

# **Ex-Post Project Evaluation 2014: Package II-7 (Jordan, Egypt)**

**September 2015**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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**Octavia Japan, CO., LTD.**

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The Arab Republic of Egypt

Ex-Post Evaluation of Japanese Grant Aid Project

“The Project for Rehabilitation of Monshat El Dahab Regulator on Bahr Yusef Canal”

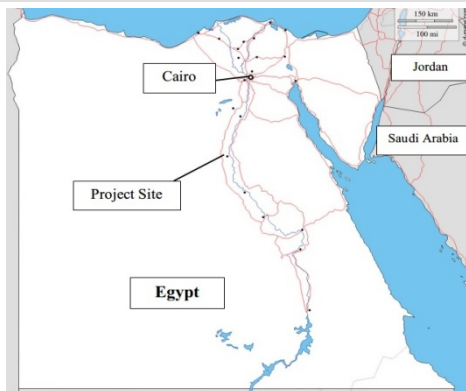
External Evaluator: Kenichi Inazawa, Octavia Japan Co, Ltd.

## **0. Summary**

This project rehabilitated the aged Dahab Regulator on Bahr Yusef Canal, the functioning of which was deteriorating. Located in central Egypt, the rehabilitation aimed to stabilize water levels upstream of the Dahab Regulator and to provide stable irrigation water to the targeted areas. At the time of the ex-post evaluation, the Government of Egypt formulates the National National Water Resources Plan 2017 and the Government aims to further stabilize the supply of irrigation water and improve agricultural productivities in the targeted beneficiary areas through the rehabilitation of the Dairut Regulator Group, located upstream of the Dahab Regulator; thus, this project is consistent with development needs. The project is also consistent with the assistance policy of Japan such as the Japan's Country Assistance Program for Egypt. Therefore, its relevance is high. Both the project cost and the project period fell within the original plan; thus, efficiency of the project is high. On the other hand, although the volume of irrigation water delivered from Bahr Yusef Canal to the beneficiary areas increased from what it had been prior to the project's commencement, as a result of the rehabilitation of the Dahab Regulator, the target value has not been achieved. Agricultural production (wheat and clover) exceeded the baselines and targets set prior to the project's commencement; thus it is presumed that this project has contributed to improved agricultural productivity to some extent. Meanwhile, according to a beneficiary survey, it is difficult to conclude that agricultural production and agricultural incomes have improved as a result of this project. Thus, effectiveness and impact of this project are fair. On the other hand, there are no particular problems in the institutional, technical and financial aspects of the operation and maintenance of this project, and sustainability of the project effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

## 1. Project Description



Project Location



Rehabilitated Dahab Regulator

### 1.1 Background

Bahr Yusef Canal<sup>1</sup>, which supports the agriculture of central Egypt, receives five billion m<sup>3</sup> of precious water; this is 9% of the country's scarce water resources, which are limited to 55.5 billion m<sup>3</sup>/year under the Nile Waters Agreement. Along the canal, four regulators have been constructed and played an important role in providing stable irrigation water to beneficiary areas. However, these regulators were almost 100 years old and were not functioning properly. Out of the four regulators, three regulators, i.e., the Lahoun Regulator (1997), Mazoura Regulator (2002) and the Sakoula Regulator (2006) were rehabilitated with Japanese assistance (Grant Aid Projects). The Dahab Regulator, which is located upstream of the three rehabilitated regulators, had a serious problem with water leaking from the installed gates (a total of 20 gates). Thus, there was a need to rehabilitate the Dahab Regulator with a view toward managing water properly, providing irrigation water to beneficiary areas in a stable manner and supplying the required discharge to downstream canals. Based on this situation, the Government of Egypt requested from the Japanese Government a grant aid project for rehabilitating the Dahab Regulator.

### 1.2 Project Outline

The objective of this project is to stabilize the water levels upstream of the Dahab Regulator and to provide stable irrigation water to the beneficiary areas by rehabilitating the Dahab Regulator located along Bahr Yusef Canal, which plays a central role in the irrigation system of central Egypt, thereby contributing to improve agricultural productivity and to the living

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<sup>1</sup> An irrigation canal, the flow of which starts in the Minia Governorate in central Egypt and flows through Beni Suef, Faiyum and Giza. Its total length is approximately 300 km.

standards of farmers.

Grant Limit / Actual Grant Amount	2,141 million yen / 2,131 million yen
Exchange of Notes Date	June 2008
Implementing Agency	Ministry of Water Resources and Irrigation (MWRI)
Project Completion Date	July 2010
Main Contractor	Dai Nippon Construction Co., Ltd
Main Consultant	Sanyu Consultants Inc.
Basic Design	September 2007
Detailed Design	June 2008
Related Projects	<p>【Grant Aid Projects】</p> <p>Project for Rehabilitation and Improvement of Bahr Yusef Canal (1995-1997)</p> <p>Project for Rehabilitation and Improvement of Mazoura Regulator at Bahr Yusef Canal (2000-2002)</p> <p>The Project for Rehabilitation and Improvement of Sakoula Regulator on Bahr Yusef Canal (2004-2006)</p> <p>【Technical Cooperation】</p> <p>(Technical Cooperation for Development Planning)</p> <p>Feasibility Study on Rehabilitation and Improvement of Delivery Water System on the Bahr Yusef Canal (1990-1992)</p> <p>(Technical Cooperation Project)</p> <p>Improving Small-Scale Farmers' Market-Oriented Agriculture Project (2014-2019)</p>

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa (Octavia Japan Co., Ltd.)

## 2.2 Duration of Evaluation Study

Duration of the Study:	September 2014-September 2015
Duration of the Field Study:	February 13, 2015-February 27, 2015 May 3, 2015-May 9, 2015

## 3. Results of the Evaluation (Overall Rating: A<sup>2</sup>)

### 3.1 Relevance (Rating: ③<sup>3</sup>)

#### 3.1.1 Relevance to the Development Plan of Egypt

At the time of the project planning, the Government of Egypt had formulated the Fifth Five-Year Plan (2002-2007), which identified seven objectives for the country's long-term socio-economic development<sup>4</sup>. Among these, food security associated with the population increase<sup>5</sup> was viewed as important. The government thus indicated its direction of (1) horizontal expansion (expansion of agricultural land) and (2) vertical expansion (production/productivity improvement) with a view toward improving food self-sufficiency. In this five-year plan, the Government of Egypt indicated that it would promote the integrated improvement of water resource development and an irrigation/drainage system as part of its policy for the agriculture/irrigation sector.

On the other hand, at the time of the ex-post evaluation, the Government of Egypt formulated a national strategic policy, the Strategic Framework for Economic and Social Development in 2011, with a target year of 2022. This policy stipulates the necessity for investing in the development and improvement of an irrigation system in order to protect the available land and water resources. In addition, the government also formulated its National Water Resources Plan 2017 in 2007 (revised in 2013), with a target year of 2017, which addresses the utilization and development of valuable water resources from socio-economic development and environmental perspectives, as well as the importance of utilizing irrigation water and its sustainable operation and maintenance.

In light of the above, this project was, and continues to be consistent with the development

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<sup>2</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory and D: Unsatisfactory.

<sup>3</sup> ③: High, ② Fair, ① Low.

<sup>4</sup> (1) Conservation of natural resources and the development of cities in desert areas; (2) stable decrease of the current population increase rate; (3) attainment of a high GDP rate and its sustainable development; (4) a slow escape from the deficit of the national income and expenditures; (5) poverty reduction and a decrease in income unbalance; (6) development of human capital and the realization of full employment; (7) improvement of social welfare.

<sup>5</sup> The population of Egypt was 57 million in 1991 and 70 million in 2004, prior to the project commencing. It is predicted that the population will reach 86 million by 2022. The source for these statistics is document provided by JICA (the Basic Design Study Report).

policy of Egypt at the time of the planning, as well as at the time of the ex-post evaluation.

### 3.1.2 Relevance to the Development Needs of Egypt

At the time of the project planning, the Dahab Regulator, which existed upstream of the three regulators along the Bahr Yusef Canal and which had been rehabilitated with Japanese Grant Aid Projects (Lahoun Regulator, Mazoura Regulator and Sakoula Regulator), was extremely old and 100 years had elapsed since its construction. Water leaked severely from the gates (20 gates in total) installed at the regulator and it required time to open and close the gates, as they were manually operated using human power. Thus, their function, as well as operation of the main body of the regulator were unstable. In order to improve this situation, there was a great demand for proper water management, a stable supply of irrigation water to the beneficiary areas and controlled discharge to downstream of the Bahr Yusef Canal through the rehabilitation of the main body of the Dahab Regulator.

On the other hand, there continues to be a development need for realizing a stable supply of irrigation water along the Bahr Yusef Canal at the time of the ex-post evaluation. The Asyut Regulator is the third regulator being constructed along the River Nile and originates from the Aswan High Dam in southern Egypt. Water taken in by the Asyut Regulator flows through the Dairut Regulator Group<sup>6</sup> to reach the Bahr Yusef Canal<sup>7</sup>. The Dairut Regulator Group is more than 100 years old and faces problems such as malfunctioning when opening and closing the gates. Therefore, the Government of Egypt is pursuing a plan to rehabilitate the Dairut Regulator Group with the aim of further stabilizing the supply of irrigation water to the beneficiary areas of the four rehabilitated regulators (Lahoun Regulator, Mazoura Regulator and Sakoula Regulator) along the Bahr Yusef Canal, which is located downstream of the Dairut Regulator Group, and to enhance agricultural productivity. JICA assisted the Feasibility Study for the Dairut Regulator Group Rehabilitation Project<sup>8</sup> and in March 2015, signed a loan agreement for a new ODA project, the New Dairut Regulator Group Construction Project. Based on these factors, it was judged that the development need was high for improving agricultural productivity through a stable supply of irrigation water in central Egypt at the time of the ex-post evaluation.

In light of the above, the necessity for rehabilitating regulators along the Bahr Yusef Canal

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<sup>6</sup> It consists of five regulators.

<sup>7</sup> Refer to Figure 1.

<sup>8</sup> Feasibility Study (2009- 2010)

and for improving agricultural productivity is considered equally important; thus, this project is consistent with the development needs of the country at the time of planning, as well as at the time of the ex-post evaluation.

### 3.1.3 Relevance to Japan's ODA Policy

The Japan's Country Assistance Program for Egypt, formulated in June 2000, sets out the following priority areas: (1) economic/social infrastructure and promotion of industry; (2) poverty countermeasures; (3) developing human resources and enhancing education; (4) conserving the environment and improving the living environment; (5) promoting tripartite cooperation (South-South cooperation). As part of the poverty countermeasures above, it said that “assistance relating to agriculture infrastructure and increased food production will be continued and that assistance is considered for agriculture/rural development, improved agricultural technology and agricultural processing and distribution as well as for fishery promotion.” This project extended its assistance in the priority area listed above (2) poverty countermeasures: agriculture/rural development); thus, it is consistent with the assistance policy of Japan.

This project has been highly relevant to the development plan and development needs of Egypt, as well as to Japan's ODA policy. Therefore, its relevance is high.



### 3.2 Efficiency (Rating: ③)

#### 3.2.1 Project Outputs

Table 1 shows the (plan and actual) outputs of this project.

Table 1: Outputs of This Project (Plan/Actual)

Plan (Before Project's Commencement)		Actual (At the Time of Ex-Post Evaluation)
<b>【Japanese Side】</b> (Rehabilitation of the Dahab Regulator and Associated Facilities)		
1	Rehabilitation of Dahab Regulator's main body (design water flow/design water level: maximum water flow 210.15m <sup>3</sup> /sec)	As planned
2	Renewal of water gates (installation of overflow gates: 8m x 4 gates)	As planned
3	Construction of regulator bridge (width: 10m)	As planned
4	Foundation work for a control house and installation of equipment such as remote consoles for the gates	As planned
<b>【Egyptian Side】</b>		
1	Construction of the control house	As planned
2	Inspection and repair of secondary canals	As planned
3	Custom clearance and payment of customs	This was exempted and was thus not implemented.
4	Securing and preparing temporary yard	As planned

Source: Document provided by JICA

The outputs by the Japanese and the Egyptian sides were generally implemented as planned<sup>9</sup>. Regarding the inspection and repair of secondary canals (refer to Table 2), which is input from the Egyptian side, the judgment was made at the time of planning that it was only necessary to improve the water distribution capacity of one canal (Rahiel Canal) among the secondary canals (13 canals in total). At the time, Rahiel Canal was narrow with a base width of 1.5m and its actual water flow was estimated to be 1.40m<sup>3</sup>/sec, compared to the design water flow of 2.08m<sup>3</sup>/sec; thus, it was deemed necessary to rehabilitate the canal, such as widening of the canal. This was planned and implemented by the Egyptian side, from the perspective of beneficiary's contribution. The reasons why the custom clearance and payment, which was input from the Egyptian side, was not implemented will be explained in the section "3.2.2.1 Project Cost".

