the sustainable water management. In particular, introduction of water tariff system is vital for the future renewal of facility and equipment by the WUA. Clarification of water fee by tariff could help farmers to have motivation to examine and lower the production cost of agriculture produces.
- (7) Since electrification in the Study Area is under development, it is recommended that power sources for future plan such rehabilitation of wells should be examined depending on progress of the electrification, in order to save O&M cost.
- (8) There is a water resource registration system for wells in the central government, but it is not functioning well. Modification of the system is recommended in order to control and restrict well abstraction according to the license volumes in parallel with establishment of monitoring system of water utilization.
- (9) The central government does not have any registration system for springs although wells registration system exists. It is recommended to establish the registration, monitoring and restriction system of spring water right and its actual utilization as a bylaw.
- (10) A capacity development program of local authorities such as village councils is required as to be a part of organizations in charge of the national water resources management.
- (11) It is necessary to hold workshops for explanation of proposed new conveyance and distribution system and its operation and maintenance method and to conduct site investigations with water right holders to determine the new conveyance alignment, distribution boxes and outlets for farmers in the designing stages for the priority schemes.
- (12) Improvement of the other spring systems than the prioritized ones should be planned and designed after a study on detailed water right systems and confirmation of feasibility for establishment of a fair public spring water utilization system.
- (13) A proper water allocation between domestic and agricultural purposes is recommended to be planed by the central government through the proposed monitoring system of spring water discharges and utilization.
- (14) Untreated wastewater has been flowing from the Nablus city into the Wadis Far'a and mixing with some spring water which is also flowing into the wadis. The downstream users have no other choice but to use such deteriorated water. It is recommended to commence a project for development of wastewater collection and treatment system in Nablus as soon as possible.
- (15) Some of recommended wastewater reuse system will function as an inter-regional collection and conveyance system. It is necessary to introduce registrations of reused water right system in advance of its infrastructure development.

- (16) In parallel with the implementation of the priority schemes, proper on-farm water management should be extended. In particular, capacity development of extension agents is encouraged.
- (17) Based on the IEE study for the storm water harvesting, it is concluded that the environmental assessment study should be conducted prior to implementation of pilot project for the storm water harvesting.
- (18) Recycled water from wastewater and desalted water are other new water resource for irrigation purposes. The availability of recycled water depends on the progress of development of sewerage network and treatment systems in major cities. Introduction of water recycling from wastewater as well as desalination, in taking into consideration the shortage of absolute water volume in the study area, is recommended, although related details are excluded from this study.
- (19) Other than the water resources development in the basic plan of this study, many micro irrigation facilities in the field exist, such as micro spring, pond and others. It should be realized that these facilities need to be maintained in order to utilize the limited available water effectively.
- (20) All the findings and lessons learned through the implementation of the pilot projects are quite important and precious for the every stakeholder concerned to the water resources development and management in the Jordan River Rift Valley. Those findings and lessons learned are outcomes from what JICA Study Team and Palestinian counterparts have acquired through the implementation of the pilot projects of this study. It is recommended that those precious findings and lessons learned are reviewed either for the implementation of the priority schemes or preparation of other new water resources development and management plans by the related Palestinian authorities.

## *Attachments*

*Attachment-1*

*Scope of Work (S/W)*

SCOPE OF WORK  
FOR  
THE FEASIBILITY STUDY  
ON  
WATER RESOURCE DEVELOPMENT AND MANAGEMENT  
IN  
JORDAN VALLEY  
IN  
PALESTINE  
AGREED UPON  
BETWEEN  
THE AUTHORITIES CONCERNED  
OF  
PALESTINIAN NATIONAL AUTHORITY  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Ramallah, February 27, 2007

Dr. Azzam Tubalileh  
Deputy Minister  
Ministry of Agriculture  
Palestinian National  
Authority



Mr. Fadel Kuwajah  
Head  
Palestinian Water Authority  
Palestinian National  
Authority

Dr. Samir Al-Jarid  
Deputy Minister  
Ministry of Planning  
Palestinian National  
Authority

Mr. Takeshi Naruse  
Resident Representative  
Palestine Office  
Japan International  
Cooperation Agency

FK

## I INTRODUCTION

In response to the request of the Palestinian National Authority (hereinafter referred to as "PNA"), the Government of Japan has decided, in accordance with the relevant laws and regulations in force in Japan, to conduct The Feasibility Study on Water Resource Development and Management in Jordan Valley (hereinafter referred to as "the Study").

Based on the decision of Government of Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes, will undertake the Study in close cooperation with the authorities concerned of the PNA.

The present document sets forth the Scope of Works with regard to the Study.

## II OBJECTIVES OF THE STUDY

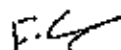
The overall goal of the Study is to enhance agricultural production making efficient use of limited available water resources for agriculture in the Jordan River Rift Valley under the concept of "The Corridor for Peace and Prosperity".