<sup>9</sup> In July 2010, the Egyptian side, using its own funds, constructed a concrete protection wall for some parts of the right side of the Dahab Regulator on landscaped grounds. This did not affect the actual cost and period of this project.



Photo 1: Dahab Regulator before rehabilitation

Source: Document provided by JICA  
(The Basic Design Study Report)



Photo 2: Dahab Regulator after rehabilitation  
(At the time of the ex-post evaluation)

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The initially planned project cost was approximately 2,458 million yen (of which 2,141 million yen was to be borne by the Japanese side and approximately 317 million yen was to be borne by the Egyptian side). In reality, the project cost was approximately 2,138 million yen (of which 2,131 million yen was borne by the Japanese side and approximately seven million yen was borne by the Egyptian side); thus, the project cost was lower than planned (approximately 84% of the plan).

While the actual project cost of the Japanese side remained almost within the plan, the project cost of the Egyptian side was significantly different from the initial plan. This was mainly because the custom duties for the materials and equipment that were budgeted at the time of the cost estimation were exempted by the Egyptian Government (the Ministry of Finance) following the project's commencement (worth approximately 280 million yen of the overall cost)<sup>10</sup>.

#### 3.2.2.2 Project Period

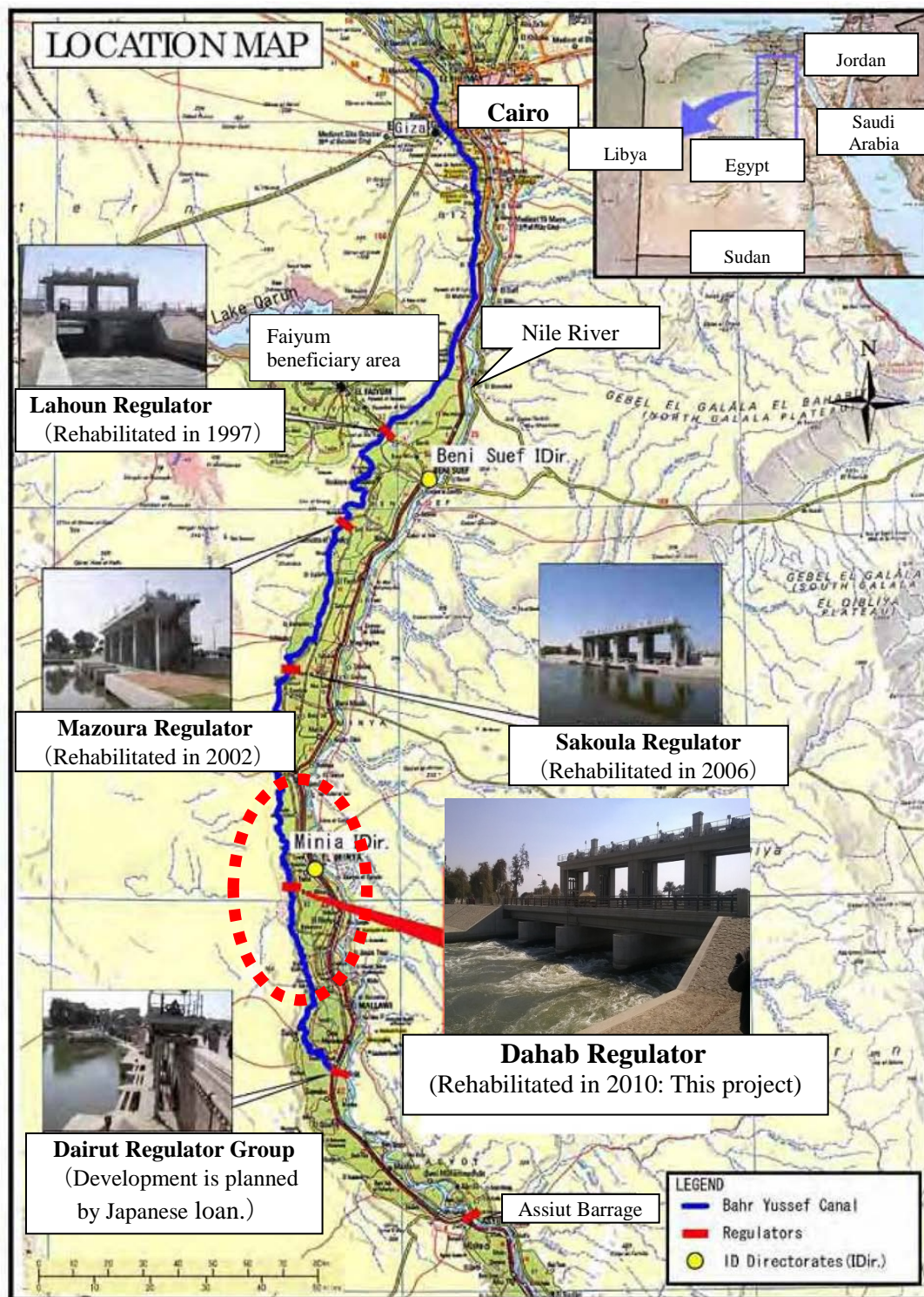
This project was planned to last for 34 months, starting from June 2008. The actual project period for the Japanese side was 26 months from June 2008 to July 2010, which was shorter than planned<sup>11</sup> (77% of the plan). It has been confirmed through interviews with the main

<sup>10</sup> While there was a discussion at the time of planning that custom duties associated with this project might be exempted by the Egyptian government, it was included in the initial project cost because it was not certain.

<sup>11</sup> The construction borne by the Egyptian side was completed by July 2010.

consultant, the Ministry of Water Resources and Irrigation (the implementing agency) and the West Minia Irrigation Directorate (a local operation and maintenance body) that the construction proceeded smoothly and without delays.

Both the project cost and project period were within the plan. Therefore, efficiency of the project is high.



Source: Document provided by JICA (Basic Design Study Report), the field survey conducted during the ex-post evaluation

Figure 1: Rehabilitated Dahab Regulator along the Bahr Yusef Canal (bold line), the Beneficiary Areas of This Project (dotted line) and Locations of Other Regulators

### 3.3 Effectiveness<sup>12</sup> (Rating: ②)

#### 3.3.1 Quantitative Effects (Operation and Effect Indicators)

In this project, (1) the volume of irrigation water and (2) the waiting time caused by congestion at the regulator bridge were set as operation indicators, and (3) agricultural production was set as an effective indicator; for each indicator, baseline and target were set at the time of project planning. Actual values for each indicator were obtained through this evaluation study and the results of these analyses were as follows:

##### (1) Volume of irrigation water

Table 2 shows the volumes of irrigation water (baseline, target and actual) from the Bahr Yusef Canal and delivered to the beneficiary areas, i.e., Monshat El Dahab, East Minia and West Minia (three areas in total) through the Dahab Regulator, as rehabilitated by this project.

Table 2: Volume of Irrigation Water (baseline, target and actual)

(Unit: Thousand m<sup>3</sup>/yr)

Baseline	Target	Actual			
2005 (Prior to project's commencement)	2011 (One year after project completion)	2011 (One year after completion)	2012 (Two years after completion)	2013 (Three years after completion)	2014 (Four years after completion)
427,445	489,650	465,782	451,070	451,795	445,635

Source: Document provided by JICA (prior to project's commencement); answers to the questionnaire (following the project's completion)

The actual values after completion have exceeded the baseline prior to the project's commencement. This is because the brick-style manual gates were upgraded to electric overflow gates with concrete bodies that can control the flow rate accurately and can be operated swiftly. As a result, water stopped leaking, which had been a problem prior to the project's commencement and the regulator was able to supply a stable volume of water.

On the other hand, the actual values have not reached their targets. According to the explanation, this may be due to the fact that for areas planted with rice, water consumption increased in the Faiyum beneficiary area (see Figure 1) near Lahoun, along the Bahr Yusef Irrigation Canal, after the project commenced and because the water demand is increasing in this area<sup>13</sup>. There is also significant water demand among farmers in beneficiary areas near the

<sup>12</sup> The sub-rating for Effectiveness is to be considered alongside Impact.

<sup>13</sup> According to the West Minia Irrigation Directorate, following the social unrest in 2011 (the Arab Spring), an increasing number of people opted for migrating to the Faiyum beneficiary area to engage in farming; thus, there is an increasing demand for water in this area.

Lahoun and Sakoula Regulators. Additionally, the Assiut Irrigation Directorate under the Ministry of Water Resources and Irrigation, which is responsible for water allocation, tends to be influenced by requests from these downstream beneficiary areas. In other words, because water allocation to downstream areas is prioritized<sup>14</sup>, the volume of allocated irrigation water to the beneficiary areas near Dahab Regulator is affected and not increasing, as was intended (see Table 2). Another factor affecting the situation is rapid population increase of Egypt<sup>15</sup>, while Egypt's water resources are limited to 55.5 billion m<sup>3</sup>/year under the Nile Waters Agreement and cannot be increased. The more downstream and closer to the capital city, Cairo, the larger the population grows; accordingly, cultivation is expanding in the downstream beneficiary areas such as Faiyum, as mentioned above. Nevertheless, crop land near the Dahab Regulator is also one of the beneficiary areas; thus, it can be said that revisiting and improving the management system for water allocation is necessary for the entire Bahr Yusef Irrigation Canal<sup>16</sup>.

Other factors include the aging Dairut Regulator Group (see Figure 1), which exists upstream of the Dahab Regulator, as mentioned above. While irrigation water along the Bahr Yusef Canal flows through the Dairut Regulator Group, more than 100 years have elapsed since the construction of the latter and problems exist regarding the controlling and opening-and-closing of gates, as well as with the management of water distribution. At the time of the ex-post evaluation, the Government of Egypt requested the Japanese Government to assist the "New Dairut Regulator Group Construction Project", which aims to rehabilitate this regulator and improve the water management system including that of the Bahr Yusef Canal. In March 2015, the Government of Egypt and the Government of Japan agreed to implement this as an ODA loan project. After completion of this project, more stable water supply and efficient water distribution are expected for the Bahr Yusef Canal as a whole. Thus, irrigation water volume from the Dahab Regulator to its beneficiary areas is also expected to increase.

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<sup>14</sup> As the volume of irrigation water is limited, water is distributed by integrating requests from downstream areas, including the downstream beneficiary areas. In other words, water is distributed by taking into consideration the total irrigation water needed by all areas.

<sup>15</sup> When this project commenced (2007), the population was 73.64 million; this number rose to 78.69 million at the project's completion (2010) and 84.63 million at the time of the ex-post evaluation (source: Central Agency for Public Mobilization and Statistics (CAPMAS)). According to IMF's projection, the population was estimated to reach 97 million in 2020 (source: World Economic Database, IMF (as of April 2015)). As explained in footnote 4, before the project's commencement, it was predicted that the population would reach 86 million in 2022. This means that the population is growing at a faster pace than what was estimated prior to the project's commencement.

<sup>16</sup> Additionally, in some cases, water distribution from each regulator to secondary canals is coordinated among different irrigation directorates along Bahr Yusef; in other cases, each irrigation directorate distributes water by opening and closing gates based on requests from farmers. In other words, water distribution along the canal is not managed in accordance with established rules. It is considered necessary that a water distribution plan be revisited and improved.



## 2) Waiting Time at the Regulator Bridge Due to Congestion

Table 3 indicates the waiting time at the regulator bridge, which was rehabilitated along with the Dahab Regulator. There has not been any vehicle waiting time since the completion of this project (July 2010). As a result of this project, widening the bridge from 4m to 10m saw two-lane traffic realized and vehicles no longer need to wait on one side of the bridge for a clear lane, making the traffic smooth (see Photo 3 and 4). Through regulator bridge inspections and interviews with staff members maintaining the Dahab Regulator during the field survey of the ex-post evaluation, it has been confirmed that congestion was addressed after widening of the bridge and that this had led to the smooth transportation of agricultural products. It can therefore be said that this project addressed the problem of waiting time for vehicles crossing the bridge.

Table 3: Changes in Waiting Time at the Regulator Bridge due to Congestion  
(Baseline, target and actual)

Baseline	Target	Actual
2005 (Prior to project's commencement)	2011 (One year after the completion)	2014 (Four years after the completion)
5 minutes	0 minute	0 minute

Source: Document provided by JICA (prior to the project's commencement); answers to the questionnaire and facts confirmed during the field survey (after completion)



Photo 3: Regulator Bridge and Road  
prior to Rehabilitation  
(narrow with a 4m width and prominent congestion)



Photo 4: Regulator Bridge and Road after  
the Rehabilitation  
(expanded to 10m wide by this project)

Source: Document provided by JICA (Basic Design Study Report)

### 3) Agricultural Production

Table 4 shows the changes in agricultural production (wheat and clover<sup>17</sup>) in the beneficiary area (approx. 38, 000 ha) served by the Dahab Regulator and rehabilitated by this project.

Table 4: Agricultural Production (baseline, target and actual)  
in the Dahab Regulator Beneficiary Area

(Unit: Thousand ton)

Crop	Baseline	Target	Actual			
	2005 (Prior to project's commencement)	2011 (One year after completion)	2011 (One year after completion)	2012 (Two years after completion)	2013 (Three years after completion)	2014 (Four years after completion)
Wheat	132,872	142,173	150,643	163,397	161,921	182,798
Clover	390,882	434,998	462,662	471,433	421,831	453,843

Source: Document provided by JICA (prior to the project's commencement); answers to the questionnaire (after the project's completion)

The actual values (for 2011 and onwards) have exceeded the baseline and target set prior to the commencement of this project. While through this project, the rehabilitation of Dahab Regulator has presumably contributed to improved agricultural productivity to a certain extent, it is perhaps more attributed to other factors such as improvement in agricultural technologies. According to farmers in the beneficiary areas who were interviewed during the ex-post evaluation, production increased because fertilizer and seedlings improved and because agricultural machinery became widely available<sup>18</sup>.

At the time of the ex-post evaluation, a problem of waste dumping was observed such as livestock carcasses, household waste and waste from harvests (hereafter referred to as “wastes”) by farmers and residents in some areas along terminal irrigation canals. Additionally, some areas did not receive sufficient irrigation water according to the persons in charge and the site visits conducted during the field survey. These factors may hinder improvement in agricultural productivity. An imperfect waste collection system is one of the factors influencing the situation. There are no designated places for waste disposal, and farmers easily dump wastes along the canals as their awareness is limited. Although the West Minia Irrigation Directorate contracts private firms to clean and remove silt from the canal (major clean-ups are conducted semi-annually), waste is dumped directly after the cleaning. Therefore, it can be said that the

<sup>17</sup> These are the two main agricultural products of the beneficiary areas of this project. Clover is produced as livestock feed, particularly for horses, cows and goats.

<sup>18</sup> Although some farmers stated that agricultural productivity increased because of the water from the Dahab Regulator, its extent was limited.



irrigation directorate need to collaborate with municipalities to establish a more frequent and reliable waste collection system<sup>19</sup>.

### 3.3.2 Qualitative Effects (Other effects)

#### 1) Efficient Operation of Pumps

Some beneficiary areas along the secondary canal to which irrigation water is supplied from the Dahab Regulator (Monshat El Dahab Canal) use water-intake pumps, branch canals and relay pumps for irrigation. Prior to the commencement of this project, suction water levels of the water-intake pumps were not constantly stable, as the water level of the Dahab Regulator was unstable. It was expected that this project would stabilize suction water levels of the water-intake pumps by rehabilitating the Dahab Regulator, thereby improving the efficiency of pump operation. At the time of the ex-post evaluation, it was confirmed through interviews with the West Minia Irrigation Directorate and site inspections that the suction water levels of the pumping stations (two areas) along the Monshat El Dahab Canal were constantly stable. Therefore, it can be judged that there are no problems concerning the efficiency of water distribution from the Dahab Regulator to the beneficiary area, or with the operation of the pumping facilities.

#### 2) Improvement in Sanitation

Prior to the commencement of this project, the Dahab Regulator was so old that some gates were not functional and an underflow discharge was applied<sup>20</sup>. Livestock carcasses and wastes that float over from the upstream Bahr Yusef Canal accumulated on the upstream side of the regulator, which decayed and worsened the water quality. This project installed overflow-type gates at the regulator, making overflow discharge<sup>21</sup> possible. As a result, wastes stopped accumulating and sanitation around the regulator has improved.

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<sup>19</sup> This issue is not limited to the beneficiary area of this project, but is a common problem for Egypt. It has been confirmed through the interviews with the Ministry of Water Resources and Irrigation and other stakeholders that there are similar problems in other areas.

<sup>20</sup> Water gets discharged by going under the gate. In other words, the gate is lifted so that water can flow under the gate in this method.

<sup>21</sup> To the contrary to the underflow discharge method, water is discharged over the gate. It is relatively easier to control water levels and discharge rates as compared to the underflow method.

### 3.4 Impacts

#### 3.4.1 Intended Impacts

##### 3.4.1.1 Improvement of Agricultural Productivity and the Living Standards of Farmers in Central Egypt

It was expected that this project would stabilize irrigation water supply through the rehabilitation of the Dahab Regulator and thereby contribute to improvement in the agricultural productivity and living standards of farmers. As part of this ex-post evaluation, a beneficiary survey was conducted, targeting farmers who are receiving irrigation water from the Dahab Regulator through secondary canals, in order to assess improvements in the agricultural productivity and living standards of farmers. The questions and responses are summarized in Figures 2-5<sup>22</sup>.

Regarding the level of satisfaction with the rehabilitation of the Dahab Regulator, approximately 64% respondents said that they were “dissatisfied” or “very dissatisfied”, as shown in Figure 2; thus, there were relatively more farmers who were not satisfied. Although it is not directly linked to this project, many of those who were dissatisfied stated that the distribution of irrigation water was not efficient for the terminal canals. There is no problem concerning the water intake functioning of the Dahab Regulator and water distribution from the regulator; however, waste dumping along the terminal canals seems to be disturbing the water distribution. On the other hand, interviews revealed that many of the farmers who answered “very satisfied” and “satisfied” (28% in total) cultivate land upstream of the secondary canal close to the Dahab Regulator. This illustrates that there is waste-related water problems along the terminal canals, which explains why the level of dissatisfaction with the Dahab Regulator is high.

Regarding the improvement in agricultural incomes, many respondents answered “slightly improved” and “no change” (78% in total), as shown in Figure 3. The question shown in Figure 4 was exclusively directed at those who answered “greatly improved” and “slightly improved”. Many respondents mentioned “improved seeds/seedlings, fertilizer and pesticides”. As many selected “improved seeds/seedlings, fertilizer and pesticides”, it can be said that the contribution of this project to improvement in agricultural income is limited.

Figure 5 concerns a question regarding improvement in living standards. Many respondents

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<sup>22</sup> With the aim of measuring effectiveness and impacts accurately, farmers who have been cultivating in the target beneficiary areas (Monshat El Dahab, East Minia and West Minia) since before the rehabilitation of the regulator (prior to 2007). The beneficiary survey was conducted using a questionnaire and samples were drawn using the random sampling method. (n=103, out of which 98 were male and five were female.)

chose “no change” (96% in total); thus, it can be said that farmers are not truly experiencing improvements in living standards as a result of this project.

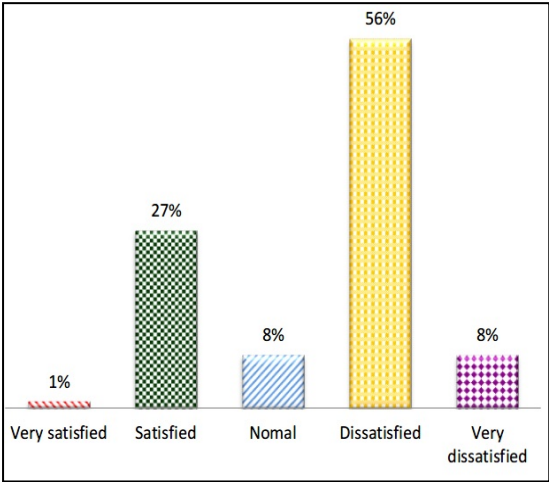


Figure 2: Are you satisfied with the rehabilitation of the Dahab Regulator?

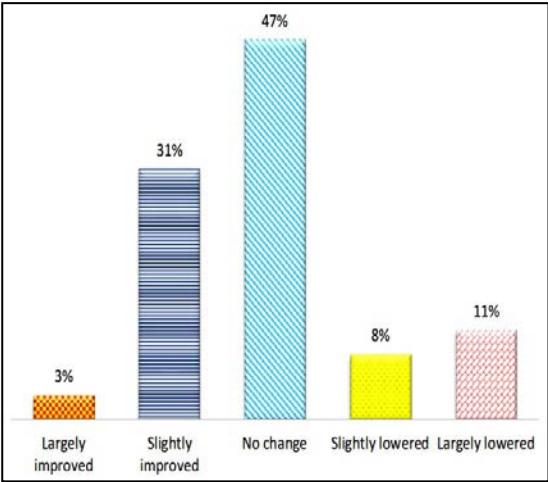


Figure 3: Has your agricultural income improve after the completion of this project?

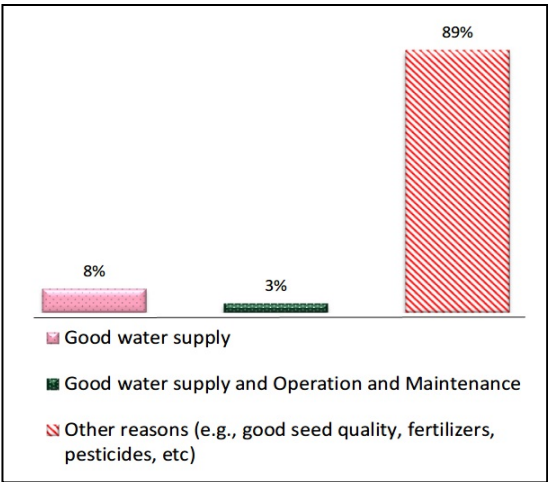


Figure 4: Why did your agricultural income improve? (n=35; this question was exclusively for those who answered “greatly improved” or “slightly improved”).

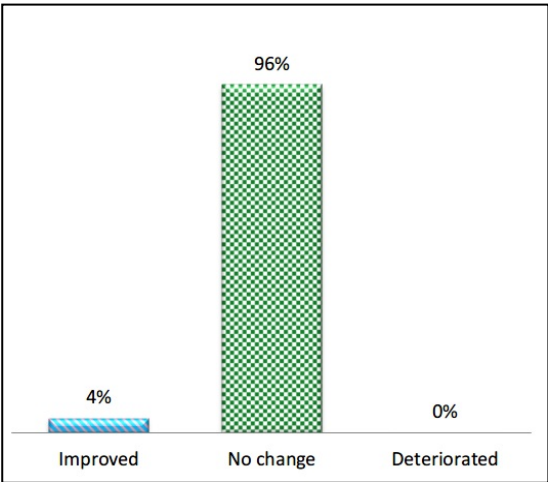


Figure 5: Do you think the living standard has improved compared to before the completion of this project?

In the interviews with the Ministry of Water Resources and Irrigation and the West Minia Irrigation Directorate, they commented on farmers’ incomes as follows: “While the incomes from the sales of agricultural products are increasing, the costs of fertilizer, seeds/seedlings, agricultural machineries and land rent are also increasing; thus, expenses are also substantial.” The impacts of the project on agricultural production and socio-economic vitalization are judged

to be limited because even though farmers' incomes increase, increase in costs due to inflation possibly offset the profits. In order to improve this situation, the above-mentioned issue of waste dumping along the terminal canals should be addressed. In addition, the improvement of water management for the entire Bahr Yusef Canal through the New Dairut Regulator Group Construction Project is also thought to be necessary. Such measures can enhance the impacts of this project.



Photo 5: Dairut Regulator Group  
(The mobile pulley above opens and closes the gates.  
The structure is generally old.)  
(At the time of the ex-post evaluation)



Photo 6: Beneficiary Area of This Project  
(The crop is clover)  
(At the time of the ex-post evaluation)

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

At the time of planning, it was judged that this project would not negatively impact the national environment and local society, as it aimed to rehabilitate the existing Dahab Regulator and its accessories. On the other hand, as environmental considerations during the project's implementation, it was planned that low-noise generators would be used and an oil fence would be installed along the canal for the cofferdam construction with the aim of preventing water pollution. It has been confirmed through interviews with the West Minia Irrigation Directorate and the Dahab Office that such considerations were implemented. Thus, it can be judged that this project has had no negative impact on the national environment.

With regard to the system for environmental monitoring related to this project's facilities such as the Dahab Regulator and the regulator bridge, it has been confirmed that the West Minia Irrigation Directorate is fulfilling its responsibilities. Should an environmental problem occur near the regulator, the Monshat El Dahab Irrigation Office staff members will respond, as will be elaborated in section "3.5.1 Institutional Aspects of Operation and Maintenance" below.