The objectives of the Study are:

1. To formulate a basic plan on water resources development and to conduct feasibility study on selected water resources management schemes for water resource development and for efficient utilization of water for agriculture including implementation of small scale pilot projects, and
2. To carry out technology transfer to Palestinian counterpart personnel through on-the-job training in the course of the Study.

## III STUDY AREA

1. Technical and social investigations for the basic plan will cover the West Bank of the Jordan River Rift Valley, which includes water head areas of Wadi Al-Qilt, Wadi Al-Auja and Wadi Al-Fara. The location map is attached as ANNEX I.



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2. The feasibility study will cover selected areas based on the results of technical and social investigations.

#### **IV SCOPE OF THE STUDY**

The Study period is divided into two phases. Phase-1 covers technical and socio-economic investigations for 9 months, and Phase-2 includes the feasibility studies for the selected schemes for 13 months.

##### **1. Phase 1: Technical and socio-economic Investigations and Draft Design of the Basic Plan**

1-1) Investigation on present situation for utilizing water resources and potential for water resources development


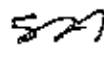
- a) Review of existing development programme(s), master plan(s) and project(s) which have a direct relevance to the Study
- b) Data collection and investigation on situation of rural community, irrigated agriculture, water resources and others
- c) Improvement and updating of existing GIS database for integrated water resources management

##### **1-2 Draft Basic Plan for Improvement of Spring Water Conveyance System for Ein Qilt, Ein Sultan, Ein Duyuk Group, Al-Auja, Al Fura and Al Badan Group**

- a) Data collection, inventory survey and field investigation of water resources on the spring water conveyance system (topography, water quality, discharge, facilities, water leakage, water right, water demand and its distribution, water tariff, management of facilities, and others.)
- b) Analysis and Evaluation of present condition and potential for improvement
- c) Prioritization of the spring water conveyance system
- d) Draft design of the basic plan for improvement of the spring water conveyance system
- e) Selection of schemes for the feasibility study on the spring water conveyance system

##### **1-3 Draft Basic Plan for Rehabilitation and Integrated Management of Agricultural Wells in the Jordan River Rift Valley**

- a) Data collection, inventory survey and field investigation on the agricultural wells (facilities, water resources, surroundings, usage and others.)
- b) Analysis and Evaluation of present condition and potential for rehabilitation





2

- c) Sociological assessment of possibilities for organizing the utilization of respective wells
- d) Technical assessment for rehabilitation of the agricultural wells and water distribution manners
- e) Prioritization of the agricultural wells
- f) Draft design of the basic plan for rehabilitation of the agricultural wells and water distribution systems
- g) Selection of schemes for the feasibility study on rehabilitation of agricultural wells and on institutional arrangement of water users association

#### 1-4 Draft Basic Plan for Storm Water Harvesting for Wadi Al-Qilt and Wadi Al-Fara Watersheds

- a) Analysis of topography and vegetation of the watersheds
- b) Hydrological analysis of watersheds
- c) Planning of hydrological observation stations and their installation
- d) Development of hydro-geological run-off model and simulation analysis based on the model
- e) Analysis and evaluation of present condition and potential
- f) Draft design of the basic plan for the storm water harvesting
- g) Selection of schemes for the feasibility study on the storm water harvesting of the wadis

#### 1-5 Planning of the pilot projects

Small scale pilot projects shall be selected and implemented under the following purposes:

- a) To verify the effect of the scheme,
- b) To collect accurate data / information for the optimum design of the schemes,
- c) To provide visual and quick impact on beneficiaries

#### 1-6 Initial Environmental Examination

### 2. Phase 2: Feasibility Study of the Selected Schemes and implementation of the pilot projects

#### 2-1 Implementation of the pilot projects

- a) Monitoring and operation of the pilot projects
- b) Evaluation of the results of the pilot projects and its feed back to the basic plan

3




2-2 Finalization of the Basic Plans based on the results of pilot projects

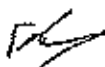
2-3 Implementation of the Feasibility study

- a) Environmental impact assessment for the selected schemes
- b) Detail topographic and geological study of the selected schemes
- c) Cost estimation and plan of construction for the selected schemes
- d) Planning operation and maintenance system of the agricultural wells with draft regulation of water allocation
- e) Feasibility analysis of the selected schemes by technical, economic, financial, social and environmental aspects based on the results of pilot projects and 2-2 a)-d) mentioned above
- f) Assessment of financial arrangement for implementation of the selected schemes

## V STUDY SCHEDULE/DURATION

The Study period shall be 22 months including implementation, monitoring and evaluation of the pilot projects. The details are shown in ANNEX II.

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## VI REPORTS

JICA shall prepare and submit the following reports in English

Inception Report:	Twenty (20) copies
Interim Report:	Twenty (20) copies
Progress Report(s)	Twenty (20) copies
Draft Final Report:	Twenty (20) copies at the end of phase 2; the PNA shall submit written comments on the DF/R to JICA within one(1) month of its receipt of the report
Final Report <sup>1</sup> :	Thirty (30) copies within two (2) months of the receipt of PNA's comments on the Draft Final Report

## VII UNDERTAKING OF THE AUTHORITIES CONCERNED OF PALESTINE NATIONAL AUTHORITY

1. In order to facilitate a smooth and efficient execution of the Study, PNA shall undertake the following necessary measures:
  - a) to secure the safety of the international members of the Study;
  - b) to permit the international members of the Study to enter, leave and sojourn in Palestine for the duration of their assignment therein and exempt them from foreign registration requirements and consular fees;
  - c) to exempt the international members of the Study from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into and out of Palestine for conduction of the Study;
  - d) to exempt the international members of the Study from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the international members of the Study for their services in connection with the implementation of the Study;
  - e) to provide necessary arrangements to the international members of the Study for remittance as well as utilization of the funds introduced into Palestine from Japan in

<sup>1</sup> The final report should be opened to the public

connection with the implementation of the Study;

f) to secure permission for the team of the Study to take all data and documents including topographic maps and original manuscripts related to the Study out of Palestine to Japan; and

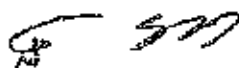
g) to facilitate medical services as needed. Its expenses will be chargeable on the international members of the Study.

2. PNA shall bear claims, if any arises, against the international members of the Study resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the international members of the Study.
3. Ministry of Agriculture and the Palestinian Water Authority shall act as the counterpart agency to the team of the Study and also, Ministry of Planning as the coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
4. PNA shall at its own expense, provide the team of the Study with the following in cooperation with organizations concerned:
  - a) available data and information related to the Study;
  - b) counterpart personnel;
  - c) suitable office space with necessary equipment in Jericho and Ramallah; and
  - d) credentials or identification cards.

## VIII UNDERTAKING OF JICA



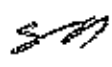
For the implementation of the Study, JICA shall undertake the following measures:

1. to dispatch, at its own expense, the team of the Study to Palestine; and
2. to facilitate technology transfer to the Palestinian counterpart personnel in the course of the Study.



## IX OTHERS

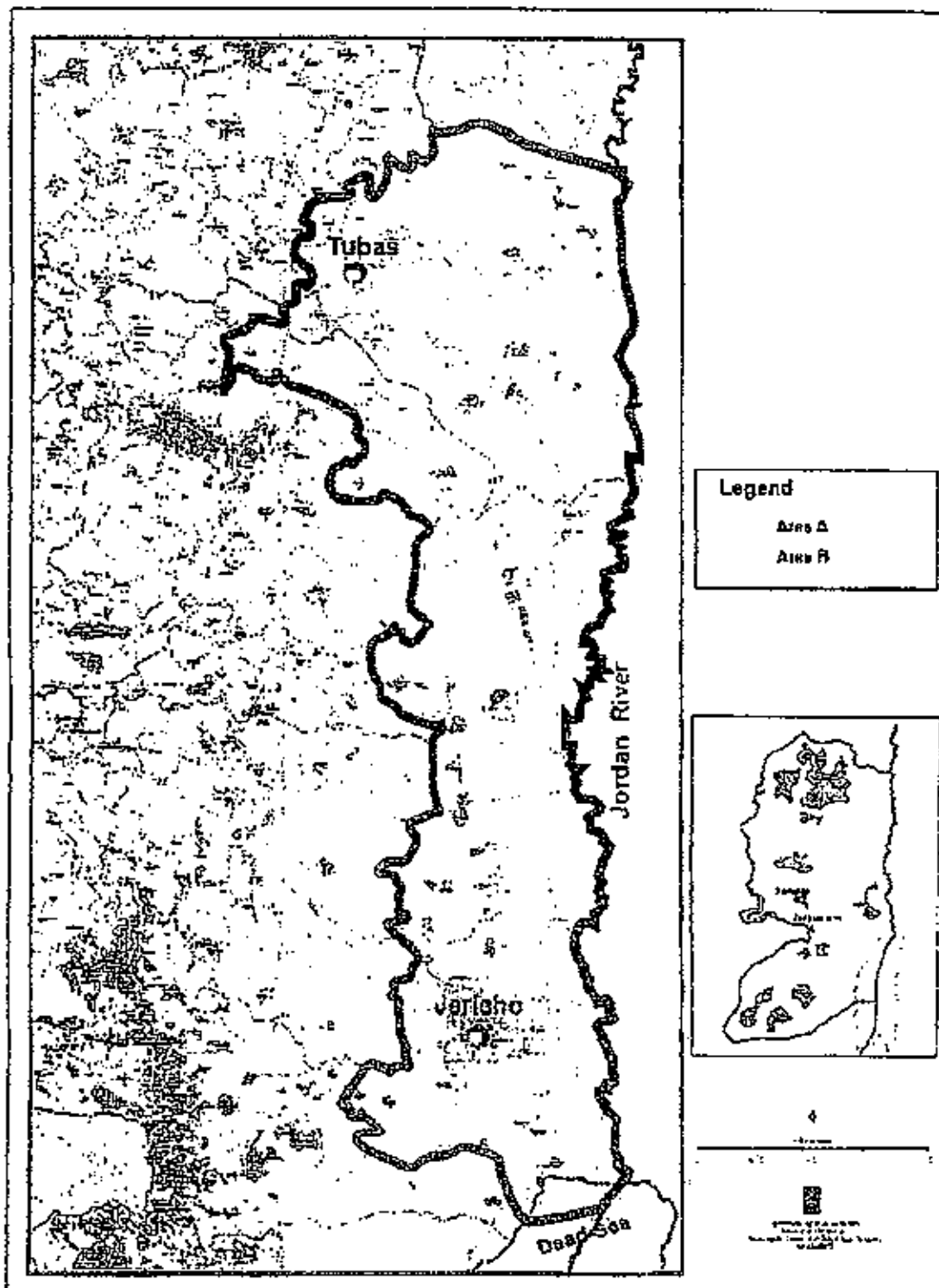
1. For the effective and successful implementation of the Study, a Steering Committee will be established whose functions and composition are described in ANNEX III.
2. JICA, Ministry of Agriculture, Palestinian Water Authority and Ministry of Planning shall consult with each other in respect of any matter that may arise from or in connection with the Study.