#### 3.4.2.2 Land Acquisition and Resettlement

This project primarily concerned rehabilitation. Through the questionnaires and interviews with the Ministry of Water Resources and Irrigation and the West Minia Irrigation Directorate, it has been confirmed that no new land acquisition or resettlement took place.

At the time of the ex-post evaluation, the water intake function of the Dahab Regulator was strengthened and the leakage problem was addressed as a result of the rehabilitation of the Dahab Regulator. Although the volume of irrigation water from the Bahr Yusef Canal to the beneficiary areas exceeded the baseline, it has not reached the target yet. Additionally, there is a problem with water passing in some parts of the terminal canals due to waste dumping, although this problem falls outside the scope of the project. While agricultural production is above the baselines and targets, many farmers attributed the increase in production to the improvement of fertilizers and seeds/seedlings, as per the interviews of the beneficiary survey. Thus, it can be said that this project's contribution to improved agricultural production was limited.

This project has to some extent achieved its objectives. Therefore effectiveness and impact of the project are fair.

### 3.5 Sustainability (Rating: ③)

#### 3.5.1 Institutional Aspects of Operation and Maintenance

The implementing agency of this project is the Ministry of Water Resources and Irrigation. On the other hand, the operation and maintenance of the rehabilitated Dahab Regulator and the associated regulator bridge is the responsibility of the West Minia Irrigation Directorate under the Ministry. However, the West Bahr Yusef Inspectorate under the Directorate carries out the actual operation and maintenance works. Furthermore, the Monshat el Dahab Irrigation Zone Office (hereafter referred to as "Dahab Office") under the Inspectorate functions as the field office<sup>23</sup>. Table 5 shows the organizations and roles concerning the operation and maintenance of this project.

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<sup>23</sup> The discharge allocation plan and water usage plan for the four regulators along the Bahr Yusef Canal and for the Dahab Regulator were completed by the Assiut Irrigation Directorate (functioning as an overall irrigation directorate) under the Ministry of Water Resources and Irrigation.

Table 5: Organizations and Roles concerning the Operation and Maintenance of This Project

Organizations	Operation and Maintenance Roles
West Minia Irrigation Directorate	Responsibility for maintenance of the Dahab Regulator and the Bahr Yusef Irrigation Canal within the Minia Governorate, communicating design water level, allocating budget, etc.
West Bahr Yusef Inspectorate (under the West Minia Irrigation Directorate)	Dredging of the canal along the Dahab Regulator, water intake facilities, operation and maintenance supervision of the facilities for branch canals, communicating design water levels, responsibility for the allocation of staff and budget, etc.
Monshat el Dahab Irrigation Zone Office (Field Office of the West Bahr Yusef Inspectorate)	On-the-ground management of the Dahab Regulator (day-to-day works), operation and maintenance of branch canal facilities, patrolling and guidance of the Dahab Regulator by technical staff, operation of the Dahab Regulator gates by gate operators, etc.

Source: Document provided by JICA (Basic Design Study Report) and interviews conducted during the field survey.

The number of staff at the time of the ex-post evaluation was 1,333 for the entire West Minia Irrigation Directorate, 194 for the West Bahr Yusef Inspectorate, and nine for the Dahab Office. The Dahab Regulator and the control houses were visited and the Dahab Office staff members were interviewed during the field survey, and it was confirmed that the office had a sufficient number of staff for the management of the regulator. Regarding the organizational structure for maintaining the Dahab Regulator, staff members of the Dahab Office developed maintenance plans and inspected the operation on a daily-basis.

The overall operation and maintenance of the Bahr Yusef Canal is the responsibility of the Ministry of Water Resources and Irrigation. Regarding each water-intake regulator, the Reservoirs and Grand Barrages Sector of the Ministry (hereafter referred to as “RGS”) is in charge of major repairs when the need arises. (However, up until the time of the ex-post evaluation, the need for major repairs was not arisen; thus, RGS has not yet performed any duty in this regard.)

In light of the above, it can be judged that there are no major problems with the institutional aspects of the operation and maintenance of this project at the time of the ex-post evaluation.

### 3.5.2 Technical Aspects of Operation and Maintenance

The staff members of the Dahab Office, under the West Bahr Yusef Inspectorate, open and close gates and maintain the Dahab Regulator, based on the operation and maintenance manual

provided by the contractor during the project's implementation. Additionally, they received training pertaining to the operation of the facilities and equipment (primarily the operation of overflow gates) during the project's implementation, as well as after the project's completion. Furthermore, they have three to five years of work experience on average and some of them are certified electricians<sup>24</sup>. Thus, it is observed that there are no issues with the technical aspects of the project.

Since the project's completion, staff members of the Dahab Office have not received any training. This is because the Dahab Regulator, which was manually operated prior to the project's commencement, is now power operated, which means less works for staff and no need for special training. The staff members are already equipped with the knowledge and skills for operating the equipment and handling the opening-and-closing of gates, because of the training they received during the project's implementation and upon completion of the project. They are handling the day-to-day operations based on the above-mentioned operation and maintenance manual. Thus, they are not in need of additional training. Through the interviews with the Dahab Office and the West Minia Irrigation Directorate, it has been confirmed that on-the-job training (OJT) is regularly provided to newly recruited staff. Newly recruited staff acquires knowledge and skills about the equipment and opening-and-closing of gates from existing staff.

In light of the above, it can be judged that there are no major problems with the technical aspects of the operation and maintenance concerning this project.

### 3.5.3 Financial Aspects of Operation and Maintenance

Table 6 shows the personnel cost, operation cost, maintenance cost and long-term repair cost of the Dahab Regulator. According to the West Minia Irrigation Directorate, which allocates the funds for these costs, necessary staff salaries have been expended and the needed necessary expenses have been expended, although the actual expenditure has not been made available<sup>25</sup>. Regarding long-term repairs, no expenditure has been made, because there has been no breakage or trouble since the completion of the project. It was confirmed through the interviews with RGBS and the West Minia Irrigation Directorate that should the needs arise in the future, RGBS would allocate funds and necessary repairs will be provided immediately.

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<sup>24</sup> For example, it is thought that they can deal with troubles relating to gate remote console and gate opening-and-closing system (electronic control).

<sup>25</sup> As mentioned above, the Dahab Regulator, which used to be manually operated before the project's commencement was upgraded to electric operation; as a result, less labor is required for maintenance works. It is presumed that this explains why the maintenance costs are not very high.

Table 6: Personnel Cost, Operation and Maintenance Cost and Long-term Repair Cost

(Unit: Egyptian pound (LE))

Item	Target (After 2010/11)	Actual			
		2010/11 (Completion year)	2011/12 (One year after completion)	2012/13 (Two years after completion)	2013/14 (Three years after completion)
Personnel Cost	100,000	103,000	110,000	112,650	124,680
Operation Cost	6,000	6,800	6,500	6,714	6,650
Maintenance Cost	3,000	(Although the actual amount is unknown, the West Minia Irrigation Directorate has been disbursing it.)			
Long-term Repair Cost	673,000	(In case of trouble/breakage, RGBS will allocate funds for long-term repairs.)			
Total		109,800	116,500	119,364	131,330

Source: Document provided by JICA (target after completion); answers to the questionnaire (following the project's completion)

Remark: 1 Egyptian pound (LE) = approximately 16 Japanese yen (early March 2015)

Table 7: Operation and Maintenance Costs of the West Minia Irrigation Directorate (actual)

(Unit: Egyptian pound (LE))

Expense	Actual		
	2011/12	2012/13	2013/14
Operation costs (including facility construction costs)	4,825,000	4,712,000	7,051,000
Maintenance costs	13,385,000	7,492,000	3,450,000

Source: Answers to the questionnaire

Remark: 1 Egyptian pound (LE) = approximately 16 Japanese yen (early March 2015)

The maintenance budget for the cleaning and dredging of terminal canals has been declining nation-wide in Egypt. This is because the budgets of governmental organizations have been reducing since the social unrest referred to as “the Arab Spring”, which occurred in 2011. Regarding this project, the Ministry of Water Resources and Irrigation has been allocating the full amount requested by the West Minia Irrigation Directorate for necessary maintenance up to the time of the ex-post evaluation<sup>26</sup>. Thus, it can be judged that there should be no particular concerns regarding the budget allocation for the time being. Table 7 shows the annual operation and maintenance budget allocated to the West Minia Irrigation Directorate in recent years. The maintenance budget of the West Minia Irrigation Directorate decreased from 2011/12 to 2013/14, because the budget up to 2013 was temporarily inflated due to large-scale dredging works and

<sup>26</sup> It was confirmed through the interviews with the West Minia Irrigation Directorate.



major gate repairs along terminal canals during the period of 2011-2013. Thus, it was explained that this should not be interpreted as a budget reduction. Based on these facts, it is judged that there are no concerns regarding maintenance budgets at the time of the ex-post evaluation<sup>27</sup>.

In light of the above, it can be judged that there are no particular problems with the financial aspects of the operation and maintenance of this project.

#### 3.5.4 Current Status of Operation and Maintenance

It has been confirmed through site visits during the field survey that the Dahab Regulator is fully functioning as an appropriate civil structure at the time of the ex-post evaluation, thanks to proper maintenance works. No problems were observed in the operational status of the main body of the regulator, gates, hoists or consoles inside the control building. Silt and wastes are being removed around the Dahab Regulator and the regulator bridge and roads are regularly cleaned.

With regard to spare parts, it has been confirmed that these are stored inside the constructed control building. There are sufficient numbers of gate hoist wires and grease, all of which can be procured domestically in Egypt. It has been confirmed through interviews that there are no particular problems with the procurement system concerning spare parts.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore, sustainability of the project's effects is high.

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<sup>27</sup> (Although it is outside the project scope) water is unable to pass along the terminal canals because of waste dumping, as explained earlier. As this issue should be addressed in order for agricultural productivity and agricultural incomes to improve, concerned organizations need to establish a better waste collection system while securing sufficient maintenance budget.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

This project rehabilitated the aged Dahab Regulator on Bahr Yusef Canal, the functioning of which was deteriorating. Located in central Egypt, the rehabilitation aimed to stabilize water levels upstream of the Dahab Regulator and to provide stable irrigation water to the targeted areas. At the time of the ex-post evaluation, the Government of Egypt formulates the National National Water Resources Plan 2017. In addition, the Government aims to further stabilize the supply of irrigation water and improve agricultural productivities in the targeted beneficiary areas through the rehabilitation of the Dairut Regulator Group, located upstream of the Dahab Regulator; thus, this project is consistent with development needs. The project is also consistent with the assistance policy of Japan such as the Japan's Country Assistance Program for Egypt. Therefore, relevance is high. Both the project cost and the project period fell within the original plan; thus, efficiency is high. On the other hand, although the volume of irrigation water delivered from Bahr Yusef Canal to the beneficiary areas increased from what it had been prior to the project's commencement, as a result of the rehabilitation of the Dahab Regulator, a target has not been achieved. Agricultural production (wheat and clover) exceeded the baselines and targets set prior to the project's commencement; thus it is presumed that this project has contributed to improved agricultural productivity to some extent. Meanwhile, according to a beneficiary survey, it is difficult to conclude that agricultural production and agricultural incomes have improved as a result of this project. Thus, the effectiveness and impact of this project are fair. On the other hand, there are no particular problems in the institutional, technical and financial aspects of the operation and maintenance of this project, and sustainability of the project's effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

### **4.2 Recommendations**

#### **4.2.1 Recommendations to the Implementing Agency**

The West Minia Irrigation Directorate commissions private companies to clean and remove silt from the canals (major clean-ups are conducted twice a year). However, it has been observed that farmers dump wastes the minute the silt removal/cleaning has been conducted. It is desirable that the West Minia Irrigation Directorate discuss with the West Minia Governorate and relevant municipalities the division of labor and the allocation of sufficient personnel for waste collection in the beneficiary areas, thereby exploring the establishment of an appropriate

cleaning and waste collection system together with those municipalities. Additionally, it is advised that advocacy works be conducted with a view toward preventing waste dumping by farmers.

#### 4.2.2 Recommendations to JICA

Following completion of the New Dairut Regulator Group Construction Project, it is worth considering evaluating the impacts of Japanese assistance to the Egyptian irrigation sector, such as the rehabilitation of water intake regulators along the Bahr Yusef Canal thus far, including this project, as well as assessing improvement in agricultural productivity in all beneficiary areas along the Bahr Yusef Canal (e.g., through an impact study). Combined with the rehabilitation of the Dairut Regulator Group, it is believed that the water distribution management plan along the Bahr Yusef Canal can be improved. Positive impacts are also expected in terms of the volume of water intake and agricultural productivity among the beneficiaries near each regulator.