7

ANNEX I

The Location of the Study Area



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F.S

ANNEX II

TENTATIVE STUDY SCHEDULE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Work in Japan																							
Work in Palestine																							
Report	△ I/R						△ P/R (1)			△ I/R							△ P/R (2)				△ DF/R	△ F/R	
Phase	Phase 1										Phase 2												

I/R inception Report                      P/R (2) Progress Report (2)  
 P/R (1) Progress Report (1)            DF/R Draft Final Report  
 I/R interim Report                        F/R Final Report

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## ANNEX III

### STEERING COMMITTEE

#### 1. Functions

The Steering Committee shall;

- (1) discuss and decide overall strategies,
- (2) monitor and evaluate the progress of the Study,
- (3) appraise the outputs of the Study

#### 2. Compositions

The Steering Committee shall be composed of;

##### (1) Co-chairperson:

Deputy Minister of Agriculture  
Head of Palestinian Water Authority

##### (2) Coordinator:

Representative of Ministry of Planning

##### (3) Members:

Ministry of Agriculture  
Palestinian Water Authority  
Ministry of Planning  
Environment Quality Authority  
Resident Representative of JICA Palestine Office  
Leader of the Study Team  
Others appointed by the Chairperson



*Attachment-2*

*Minutes of Meeting on Inception Report*



MINUTES OF MEETING ON INCEPTION REPORT  
FOR  
THE FEASIBILITY STUDY ON WATER RESOURCE DEVELOPMENT AND  
MANAGEMENT IN JORDAN RIVER RIFT VALLEY

AGREED UPON

AMONG

MINISTRY OF AGRICULTURE, PALESTINIAN NATIONAL AUTHORITY,  
PALESTINIAN WATER AUTHORITY, PALESTINIAN NATIONAL AUTHORITY,  
MINISTRY OF PLANNING, PALESTINIAN NATIONAL AUTHORITY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

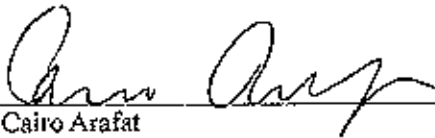
Ramallah, 3rd April, 2007



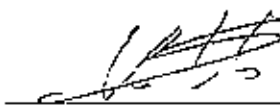
Dr. Azzam Tubalileh  
Deputy Minister  
Ministry of Agriculture (MoA),  
Palestinian National Authority



Eng. Fadel Ka'wash  
Head  
Palestinian Water Authority (PWA),  
Palestinian National Authority



Dr. Cairo Arafat  
Director General  
Aid Coordination and Management  
Department  
Ministry of Planning (MoP),  
Palestinian National Authority



Mr. Kunio Goto  
Leader of Study Team  
Japan International Cooperation Agency  
(JICA)

1. Venue: Meeting Room at Rocky Hotel Ramallah

2. Date: 3rd April, 2007

3. Time: 11:00 – 13:00

4. Attendants: refer to the attached list

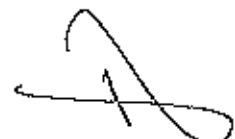
5. Subjects of Discussion

The Scope of Work for the Feasibility Study on Water Resource Development and Management in Jordan River Rift Valley (hereinafter referred to as "the Study") was agreed upon among the Ministry of Agriculture (hereinafter referred to as "MoA"), the Palestinian Water Authority (hereinafter referred to as "PWA") and Japan International Cooperation Agency (hereinafter referred to as "JICA") on 27th February, 2007. In accordance with the Scope of Work, the Government of Japan dispatched a JICA Study Team (hereinafter referred to as "the Study Team"), headed by Mr. Kunio Goto, for the implementation of the Study.

The Study Team submitted officially twenty (20) copies of the Inception Report in English and explained the basic concepts, methodology and schedule of the Study in the presence of Palestinian side. The list of participants is shown in Annex-1.

As a result of the explanations and exchange of opinions on the Inception Report, the Palestinian side and the Japanese side agreed upon the following points:

- (1) The Palestinian side confirmed that the contents of the Inception Report, which was revised based on the comments in the Steering Committee meeting, were prepared based on the conditions set forth in the Scope of Work for the Study and agreed that the Study Team would proceed to the next stage of the Study in accordance with the methodology and schedule mentioned in the Inception Report.
- (2) Both sides confirmed that the objectives mentioned in the Scope of Work shall be applied for the implementation of the Study.
- (3) Both sides agreed that the Study area is located in the West Bank of the Jordan River Rift Valley, which includes the watershed areas of Wadi Al-Qilt, Wadi Al-Auja and Wadi Al-Fara, as mentioned in the Inception Report.
- (4) In response to the request by the Japanese side, the Palestinian side confirmed to assign counterpart personnel for each member of the Study Team as shown in Annex-2. The counterpart personnel would participate in the activities of the Study according to the work schedule mentioned in the Inception Report.
- (5) The Palestinian side agreed to take responsibility to provide necessary reports, data and other information for the Study which Palestinian National Authority had, upon the request of the Study Team.
- (6) It was clarified that the technology transfer to the Palestinian counterpart personnel would be undertaken in the form of the on-the-job-training (OJT) including regular meeting throughout the course of the Study as well as in workshop held as shown in the work schedule in the Inception Report.



## LIST OF PARTICIPANTS

## 1. Co-chairperson:

- Dr. Azzam Tubalileh, Deputy Minister of Agriculture
- Eng. Fadel Ka'wash, Head of Palestinian Water Authority

## 2. Members:

(Ministry of Agriculture)

- Mr. Kasim M. Abdo, Director General, Soil and Irrigation
- Eng. Issam Nofal, Director, Water and Environment Resources Management
- Mr. Walid Hijizi, Director, International Cooperation Department

(Palestinian Water Authority)

- Eng. Deeb Abdel-Gafour, Director, Water Resources Department

(Ministry of Planning)

- Mr. Ibrahim Abdel-Rahim, Director, Americas & Far East Countries Department

(Environment Quality Authority)

- Mr. Ahmad Abu-Thaher

(JICA Study Team)

- Mr. Kunio Goto, Team Leader/Water Resource Management

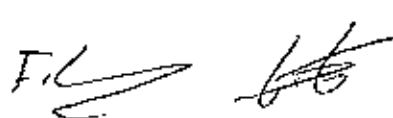
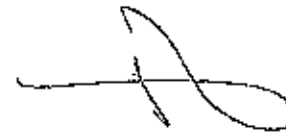
(JICA Palestine Office)

- Mr. Takeshi Naruse, Resident Representative, Palestine Office



## ANNEX II

Japanese Expert		Palestinian Counterpart	
Name	Position	Name	Organization
Kunio GOTO	Team Leader/ Water Resource Management	Issam Nofal Deeb Abdel Ghafoor	MoA PWA
Toshio KATAYAMA	Hydrological Analysis/ Water Harvesting	Motaz Husam Tlaib	PWA MoA
Toshiyuki WADA	Groundwater Analysis/ Hydrogeology & Water Quality	Deeb Majida Imad Ghanna	PWA PWA MoA
Masahiko TANIGUCHI	Satellite Image/GIS Database	Khaled Salem Yagoub Zaid Baha	EQA MoA PWA
Jun HORIMOTO	Plan & Design for Spring Water Conveyance System	Omar Zayed Mohannad Hej Hussin	PWA MoA
Abbas Zuhair KALBOUNEH	Plan & Design for Agricultural Well	Khairi Farah Sawufiah	PWA MoA
Yuji MURASE	Plan & Design for Storm Water Harvesting	Issam Nofal Omar Zayed	MoA PWA
Akio YAMASHITA	Water Management	Ibtisam Abu Haija Hani Qasem	MoA PWA
Yasunobu KUDO	Organization of Water Management/ Social Environment	Ayman Jarrar Abdel Aziz Rayyan Issam Nofal	PWA EQA MoA
Abbas Zuhair KALBOUNEH	Supervision of Pilot Project	Khairi Mohammad	PWA MoA
Honorato G. PALIS	Environmental Impact Assessment	Thaer Al-Rabi Mahmoud Abushanab	MoA EQA
Koji OTSUKA	Financial Analysis/ Project Evaluation	Kamal Issa Raed Al-Aghber Ibrahim Abdelrahim	PWA MoA MoP