#### 4.3 Lessons Learned

##### Enhancing Project Effects by Implementing Soft Component and Dispatching Technical Cooperation Experts

In the case of this project, although no problems were observed with the water intake function of the Dahab Regulator and water distribution from the regulator, water was unable to pass smoothly along terminal canals due to waste dumping. It would have been effective for the Japanese side to implement a soft component or dispatch technical cooperation experts with a view toward establishing a proper system for waste collection, by incorporating advocacy work within the project, such as seminars and workshops for farmers. Incorporating such soft components within the project is expected to realize regular waste collection and nurture moral behavior among farmers (not to dump waste), which will lead to a reduction in waste dumping.

The Hashemite Kingdom of Jordan

Ex-Post Evaluation of the Technical Cooperation Project

“Capacity Development Project for Non-Revenue Water Reduction in Jordan (Phase 1, 2)”

External Evaluator: Hirofumi Tsuruta, Octavia Japan Co., Ltd.

## 0. Summary

The projects strengthened the organizational capacity of Water Authority of Jordan (hereinafter referred to as “WAJ”) to organize countermeasures against non-revenue water (hereinafter referred to as “NRW”)<sup>1</sup> through by establishing an organizational structure and system, improving the technical ability of staff members through training, introducing pilot activities<sup>2</sup> and community awareness-raising activities, and developing a training curriculum and materials. In particular, Phase 1 focused on corrective NRW measures, and Phase 2 focused on preventive NRW measures. The relevance of the projects is “high” because both of phase 1 and phase 2 were fully consistent with national development policy including “Water Strategy for Jordan 2008-2022”, and with development needs to overcome high NRW rates, as well as with Japanese assistance policy prioritizing the enhancement of water supply capacity. Although NRW rates were not reduced enough to achieve the overall goal, the strengthening of the organizational capacity targeted by the project purpose was achieved, and organizational capacity and some activities improved by the project have been sustained. Thus, because it is difficult to conclude that the projects did not contribute to reducing NRW, the effectiveness and the impact can be rated as “fair.” Efficiency is also “fair” because the project cost of Phase 1 exceeded the plan, although the project period of Phase 1 and both the project period and cost of Phase 2 were as planned. Sustainability is rated as “fair” because some minor problems were observed in relation to the policy background and to organizational and financial aspects of the implementing agency.

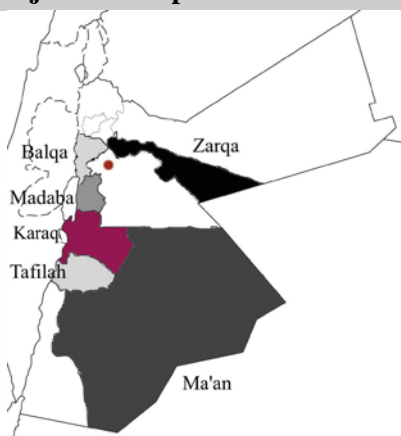
In light of the above, this project is evaluated as “partially satisfactory.”

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<sup>1</sup> NRW means water except authorized billed consumption among supplied water. Corrective NRW countermeasure means quick responses against problems including a repair work for a burst of a water pipe and/or continuous water leakage in a water pipe. In addition, preventive NRW countermeasure means an action to prevent water leakage by the improvement of the management of a water network such as reduction of water pressure.

<sup>2</sup> In Phase 1 the pilot activity selected one area in each six governorates of middle and southern region, and tried a series of corrective NRW countermeasures including mapping district metered area, detecting water leakage and conducting repair works. In Phase 2 the pilot activity select one area in each two governorates of middle and southern region, and tried preventive NRW countermeasures such as prevention of water leakage by water pressure control.

## 1. Project Description



Project Locations  
(Painted: Governorates where the pilot activity of the phase 1 was implemented)



Activity record and photos of Karak Governorate Water Administration  
(Sharing experiences through the record, photos and maps, etc.)

### 1.1 Background

The Hashemite Kingdom of Jordan (hereinafter referred to as “Jordan”) is a country facing a chronic shortage of water, with an annual average of less than 100 mm of rainfall over 80% of its land. Nowadays, the national population is also increasing<sup>3</sup>, exacerbating the water shortage. To ensure a sustainable water supply in this water shortage, it is essential for Jordan to manage its public water supply services appropriately by repairing leaks, preventing water theft, and ensuring that all service charges are collected.

However, during the planning of Phase 1 (2002), the national NRW rate<sup>4</sup> exceeded 50%, suggesting that the water supply service was not being managed appropriately. The WAJ recognized the importance of tackling such issues and took necessary action, but was impeded from getting excellent results by a chronic shortage of human resources. The WAJ clearly perceived the need to develop the technical level of the WAJ and to improve organizational structure focusing on NRW issues, in order to improve the effectiveness of the NRW counter measures.

To address challenges including the improvement of technical skills and organizational structure, Jordan requested assistance from the Japan International Cooperation Agency (hereinafter referred to as “JICA”) on a technical cooperation project (hereinafter referred to as “Phase 1”). JICA had dispatched a Japanese expert to improve Jordan’s NRW measures even before the start of Phase 1, and Jordan was becoming increasingly aware of the urgency of the NRW issues and importance of organizational development. For this reason, Jordan asked JICA to assist with a technical cooperation project to strengthen its

<sup>3</sup> Population growth rate is approximately 2.3% (statistics of World Bank, 2005)

<sup>4</sup> Generally, it is calculated by (the volume of unbilled authorized water) / (the volume of system input) x 100

organizational capacity to implement corrective NRW countermeasures. For this request, JICA agreed and implemented Phase 1 for three years, from August 2005 to July 2008.

It was acknowledged by both the Japanese and Jordanian sides that Phase 1 contributed to improve Jordan's corrective NRW countermeasures. At the same time, this phase identified some of the challenges relating to preventive NRW countermeasures; these included: 1) an increase in cases of a bust in a pipe and a meter and of water leakage due to inappropriate management without considering the water current; 2) cases of water leakage caused by poor quality work by private contractors; 3) an underdeveloped foundation for community awareness-raising activities.

In August 2007, after the completion of Phase 1, the WAJ requested a technical cooperation project (hereinafter referred to as "Phase 2") to strengthen its organizational capacity to undertake preventive NRW countermeasures. JICA agreed and implemented Phase 2 over 2.5 years, from February 2009 to August 2011.

## 1.2 Project Outline

		Phase 1	Phase 2
Overall Goal		NRW of WAJ is reduced.	NRW of water utilities in Jordan is reduced.
Project Purpose		Capacity development of WAJ on NRW reeducation measures	WAJ's capacity of taking preventive measure against NRW is improved.
Output(s)	Output 1	The preparation for the formulation of the project is completed.	WAJ's utilities' capacity of water network management is enhanced.
	Output 2	WAJ engineers and technicians <sup>5</sup> acquire essential concept and technology for NRW reduction	The mechanism for service pipe and meter installation is developed.
	Output 3	WAJ engineers acquire the implementation capability of internal training courses on NRW reduction	Relationship between WAJ and people for reduction of NRW is strengthened.
	Output 4	WAJ engineers and technicians acquire the practical technology on NRW reduction through filed work in pilot areas	
	Output 5	WAJ strengthen public awareness activity on NRW countermeasures	
Total Cost (Japanese Side)		467 million yen	331 million yen
Period of Cooperation		August, 2005 – July, 2008	February, 2009 – August, 2011
Implementing Agency		Water Authority of Jordan (under the Ministry of Water and Irrigation)	

<sup>5</sup> "Engineers" are those who receive technical education and hold official qualification. "Technicians" are those who don't receive technical education, but work as technical staff.

Other Relevant Agency/ Organizations	Community-based organizations (hereinafter referred to as “CBOs”) in each governorates where project activities were implemented, as cooperating agencies for community awareness-raising (including faith-based organizations, women’s organizations, schools, etc.)	
Supporting Agency/ Organization in Japan	Ministry of Health, Labour and Welfare, and joint venture of Nihon Suido Consultants Co., Ltd. and Tokyo Engineering Consultants Co., Ltd.	Ministry of Health, Labour and Welfare, joint venture of Nihon Suido Consultants Co., Ltd. and Tokyo Engineering Consultants Co., Ltd., and Bureau of Waterworks Tokyo Metropolitan Government
Related Projects	<p><b>【Japan’s technical cooperation】</b></p> <ul style="list-style-type: none"> <li>- Dispatch of individual expert on NRW (1999-2001)</li> <li>- Dispatch of individual on water distribution system management (2001-2003)</li> <li>- Dispatch of individual expert on NRW and water distribution management (2002-2004)</li> </ul> <p><b>【Japan’s grant aid】</b></p> <ul style="list-style-type: none"> <li>- Project for Improvement of Maintenance Equipment for Water Supply Facilities (1994)</li> <li>- Project for Improvement of Water Supply System to Greater Amman (1997)</li> <li>- Project for Improvement of Water Supply System to Greater Amman Phase 2 (1998-2001)</li> <li>- Project for Improvement of the Water Supply System for the Zarqa District (2003-2004)</li> <li>- Project for Improvement of the Water Supply System for the Zarqa District Phase 2 (2006-2010)</li> <li>- Project for Energy Conservation through Upgrading Water Supply Network (2010)</li> </ul> <p><b>【Projects of other donors】</b></p> <ul style="list-style-type: none"> <li>- Rehabilitation of the Water Supply Network in Greater Amman (World bank, European investment Bank, Italy, Grant Aid) (1999-2004)</li> <li>- Zai-Dabouq Water Project (KfW, loan)(2002-2003)</li> <li>- National Water Master Plan (GIZ, technical cooperation)(2002-2004)</li> <li>- Water Loss Reduction in the Northern Governorates (KfW, Grant Aid) (2003-2007)</li> <li>- Northern Governorates Water Transmission System Project (USAID, Grant Aid) (2004-2005)</li> </ul>	

### 1.3 Outline of the Terminal Evaluation

#### 1.3.1 Achievement Status of Project Purpose at the time of the Terminal Evaluation

##### 1.3.1.1 Phase 1

At the time of the terminal evaluation, it was judged that the project purpose had been nearly attained, as the outputs and indicators were mostly achieved. In particular, it was recognized that the technical and organizational capacity of the WAJ headquarters and the Governorate Water Administration (hereinafter referred to as “GWA”) to carry out corrective NRW countermeasures had been enhanced by Phase 1.

#### 1.3.1.2 Phase 2

At the time of the terminal evaluation, it was judged that the project purpose would be attained by the project completion because all of the outputs and indicators were mostly achieved. It was recognized that the organizational capacity to implement preventative NRW countermeasures, and the awareness and motivation of the six GWAs and Marka Training Center staff members were significantly improved.

### 1.3.2 Achievement Status of Overall Goal at the time of the Terminal Evaluation

#### 1.3.2.1 Phase 1

At the time of the terminal evaluation, it was judged highly possible for the NRW rate to decrease even after the end of Phase 1, because the NRW had already declined to 46.3% in 2005 and 44.6% in 2006. However, it was forecasted that it would be quite difficult to achieve the target number: “more than a 2% annual reduction.”<sup>6</sup>

#### 1.3.2.2 Phase 2

The terminal evaluation concluded that it was highly likely that Phases 1 and 2 would achieve their overall goal, because the WAJ and GWAs had awareness of the need for effective human resources development, as well as for corrective and preventive NRW countermeasures.

### 1.3.3 Recommendations at the time of the Terminal Evaluation

Recommendations made at the time of the terminal evaluation of Phases 1 and 2 and the actions taken by the WAJ headquarters and/or GWAs are shown in Table 1.

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<sup>6</sup> This was because the activities of Phase 1 were implemented mostly among GWAs and their impacts were limited to the GWAs. It was therefore concluded that the WAJ needed to institutionalize the process of the planning NRW countermeasures and budget allocations within the WAJ headquarters to expand the impact.