***Attachment-3***

***Minutes of Meeting on 2nd Steering Meeting***

MINUTES OF MEETING ON 2ND STEERING MEETING  
FOR  
THE FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT AND  
MANAGEMENT IN JORDAN RIVER RIFT VALLEY

AGREED UPON

AMONG

MINISTRY OF AGRICULTURE, PALESTINIAN NATIONAL AUTHORITY,  
PALESTINIAN WATER AUTHORITY, PALESTINIAN NATIONAL AUTHORITY,  
MINISTRY OF PLANNING, PALESTINIAN NATIONAL AUTHORITY

AND

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)


Ramallah, 23rd July, 2007



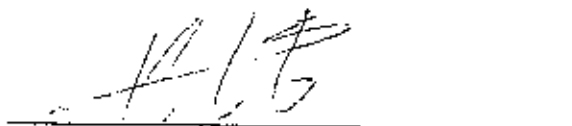
Dr. Azzam Tubalileh  
Deputy Minister  
Ministry of Agriculture (MoA),  
Palestinian National Authority



Mr. Fadel Ka'wash  
Head  
Palestinian Water Authority (PWA),  
Palestinian National Authority



Dr. Cairo Arafat  
Director General  
Aid Coordination and Management  
Department  
Ministry of Planning (MoP),  
Palestinian National Authority



Mr. Kunio Goto  
Leader of Study Team  
Japan International Cooperation Agency  
(JICA)

1. Venue: Meeting Room at Rocky Hotel Ramallah

2. Date: 23rd July, 2007

3. Time: 11:30 – 13:30

4. Attendants: refer to the attached list

**5. Subjects of Discussion:**

Upon the progress of the First Field Work in the Study, the Study Team explained major outcomes in the First Field Work, which mainly covered the contents of basic plan, the selection of pilot projects as well as the schedule of the Second Field Work in the presence of Palestinian side. The list of participants is shown in Annex-1.

As a result of the explanations and exchange of opinions on the basic plan and pilot projects, the Palestinian side and the Japanese side agreed upon the following points:

- (1) The Palestinian side confirmed contents and process of the proposed basic plan and the selected pilot projects and agreed to proceed to the next step for finalizing the plan.
- (2) Both sides confirmed that number of the pilot projects to be implemented is one for improvement of spring conveyance system and around eight for rehabilitation of agricultural wells.
- (3) Both sides confirmed that budget allocation for the implementation of the pilot project is under processing in JICA Headquarter.
- (4) In response to the request by the Japanese side, the Palestinian side confirmed to take actions necessary for the implementation of the pilot projects such as obtaining JWC's approval and agreement with beneficiaries in accordance with the implementation schedule as explained in the meeting.
- (5) The Palestinian side confirmed and agreed with the schedule of the Second Field Work of the Study.

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## List of Participants (2<sup>nd</sup> St/C Meeting)

### I. Ministry of Agriculture (MoA)

Dr. Azzam Tubalileh : Deputy Minister  
 Eng. Issam Nofal : Director of Water Department

### II. Palestinian Water Authority (PWA)

Eng. Fadcl Ka'wash : Head of PWA  
 Eng. Deeb Abdcl-Ghafour : Director of Water Resources Development Dept.

### III. Ministry of Planning (MoP)

Mr. Ibrahim Abdelrahim : Director of North, South America and Far East Countries

### IV. Environment Quality Authority (EQA)

Eng. Yaser Abu Shanab : Director of Public Health Department

### V. JICA Palestine Office

Mr. Takeshi Naruse : Resident Representative  
 Mr. Akihiro Iwasaki : Deputy Resident Representative

### VI. JICA Study Team

Mr. Kunio Goto : Team Leader/Water Resource Management  
 Mr. Jun Horimoto : Plan & Design for Spring Water Conveyance System  
 Mr. Abbas Zuhair KALBOUNEH : Plan & Design for Agricultural Well  
 Dr. Honorato G. PALIS : Environmental Impact Assessment  
 Mr. Akio Yamashita : Water Management



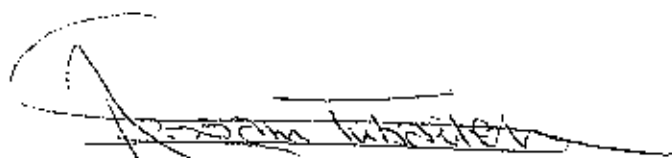
***Attachment-4***

***Minutes of Meeting on 3rd Steering Meeting***

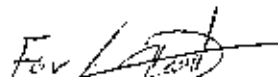
MINUTES OF MEETING ON 3<sup>rd</sup> STEERING MEETING  
FOR  
THE FEASIBILITY STUDY ON WATER RESOURCE DEVELOPMENT AND  
MANAGEMENT IN JORDAN RIVER RIFT VALLEY