Table 1. Recommendation and actions taken after the end of the project

Recommendations	Actions taken after the project (Confirmation as of ex-post evaluation)
Phase 1	
A budget dedicated to NRW countermeasures should be allocated.	A budget dedicated to NRW countermeasures had not been allocated from the end of Phase 1 to the time of the ex-post evaluation.
The GWAs should analyze the cost-benefits of the NRW countermeasures on the basis of the results of pilot activities, and develop a plan for the NRW countermeasures, allocating personnel, equipment, and a budget.	By the end of Phase 1, a cost analysis had been conducted and a budget developed. However, a specific budget was not set after the end of Phase 1; operation and maintenance costs were relied on instead. As for human resources and equipment, by the end of Phase 2, staff and equipment were assigned to NRW countermeasures. When Phase 2 was over, the operations and maintenance staff took over their responsibilities. After 2012, when an NRW unit was established in the WAJ headquarters, staff members were assigned again in the GWAs for NRW issues.
Customer meters should be replaced periodically in order to reduce measurement errors.	In some areas, meters were replaced during Phase 2 pilot activities.
Water pressure management should be promoted to further reduce NRW.	The activities were conducted for the Output 1 of Phase 2.
A system of qualifications for technicians and plumbers (trained staff members requiring sufficient knowledge and skills to carry out corrective NRW measures) should be established to motivate GWA staff.	By the end of Phase 2, basic and middle level technicians had received technical certification in NRW countermeasures through examination; no further examinations were conducted after Phase 2.
Minimum night flow measurement should be conducted on a routine basis to further reduce NRW.	Because the night work allowance had not been paid in full, minimum night flow measurements were not carried out.
Phase 2	
GWA's action plans for the NRW countermeasures should be clearly mentioned in the WAJ's budget. (The GWA, for example, should include a separate budget for NRW countermeasures in the general budget submitted to WAJ headquarters. The Secretary General of the WAJ should instruct GWAs to prepare such a budget proposal.)	There was no specific budget for NRW countermeasures; as a result, the status of NRW countermeasures in the general budget plan was unclear.
Trained staff members should be utilized effectively (for example, to deploy into NRW-related sections, or to provide further training program on the NRW countermeasures).	After 2012, when the NRW unit was established, such activities were promoted. Previously, because the NRW countermeasures in the WAJ had been a part of operation and maintenance activities, the recommendation did not lead to the actions.

(Source) Recommendation: Terminal Evaluation Report for the Capacity Development Project for Non-Revenue Water Reduction (Phase 1, 2008) and the Terminal Evaluation Report of Phase 2 (2014)  
 Actions taken after the project: interviews with staff members at the WAJ headquarters and GWAs

## **2. Outline of the Evaluation Study**

### **2.1 External Evaluator**

Hirofumi Tsuruta, Octavia Japan Co., Ltd.

### **2.2 Duration of Evaluation Study**

Duration of the Study: September, 2014 – September, 2015

Duration of the Field Study: December 14, 2014 – December 28, 2014

March 13, 2015 – March 20, 2015

### **2.3 Constraints during the Evaluation Study**

No detailed data or information about the actual project cost of Phase 1 was acquired. As a result, it was not possible to ascertain why the actual cost exceeded the planned cost. Due to this, the efficiency mentioned below was analyzed and assessed by inferences from stakeholder interviews.

## **3. Results of the Evaluation (Overall Rating: C<sup>7</sup>)**

### **3.1 Relevance (Rating: ③<sup>8</sup>)**

#### **3.1.1 Relevance to the Development Plan of Jordan**

At the time of the ex-ante evaluation of Phase 1, the Government of Jordan had formulated its “National Social and Economic Development Action Plan 2004–2006” as a national development plan with four targets: 1) human resources development; 2) the improvement of public services; 3) rural development and poverty reduction; and 4) the improvement of organizations and institutions, in order to enhance living standards and quality. Under the second of these targets (the improvement of public services), the Government of Jordan clearly cited the need to improve the water situation through specific measures: “reduction of water leakage and NRW”, “decrease of the theft of underground water”, “improvements in the water supply system” and “development of a database of water resources and their uses”.

In addition, at the time of the ex-ante evaluation of Phase 2, the Government of Jordan set national goals that included “income generation”, “a rise in living standards”, and “an improved quality of life through social welfare”, in the “National Agenda 2006–2015”, the new National Development Plan. To achieve these goals, the Government promoted infrastructure development, and aimed to improve the efficiency of water supply networks to reduce operational costs and NRW. In addition, the water sector strategic plan, “Water Strategy for Jordan 2008–2022”, set quantitative targets, such as the following: “NRW rates should be under 25%; technical losses should be less than 15%.”

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<sup>7</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>8</sup> ③: High, ② Fair, ① Low

Moreover, at the end of Phase 2, Jordan's national development plan such as "National Agenda 2006–2015" and water sector strategic plan such as the "Water Strategy for Jordan 2008–2022" were still regarded as important policy documents.

In summary, from the beginning of Phase 1 to the end of Phase 2, Jordanian national development policy aimed to improve the water supply network and reduce NRW. For this reason, projects designed to implement NRW countermeasures were consistent with Jordanian national development policy.

### 3.1.2 Relevance to the Development Needs of Jordan

Jordan had a chronic water shortage at the time of the ex-ante evaluation of Phase 1. In the background, there are several NRW issues such as water resources were limited (the annual internal renewable water resources per capita was 135 m<sup>3</sup>/year (2005 estimate) in comparison with the international standard<sup>9</sup> of 500 m<sup>3</sup>/year), Jordan's population had recently grown<sup>10</sup>, and the rate of NRW exceeded 50%<sup>11</sup>.

The water shortage continued even at the time of the ex-ante evaluation of Phase 2. The NRW rate was also still high, around 45%.<sup>12</sup> In addition, the situation did not improve even by the end of Phase 2, and the NRW rate was very far from the target named in the Water Strategy for Jordan in 2008–2022, although it had decreased to 37.2%<sup>13</sup>. Jordan still needs to counteract NRW issues.

In summary, from the ex-ante evaluation of Phase 1 to the end of Phase 2, the Government of Jordan needed to tackle the issue of the NRW rate, which was high all over Jordan. Thus, the projects aiming at the capacity development of the WAJ to reduce NRW were consistent with the national development needs of Jordan.

### 3.1.3 Relevance to Japan's ODA Policy

At the time of the ex-ante evaluation of Phase 1, the Japan's Country Assistance Plan for Jordan (2004) prioritized the following areas: 1) the enhancement of basic life, 2) industry development, and 3) environmental protection. "Strengthening the water supply capacity" was included as a specific target under 1) enhancement of basic life.

In addition, the first draft of the Country Assistance Plan for Jordan (2008) listed the "effective use and environment of water resources" as a target, in which community activities to preserve water resources and the environment and NRW measures were major areas of cooperation.

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<sup>9</sup> "Water Supply and Water Use Statistics in Jordan," International Work Session on Water Statistics, Vienna, June 20–22, 2005

<sup>10</sup> See caption 3. Population growth rate is approximately 2.3% (statistics of World Bank, 2005)

<sup>11</sup> Statistics of the WAJ, 2002

<sup>12</sup> Statistics of the WAJ, 2006

<sup>13</sup> Statistics of the WAJ, 2011

In summary, as of the ex-ant evaluation of the projects, Japan's ODA Policies prioritized improving the water supply as well as NRW countermeasures. Therefore, the projects were consistent with Japan's ODA policies.

In light of the above, these projects were highly consistent with the country's development plan and development needs, as well as to Japan's ODA policy. Therefore, the relevance is high.

### 3.2 Effectiveness and Impact<sup>14</sup> (Rating: ②)

#### 3.2.1 Effectiveness

To evaluate effectiveness, it is necessary to clearly define the “the WAJ's capacity for taking NRW measures” mentioned as a project purpose of Phases 1 and 2. It is defined as the organizational capacity of the WAJ headquarters and the GWAs, not the individual capacity of staff members<sup>15</sup>. That is, this is the organizational capacity related to corrective and preventive NRW countermeasures (mainly including knowledge, skills, and experiences accumulated within the organization). Table 2 details this capacity. To judge effectiveness, we take into consideration not only outputs and the achievement of project purposes, but also the status of these four points at the projects' end.

Table 2. Aspects of the WAJ's capacity targeted during Phases 1 and 2

Aspects of the WAJ's capacity supported by the projects	Position within the projects
① Specialty for NRW countermeasures	Phase 1 covered the knowledge, skills, and experiences necessary for implementing corrective NRW countermeasures. Phase 2 covered the knowledge, skills, and experiences necessary for implementing preventive NRW countermeasures.
② Planning, budgeting, and project-managing capacity of GWAs	These were included as the indicators of the project purpose and the practice of pilot activities of Phases 1 and 2.
③ Internal training capacity	Output 3 of Phase 1 and Output 2 of Phase 2 included relevant activities (as designing the training curriculum, developing training materials, and training instructors.)
④ Ability to build a relationship with people	Output 5 of Phase 1 and output 3 of Phase 2 included relevant activities such as raising awareness of appropriate water use and preventing water theft.

Notice: The evaluator classified these using Phase 1 and Phase 2 activities and an analysis by a former Japanese expert.

<sup>14</sup> The sub-rating for Effectiveness is included with consideration of Impact.

<sup>15</sup> From the terminal evaluation report of Phase 1, p. 2–2. This definition was confirmed by both Japanese and Jordanian sides at the time of the mid-term review of Phase 1.

### 3.2.1.1 Project Output

#### 1) Phase 1

The outputs of Phase 1 were achieved. Phase 1 reconstructed the WAJ's organizational structure and system as planned, a unit working specifically on NRW measures was independent of the existing Operation and Maintenance Unit, and the responsibilities of the unit and GWAs for NRW measures were clarified (Output 1). Based on these responsibilities, the training curriculum, instructors, and training materials were developed, and a training structure was prepared (Output 3). Training and pilot activities were conducted in parallel with these activities, and the knowledge and skills needed to implement NRW countermeasures were strengthened (Outputs 2 and 4). Community activities with people were conducted as planned with development of various awareness-raising tools as well as with the use of external local consultant (Output 5).

#### 2) Phase 2

Phase 2 outputs were achieved; Phase 2 strengthened the management capability of water supply networks through training and pilot activities and codified the experience into a set of guidelines (Output 1). The licensing system of private contractors for pipelines and water meters installation<sup>16</sup> were developed, and its relevant training structure was prepared as planned. As a result, the mechanism of the installation of pipelines and water meters was prepared (Output 2). Through experience gained in Phase 1, community activities were launched and the relationship between GWAs and community organizations was strengthened (Output 3).

### 3.2.1.2 Achievement of Project Purpose

Most indicators of Phase 1 were achieved, as shown in Table 3.

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<sup>16</sup> This activity aimed to alleviate the risk of water leakage by improving the quality of private contractors that installed water supply facilities and equipment. It is therefore a preventive measure. After this system was enforced, it became conditions of tendering that all private contractors commissioned by the WAJ and GWAs had to receive training and get certification.

Table 3. Achievement of the Project Purpose of Phase 1

Project Purpose	Indicators	Achievement
Capacity development of WAJ on NRW reeducation measures	① Budget related to NRW countermeasures allocated to six GWAs is to be increased in real terms, starting in 2008.	It is not possible to make judgment on the status of the end of Phase 1 because the indicator compares conditions at the end of the project (2008) and after.
	② The WAJ establishes Performance Indicators for NRW reduction activities.	<b>Achieved:</b> In August 2005, the WAJ established performance indicators in accordance with the guidelines of the International Water Association. These included indicators related to NRW countermeasures, involving the volume of NRW per length of pipe per day ( $\text{m}^3/\text{km}/\text{day}$ ) and the volume of NRW per connection in the pipe network per day ( $\text{m}^3/\text{connection}/\text{day}$ ). The data for these indicators were collected by the end of Phase 1.
	③ Capacity development index of the WAJ will be assessed by a expert team <sup>*1</sup> and to be increased from August 2005 levels.	<b>Achieved:</b> At the end of Phase 1, the Japanese expert team concluded that capacity development at the WAJ headquarters and GWAs had improved as follows: 1. Phase 1 grew up engineers and technicians who acquired basic techniques related to NRW reduction measures (WAJ headquarters and GWAs) 2. GWA staff members acquired the capacity to develop action and budget plans. (GWAs) 3. The responsibilities of the unit and staff for NRW reduction was expanded (GWAs) 4. Internal training capacity was enhanced (WAJ headquarters and GWAs)

(Sources) Terminal Evaluation Report, JICA documents, and interviews at the WAJ headquarters

\*1 Because one judgment expected to be made by a team consisting of several experts (team judgment), “a expert team” was written clearly rather than “an expert”.

Because indicator ① called for the situation to change after the end of the project, it was not appropriate as an indicator to assess the status of the end of the project. Thus, this ex-post evaluation didn't include it in the evaluation judgment.<sup>17</sup>

Indicator ② was achieved because the WAJ established performance indicators at the beginning of Phase 1 in accordance with the guidelines of the International Water Association; the feasibility of data collection was confirmed by the pilot project. The approximately 10 indicators included the volume of NRW per length of pipe network per day ( $\text{m}^3/\text{km}/\text{day}$ ) and the volume of NRW per connection in the pipe network per day

<sup>17</sup> However, it should be noted that there were positive changes during the project period, in terms of budget allocation for NRW countermeasures. For example, while there had been no specific budget for NRW countermeasures before Phase 1, a specific budget for activities in 13 pilot areas was allocated by the end of Phase 1. In addition, at the terminal evaluation, a budget covering a further 9 areas was expected to be in place by 2009. We can therefore say that there was an improvement of WAJ finances in relation to NRW countermeasures during the project period.