AGREED UPON  
AMONG  
MINISTRY OF AGRICULTURE, PALESTINIAN NATIONAL AUTHORITY,  
PALESTINIAN WATER AUTHORITY, PALESTINIAN NATIONAL AUTHORITY,  
MINISTRY OF PLANNING, PALESTINIAN NATIONAL AUTHORITY  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)


Ramallah, 13th February, 2008



Dr. Azzam Tubalileh  
Deputy Minister  
Ministry of Agriculture (MoA),  
Palestinian National Authority




Eng. Fadel Ka'wash  
Head  
Palestinian Water Authority (PWA),  
Palestinian National Authority



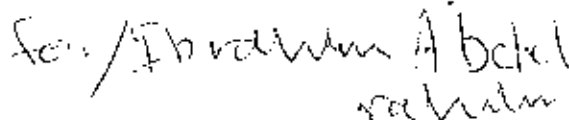
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Dr. Cairo Arafat  
Director General  
Aid Coordination and Management  
Department  
Ministry of Planning (MoP),  
Palestinian National Authority



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Mr. Kunio Goto  
Leader of Study Team  
Japan International Cooperation Agency  
(JICA)



1. Venue: Meeting Room at Rocky Hotel Ramallah

2. Date: 13th February, 2008

3. Time: 11:30 – 13:30

4. Attendants: refer to the attached list

5. Subjects of Discussion.

Upon the progress during the interim period of the Study, the Study Team explained major outcomes in the said period, which mainly covered the basic plan for water resources development and management, the activities and progress of the pilot projects, plan of the selected priority schemes as well as the schedule of the next field work in the presence of Palestinian side. The list of participants is shown in Annex-1.

As a result of the explanations and exchange of opinions on the above subjects, the Palestinian side and the Japanese side agreed upon the following points:

- (1) The Palestinian side confirmed the concept and contents of the proposed basic plan and the selected priority schemes and agreed to proceed to the next step for the finalization of the plan.
- (2) Both sides confirmed the basic frame of the implementation program for the water resources development comprising of short term, medium term and long term plans.
- (3) Both sides confirmed that the large scale of storm water harvesting project will be implemented as a long term plan since the accumulation of the relevant data is still required for preparation of the plan. Both sides also confirmed that small scale pilot projects for the storm water harvesting will be programmed during the short and medium term in order to verify the sustainability and effectiveness of the future plans.
- (4) Both sides confirmed that ownership of the wells for the future O&M will be examined in the three alternatives throughout the pilot projects as explained in the meeting.
- (5) Both sides confirmed that the evaluation method for the pilot projects proposed by the study team will be applied to the study.
- (6) In response to the request by the Japanese side, the Palestinian side confirmed to take actions necessary for the implementation of the pilot projects and the execution of the study such as issuing official application to the JWC as well as beneficiaries in accordance with the implementation schedule of the pilot project and the study during the next field work as explained in the meeting.
- (7) The Palestinian side confirmed and agreed with the schedule of the Next Field Work of the Study.

## List of Participants (3<sup>rd</sup> St/C Meeting)

### I. Ministry of Agriculture (MoA)

Dr. Azzam Tubalilh : Deputy Minister  
 Eng. Issam Nofal : Director of Water Department

### II. Palestinian Water Authority (PWA)

Eng. Fadel Ka'wash : Head of PWA  
 Eng. Deeb Abdel-Ghafour : Director of Water Resources Development Dept.

### III. Ministry of Planning (MoP)

Mr. Ibrahim Abdelrahim : Director of North, South America and Far East  
 Countries

### IV. Environment Quality Authority (EQA)

Eng. Mahmoud Abu Shanab : Deputy D.G. for Environmental Protection

### V. JICA Palestine Office

Mr. Kazuhiko Sakamoto : Deputy Resident Representative  
 Dr. Masae Sumikoshi : JICA Expert / Project Coordinator

### VI. JICA Study Team

Mr. Kunio Goto : Team Leader/Water Resource Management  
 Mr. Toshiyuki Wada : Groundwater Analysis/ Hydrogeology & Water  
 Quality  
 Mr. Jun Horimoto : Plan & Design for Spring Water Conveyance System  
 Mr. Abbas Zuhair Kalbounch : Plan & Design for Agricultural Well/ Supervision of  
 Pilot Project  
 Dr. Masahiko Taniguchi : Satellite Image/GIS Database  
 Mr. Yasunobu Kudo : Organization of Water Management/Social  
 Environment  
 Mr. Akio Yamashita : Water Management

***Attachment-5***

***Minutes of Meeting on 4th Steering Meeting***

MINUTES OF MEETING ON 4th STEERING MEETING  
FOR  
THE FEASIBILITY STUDY ON WATER RESOURCE DEVELOPMENT AND  
MANAGEMENT IN JORDAN RIVER RIFT VALLEY