(m<sup>3</sup>/connection/day). These two indicators were collected during the pilot activities and their feasibility was verified. Besides, reference numbers of the indicators<sup>18</sup> relates to NRW countermeasures were worked out for the activities after the end of Phase 1.

Indicator ③ was achieved because the terminal evaluation judged that the WAJ developed its organizational capacity. In addition, according to the interview with a former Japanese expert, the Japanese expert team justified it at the end of Phase 1 as shown in Table 3. Moreover, this improvement in organizational capacity was confirmed through a questionnaire-based survey at the time of the ex-post evaluation. Tables 4 and 5<sup>19</sup> show that average ability rates increased from the beginning of Phase 1 (2005) to the end of Phase 1 (2008), suggesting an improvement in capacity at both of the WAJ headquarters and GWAs. Although the difference between those who did and did not participate in the project was not significant, interviews suggest that gap in 2005 and 2008 between them and the data that the rate of those who participated was higher than those who didn't were influence of Phase 1.

Table 4. Self-assessment of the organizational capacity of GWAs (on average)

(n=5)  
(5 scale rating: 1=Lowest...5= highest)

Abilities	2005 (Beginning of Phase 1)	2008 (End of Phase 1, just before the start of Phase 2)	2011 (End of Phase 2)	2014 (As of ex-post evaluation)
Specialty for NRW countermeasures	3.63	4.15	4.12	3.90
Planning, budgeting, and project-managing capacity of GWAs	2.25	3.45	3.30	2.95
Internal training capacity	1.50	2.70	2.30	1.90
Ability to build a relationship with people	2.20	3.00	3.20	2.80

(Source) Questionnaire survey

<sup>18</sup> "Reference" refers to the estimated amount of the volume of NRW per length of pipe network per day (m<sup>3</sup>/km/day) and the volume of NRW per connection in the network per day (m<sup>3</sup>/connection/day) as well as the extent to which the indicator expects to be reduced by pilot activities.

<sup>19</sup> Table 4, "Self-assessment of the organizational capacity of GWAs" shows the organizational response. Table 5, "Self-assessment of the personal capacity of GWA staff members" shows the individual response. When we visited GWAs for interviews, self-administrated questionnaires were distributed. The same organizations and respondents were asked to assess capacity in 2005, 2008, 2011, and 2014; they provided and to provide the rate. Completed questionnaires were then collected.

Table 5. Self-assessment of the personal capacity of GWA staff members (average)  
 (Former project participants n=48)  
 (Non-participants n=46)  
 (5 scale rating: 1=Lowest...5= highest)

Abilities		2005 (Beginning of Phase 1)	2008 (End of Phase 1, just before the start of Phase 2)	2011 (End of Phase 2)	2014 (As of ex-post evaluation)
Specialty for NRW countermeasures	Ex-participant	2.88	3.40	3.30	3.26
	Non-participant	2.68	2.92	2.91	2.75
Planning, budgeting, and project-managing capacity of GWAs	Ex-participant	2.75	3.28	2.97	3.01
	Non-participant	2.00	2.43	2.45	2.53
Internal training capacity	Ex-participant	3.50	4.04	3.65	3.67
	Non-Participant	3.00	3.45	3.48	3.41
Ability to build a relationship with people	Ex-participant	2.52	3.11	2.78	2.96
	Non-participant	2.29	2.87	2.88	2.72
Overall	Ex-participant	4.05	4.55	4.23	4.29
	Non-Participant	3.00	3.35	3.35	3.25

(Source) Questionnaire survey

In addition to these indicators, the achievements of the four aspects of the WAJ capacity mentioned above were summarized as follows:

#### ① Specialty for NRW countermeasures

As specialty for NRW countermeasures, (1) strengthening organizational structure and mechanisms was the key achievement. Throughout Phase 1, the NRW countermeasures were promoted to the activity of a unit dedicated to the NRW issues from one part of a unit for operation and maintenance, and this unit became equal in status to the Operation and Maintenance Unit. In addition, the NRW countermeasures and the responsibilities of WAJ headquarters and GWAs were clarified, staff duties were determined, and the institutional environment broadened to incorporate the new NRW countermeasures (Output 1). Then, (2) Lectures and practical training were provided for engineers and technicians at the WAJ headquarters and the GWAs (Output 2); in this way, their knowledge and skills were standardized. As a compilation of these efforts, (3) the pilot activity was conducted (Output 4) and the practical experience was absorbed in the WAJ. In particular, the pilot activities were implemented in six mid- and south Jordan governorates; these reduced NRW rates in most pilot areas, as shown in Table 6, thus proving that the pilot activities were effective. That is, it indicates that the strengthened capacity was appropriate.



Table 6. Change in NRW rates through pilot activities

(Unit: %)

Governorate	Pilot areas	Baseline (2007)	Target	Achievement (2008)
Barqa	Al Salaim	45	23	20
Zarqa	Hashimiah	58	29	25
	Wadi Al-Hajar	47	23	25
Madaba	Faisalea	57	28	28
Karaq	Smakeye & Hmoud	44	22	23
	Muhay & Hamdieh	63	31	-
Tafila	Al-Mansurah	28	14	18
Ma'an	Odruh 1	55	27	17
Simple mathematical average		49	25	22

(Source) Project documents

### ②Planning, budgeting, and project-managing capacity of GWAs

The capacity of GWAs necessary to plan, budget, and manage project activities was developed through the planning of pilot and other activities (Output 4). Before Phase 1, planning was often conducted using a top-down approach; the participation of GWA staff members was limited, and GWA activities were not managed based on an action plan. In Phase 1, Japanese experts cooperated to provide knowledge and opportunities for practice. According to the results of the interviews with staff members of WAJ headquarters and GWAs, processes including planning, management, and evaluation of activities could be mastered systematically, increasing awareness among the staff members about the importance of the development of the plan.

### ③Internal training capacity

As for the internal training capacity, Phase 1 set the Marka Training Center as a core-training center for engineers and technicians, and prepared a structure needed for the training including the development of a curriculum and materials, the training of instructors, and the provision of training equipment (Output 3). Before Phase 1, lectures on NRW countermeasures were provided by the Japanese long-term experts, but the WAJ did not have its own NRW training.

### ④Ability to build a relationship with people

As for ability to build a relationship with people, Phase 1 conducted problem analysis, development of communication tools, and the commissioning of external local consultants to undertake some parts aspects of the activities (Output 5). As a result, the structures and tools needed for community awareness-raising activities were prepared in the WAJ. According to the interviews with staff members at WAJ headquarters, the WAJ could gain the experience of managing activities through by outsourcing them to local consultants as

well as of by working with CBOs, etc.

As indicated above, measured by indicators achieved, survey results, the ex-post evaluation, and interviews, the WAJ's ability to organize NRW countermeasures was strengthened. Thus, Phase 1 achieved its purpose.

## 2) Phase 2

The indicators of the project purpose of Phase 2 are shown in Table 7. These indicators were achieved.

Table 7. Achievements of Phase 2

Project Purpose	Indicators	Achievement
WAJ's capacity to take preventive measures against NRW is improved	①In six middle and southern governorates, each GWA prepares a realistic action plan to take active, and preventive measures against NRW based on all the trainings of the project <sup>20</sup>	<b>Achieved:</b> The draft action plan was developed in basis of the self-assessment of organizational capacity carried out in November 2010.
	②In the six governorates, procedures to realize their action plans are reviewed with each GWA's staff members in reference to the three guidelines prepared in the project, which are on overall NRW reduction, distribution network management, and the installation of service pipes and water meters.	<b>Achieved:</b> During the half year after November 2010 when the action plan was drafted, the draft was reviewed, taking into consideration issues such as the current status of activities (whether implemented or not), approaches (whether direct implementation or outsourcing), the responsible unit, and each GWA's priorities, in accordance with the guidelines.
	③WAJ headquarters establishes its mechanism to implement preventive measures against NRW and disseminate them to GWAs. <sup>21</sup>	<b>Achieved:</b> Phase 2 took over the organizational structure and mechanisms established from Phase 1. Preventative measures were carried out within this structure where GWAs undertook core NRW countermeasures, and the specialized NRW units of the WAJ headquarters supervised the GWAs.

(Source) Terminal Evaluation Report, project documents, and interviews with WAJ staff members

Indicator ① focuses on the capacity to plan, budget for, and manage activities as well as specialty for NRW countermeasures. These capacities were developed through pilot and

<sup>20</sup> This indicator questions whether the capacity are sufficiently developed to take "realistic" action against the capacity trained in Phase 2, as the indicator mentioned "based on training." Thus, this indicator does not cover budgeting or organizational structures because the training did not address these aspects.

<sup>21</sup> "Disseminate" means to share a mechanism designed by the WAJ headquarters with GWAs. According to the staff member of the WAJ headquarters, it does not mean that approaches conducted in some governorates would be expanded to other governorates not involved in Phase 2.

community awareness-raising activities, and project workshops, with the cooperation of Japanese experts. Carrying out pilot and community activities involved processes that included a preliminary problem analysis survey, the selection of pilot areas and content based on information, managing activities, and evaluating activities. A review workshop was conducted in November 2010, in which directors, engineers, and community activity coordinators of GWAs gathered to self-assess NRW countermeasures and staffing, and to develop in detail a two-year GWA action plan (January 2011 to December 2012) as part of the process of drafting a five-year mid-term action plan.

As for the indicator ②, it was also relevant to planning, budgeting, and managing the activities and specialty of the NRW countermeasures. The draft action plan developed in November 2010 was reviewed with support from Japanese experts using Phase 1 and Phase 2 documents. Thus, by reviewing the knowledge and skills acquired through Phases 1 and 2, the absorption of the knowledge and skills into the WAJ was promoted.

Indicator ③ relates to NRW countermeasures, internal training capability, and the ability to build a relationship with residents.

Organizational structure and mechanisms related to NRW countermeasures were in continuous use after Phase 1. That is, it was the structure where the specialized unit responsible for NRW countermeasures had been independent of the operations and maintenance unit.

Within this organizational structure, the WAJ developed “guidelines for managing the water supply network” (Output 1), “regulations and procedures for licensing private contractors for water pipe and meter installation” (Output 2), and various communication tools and action plans of GWAs to raise community awareness (Output 3), which were shared with various stakeholders including other GWAs, public companies, the private sector, and other donors.

In addition to the indicators, the WAJ achievements of four elements of WAJ’s capacity mentioned above are summarized below, although there might be overlapped with the section of achievement status of the indicators.

#### ①Specialty for NRW countermeasures

In Phase 2, as the development of specialty for NRW countermeasures, the project strengthened the capacity of GWAs to manage the distribution of water and established the institutional system to improve the quality of private contractors.

In Phase 2, the capacity of GWAs to manage the distribution of water meant specialized skills and relevant knowledge to prevent water leakage by controlling water pressure. This expertise was strengthened through training and pilot activities, codified into guidelines,

and absorbed by the WAJ as organizational knowledge. Pilot activities were conducted in two areas of two governorates, demonstrating that NRW rates could be reduced further through preventive measures (Output 1), although only the corrective measures implemented in Phase 1 can reduce it, as shown in Tables 8 and 9. Thus, the capacity aimed for in Phase 2 was shown to be appropriate.

Table 8. Improved NRW rates achieved through pilot activities (Fuhais area)

(Unit: %)

	Base line (March 2010)	Survey in (June 2010)	Survey in (October 2010)	End line (February 2011)
NRW Rate	36.0	31.0	26.3	17.9

(Source) Project documents

Notice: The reduction of the water pressure was circulated during the October 2010 survey. Prior to that time, from the base line, corrective NRW countermeasures were conducted.

Table 9. Improved NRW rates achieved through pilot activities  
(Sanfahah and Arwayenmm)

(Unit: %)

	Baseline (August 2009)	Survey in (December 2009)	Survey in (November 2010)	End line (March 2011)
NRW Rates	40.3	23.9	20.0	15.2

(Source) Project documents

Notice: The reduction of water pressure was circulated during the November 2009 survey. Prior to that time, corrective NRW countermeasures were conducted.

In addition, during Phase 2, a technical working group was established to draft a licensing system, current procedures and work methods were sorted out, and the both problems and solutions were examined. After that, the project took actions to introduce a licensing system for private contractors. By the end of Phase 2, discussions and consultations among WAJ insiders and other stakeholders were conducted, and a the Secretary General of WAJ issued a notice in May 2011 to begin training private contractors to install water pipes and meters to reinforce the system. That is, as a result of these Phase 2 activities, the WAJ was able to establish a system.