AGREED UPON


AMONG

MINISTRY OF AGRICULTURE, PALESTINIAN NATIONAL AUTHORITY,  
PALESTINIAN WATER AUTHORITY, PALESTINIAN NATIONAL AUTHORITY,  
MINISTRY OF PLANNING, PALESTINIAN NATIONAL AUTHORITY

AND


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Ramallah, 19th August, 2008



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Dr. Azzam Tubalileh  
Deputy Minister  
Ministry of Agriculture (MoA),  
Palestinian National Authority

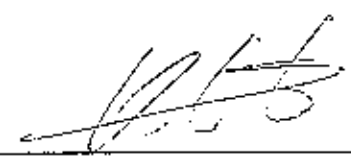


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Dr. Shaddad Al Attifi  
Head  
Palestinian Water Authority (PWA),  
Palestinian National Authority

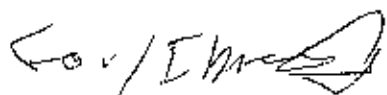
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Dr. Cairo Arafat  
Director General  
Aid Coordination and Management  
Department  
Ministry of Planning (MoP),  
Palestinian National Authority



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Mr. Kunio Goto  
Leader of Study Team  
Japan International Cooperation Agency  
(JICA)



1. Venue: Meeting Room at Rocky Hotel Ramallah
2. Date: 19th August, 2008
3. Time: 11:00 – 14:00
4. Attendants: refer to the attached list
5. Subjects of Discussion.

Upon the results throughout the study period, the Study Team explained contents of the Draft Final Report which covered basic plan of water resources development and management, activities and evaluation of the pilot projects and feasibility study of the priority schemes in the presence of Palestinian side. The list of participants is shown in Annex-1.

As a result of the explanations and exchange of opinions on the above subjects, the Palestinian side and the Japanese side agreed upon the following points:

- (1) The Palestinian side confirmed the concept and contents of the proposed basic plan.
- (2) Both sides confirmed the basic frame of the implementation program for the water resources development comprising of short term, medium term and long term plans.
- (3) Both sides confirmed that a feasibility study for the storm water harvesting will be conducted after accumulation of the relevant data such continuous hydrological data with a period at least 5 years for long scale projects such as dams, and about 1-2 years for small scale project (pilot project).
- (4) Both sides confirmed the proposed plan of priority schemes for the rehabilitation and integrated management of agricultural wells and improvement of spring water conveyance system.
- (5) Both sides confirmed that monitoring and evaluation of the pilot project will be continued periodically. Palestinian side expressed to expect further assistance of JICA.
- (6) Both side agreed on the necessity to conduct further water resources development projects in near future based on the development plan proposed in this feasibility study report.



## List of Participants (4<sup>th</sup> StC Meeting)

- I. Ministry of Agriculture (MoA)**
- Dr. Azzam Tubalileh : Deputy Minister  
 Eng. Kasim M. Abdo : Director General of Soil & Irrigation Department  
 Eng. Issam Nofal : Director of Water Department
- II. Palestinian Water Authority (PWA)**
- Eng. Yousef Awayes : Director General of International Coordination  
 Eng. Deeb Abdel-Ghafour : Director of Water Resources Development Dept.
- III. Ministry of Planning (MoP)**
- Mr. Ibrahim Abdelrahim : Director of North, South America and Far East Countries
- IV. Environment Quality Authority (EQA)**
- Eng. Nedal Katbeh : Director General of Environmental Resources  
 Eng. Abdul Aziz Rayyan : Director of Water Quality Department  
 Eng. Amjad Al Kharay : Director
- V. Embassy of Japan**
- Mr. Daisuke Shibasaki : Third Secretary
- VI. JICA Palestine Office**
- Mr. Seiichi Koike : Resident Representative  
 Dr. Masae Sumikoshi : JICA Expert / Project Coordinator
- VII. JICA Headquarter**
- Mr. Takeshi Naruse : JICA Chief Advisor  
 Mr. Takuma Noguchi : Project Officer
- VIII. JICA Study Team**
- Mr. Kunio Goto : Team Leader/Water Resource Management  
 Dr. Yuji Murase : Plan & Design for Storm Water Harvesting  
 Mr. Jun Horimoto : Plan & Design for Spring Water Conveyance System  
 Mr. Abbas Zuhair Kalbouneh : Plan & Design for Agricultural Well/ Supervision of Pilot Project  
 Dr. Masahiko Taniguchi : Satellite Image/GIS Database  
 Mr. Yasunobu Kudo : Organization of Water Management/Social Environment  
 Mr. Akio Yamashita : Water Management  
 Dr. Honorato G. Palis : Environmental Impact Assessment  
 Mr. Koji Otsuka : Financial Analysis/Project Evaluation