## ②Planning, budgeting, and project-managing capacity of GWAs

As mentioned under Indicators ①, and ②, the capacities of GWAs were strengthened through the pilot activities and community awareness-raising activities, with the cooperation of Japanese experts.

## ③Internal training capacity

The WAJ's ability to carry out internal training was strengthened by the development of a training curriculum linked to the "licensing system for private contractors to install water pipe and meter" (Output 2). The first plan for Phase 2 stipulated that available training

materials would be selected, with some additions and modifications. However, because the WAJ strongly requested to develop “new materials using equipment and materials provided by JICA”, training materials were developed from scratch with the cooperation of the Japanese experts. As a result, the process of developing a training curriculum and tools carried out in Phase 1 was repeated in Phase 2, so that the WAJ could strengthen and fully absorb the entire development process of the training. In other words, this process means the development of training capacity for the preventive NRW countermeasures, because a “licensing system for private contractors undertaking water pipe and meter installation” was one of preventive approach.

#### ④Ability to build a relationship with people

The ability to build a relationship with people was strengthened through community awareness-raising activities (Output 3), as in Phase 1.

However, this time the GWAs took the initiative in planning, implementing, and evaluating the activities. It was difference from Phase 1. The ability to build a relationship of GWAs were better strengthened so that GWAs were able to understand people’s needs, because the GWAs took the initiative and directly approached people and CBOs (including religious group, women’s organizations and school). In addition, because the GWAs gained the approval for cooperation<sup>22</sup> from CBOs by the end of Phase 2, they strengthened their relationship with CBOs.<sup>23</sup>

In addition, various activity tools were developed through community awareness-raising activities even during Phase 2. These included 3,000 calendars, 850 water guides, and 25,000 pamphlets to raise awareness, 5,000 magnets, and water saving devices. Because most of these tools were created proactively by GWAs on basis of action plans of community awareness-raising programs to raise community awareness developed following the baseline survey conducted in Phase 2, with support from the Japanese experts, Phase 2 strengthened the preparedness of the GWAs for the implementation of the activity.

In the light of the above, indicators and the results of the questionnaire survey and interviews at the time of the ex-post evaluation suggest that the WAJ’s organizational capacity was generally strengthened. Therefore, Phase 2 achieved its purpose.

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<sup>22</sup> By the end of Phase 2, 85 (95%) organizations approached by GWAs requesting cooperation had given a definite promised for the cooperation.

<sup>23</sup> During the first half of Phase 2, community awareness-raising activities were run through an organizational structure in which a specific unit was established in the WAJ headquarters and coordinators were appointed to each GWA. Following the organizational reform of the WAJ headquarters in 2011, this structure was changed to one in which each GWA took full responsibly for such activities. Although there was initially a designated unit at the WAJ headquarters, GWAs were the main implementers, with the unit and the Japanese experts playing an advisory role. For this reason, organizational reform in 2011 did not make a significant impact, from a technical point of view, on capacity development, although it may reduce the policy and organizational commitment to the community awareness-raising activities.

### 3.2.2 Impact

#### 3.2.2.1 Achievement of Overall Goal

The achievement of the overall goal, to decrease the NRW rate “by 2% or more every year” is shown in Table 10 and Figure 1. Because NRW rates increased after Phase 2 ended, this indicator was not achieved.

Table 10. Achieving the overall goal and changes of national NRW rates in Jordan

Indicator	Achievement
The NRW rate decreases by 2% or more every year	The NRW rate increased, in comparison with levels at the start of Phase 1. Therefore, the overall goal was not achieved.
	Beginning of Phase 1 (2005)
	45.3%
	Beginning of Phase 2 (2009)
	43.1%
	End of Phase 2 (2011)
	37.2%
	As of ex-post evaluation (2013)
	47.6%

(Source) the WAJ documents

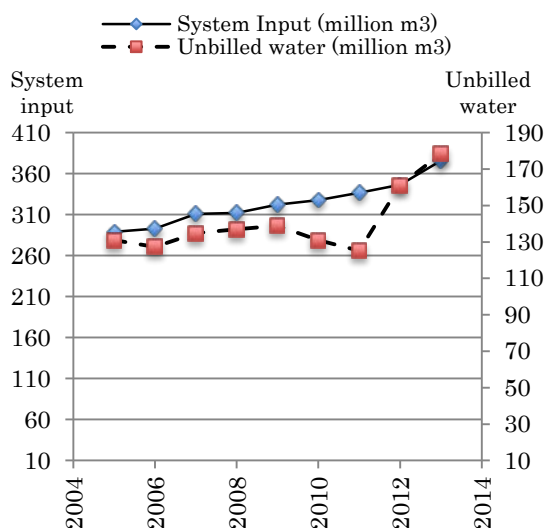


Fig. 1 Water supply and unbilled water  
(Source) the WAJ documents

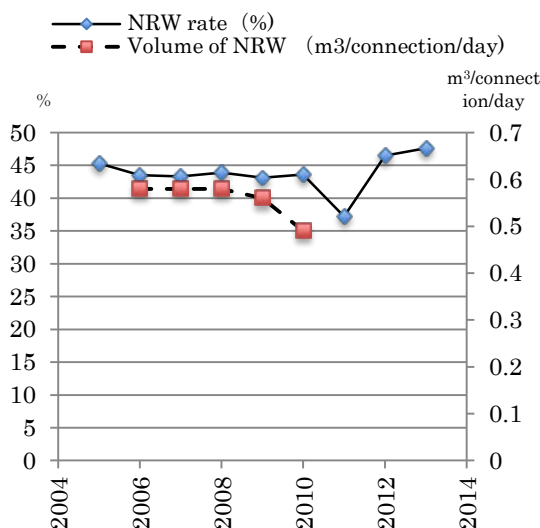


Fig. 2 Change of NRW rates & volume of NRW per connection

(Source) NRW rates: the WAJ documents  
Volume of NRW: Documents of the International Benchmark Network for Water and Sanitation

Table 11 reveals three assumptions about “how the project contributed to the achievement of the overall goal” (the causal route from project purpose to overall goal). Among them, (1) the expansion of pilot activities was not realized after the end of Phases 1 and 2. Although expansion was, from the planning stage, considered a necessary condition for achieving the overall goal, approaches taken by the pilot activities were not clearly integrated in the WAJ’s policy or system. There were also inhibiting factors, including the lack of a proactive and organizational commitment from the WAJ or other stakeholders including donors, and a lack of financial resources.

In addition, according to interviews with staff members at the WAJ headquarters, the results were influenced by dramatic social changes after 2011 (these included the stagnation of GWA activities after the Arab Spring, an increased water supply due to the influx of Syrian refugees, population growth, and Disi (fossil water) Project<sup>24</sup>), as well as by unclear positioning of NRW countermeasures with the lost of organizational commitment accelerated by the organizational reform of the WAJ in 2010.

However, before 2011, the volume of unbilled water (2005-2011) and NRW rates had never increased significantly and had been controlled as shown in Figure 1, even in the situation that demand for water increased (it implies the situation of the increased workload of GWAs due in part to the expansion of the water distribution network, etc.). In addition, if the volume of NRW per connection in the pipe network per day ( $\text{m}^3/\text{connection}/\text{day}$ ), an alternative indicator of NRW<sup>25</sup>, is used as a point of reference, the indicator continued to improve until 2010 from 2006 when Phase 1 completed, as long as we see it (Figure 2). This perspective seems to show that the quality of services related to NRW countermeasures had improved.

In practice, given in Table 11 that some project outputs have been sustained, it is difficult to argue either that “the project made no contribution to the NRW reduction at all” or “the NRW rate would not have improved, even without the rapid social changes of 2011.”

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<sup>24</sup> This is a water supply project designed to pump up water accumulated in the Disi aquifer in Southern Jordan. It started in 2013 and domestic water supply was substantially increased.

<sup>25</sup> The International Water Association has regarded the use of NRW rate as problematic, and recommended to use alternative indicators including the volume of NRW of water per length of pipe per day ( $\text{m}^3/\text{km}/\text{day}$ ) and the volume of NRW per connection in the pipe network per day ( $\text{m}^3/\text{connection}/\text{day}$ ). Using the rate, it can be influenced by the amount of the system input that is the denominator of the rate and not directly related to the NRW countermeasures. In fact, the indicator ② of the project purpose of Phase 1 showed that the alternative indicators were set as performance indicators, not the NRW rate. Thus, this ex-post evaluation also referred to them.

In Jordan, the nationwide data of the volume of NRW per connection in the pipe network per day ( $\text{m}^3/\text{connection}/\text{day}$ ) had been collected until 2010. According to the interview to the staff members of the WAJ headquarters as of the ex-post evaluation, the quality of the data will be improved under the support of United States Agency for International Development (hereinafter referred to as “USAID”), because the accuracy of the data is not adequate. The situation analysis and discussion on performance indicators is planned in the future.

Table 11. Assumptions relating to the causal route from project purpose to overall goal, and the current situation

Assumption	Detail	Current situation (as of ex-post evaluation)
(1) Extension of pilot activities	If pilot activities or similar activities were extended to other areas, then the quality and efficiency of GWA services would be improved, leading to a decrease in NRW.	Pilot activities have not been extended to other areas.
(2) Dissemination within GWAs	If experience, knowledge, and skills were transferred between staff members within each GWA, then the quality and efficiency of GWA services would improve, leading to a decrease in NRW.	Although not through any organizational initiative, experience, knowledge, and skills were acquired from OJT and transferred between staff members (new staff members, followers, and others). Bulletin boards were also used to share information.
(3) Dissemination to other areas via the WAJ headquarters	If experience, knowledge, and skills could be transferred or expanded via WAJ headquarters or the Marka Training Center (if necessary, activity would be institutionalized), then the quality and efficiency of GWA services would improve, leading to a decrease in NRW.	WAJ headquarters, including the Marka Training Center, provided training for an average of 1,000 staff members between 2011 and 2014. Among them, about 550 staff members received training in corrective NRW measures, while 450 staff members received training in preventive NRW measures. About 50% of the training sessions were held at the Marka Training Center, using procured equipment, a constructed training field, and internally developed materials. In the Marka Training Center, besides WAJ staff members, an average of 35 private contractors also received training related to the new licensing system between 2011 and 2014.

(Source) Interviews with staff members at WAJ headquarters

From the above mentioned, the overall goal was not achieved because the pilot activities were not extended to other areas as well as there were a rapid social changes.

However, it is difficult to conclude that the project did not contribute to reducing NRW, given the fact that the organizational capacity strengthened by the projects and some of NRW activities have been sustained, and considering the change of indicators.

### 3.2.2.2 Other Impacts

According to interviews with staff members at the WAJ headquarters and GWAs and other relevant documents, the projects did produce a positive impact and various ripple



effects, as shown in Table 12.

At the same time, no negative effects were reported in any of the WAJ or GWA staff interviews, or by the Japanese experts. Although it was stated during the planning stage of Phase 1 that “it is necessary to be alert to the fact that Jordanian culture or customs might limit some NRW countermeasures,” no such cases were reported in interviews with staff members of the WAJ headquarters and GWA.

Table 12. Indirect impact or ripple effect

Indirect Effect, etc.	Detail
Dissemination of knowledge and skills to other countries	According to the interviews with the staff members of the WAJ headquarters and GWAs, Jordan has been the resource country of knowledge and skills for neighboring countries. Thus, the knowledge and skills strengthened and materials developed by the project were disseminated to other Middle East Countries through the Third Country Training Program, etc.
Impacts of the results proved by the pilot activities	The pilot activity of Phase 1 could show that “corrective NRW countermeasures can significantly reduce the rates, but there is a limit”, and the one of Phase 2 did “preventive NRW measures can reduce the rate further, beyond the limit of the corrective countermeasures”, for various stakeholders. These results could induce the appeal of the Japan’s International Cooperation such as sharing with other donors through the anniversary report <sup>26</sup> developed by JICA Jordan Office, as well as disseminating the results to all over the world via Wikipedia, the free encyclopedia, etc.
Change of relationship among GWAs	According to the interview with the staff members of the GWAs, the project activities built solidarity and communicative relationship by sharing the common awareness on the NRW issues among GWAs. In addition, competitiveness among GWAs was born, leading to the quality improvement of the services of GWAs.

(Source) JICA documents, interview with staff members at WAJ headquarters and GWAs

In the light of the above, since the project has to some extent achieved its purpose and overall goal, the effectiveness and impact of the project can be rated as “fair.” The project purpose of strengthening the WAJ’s organizational capacity was achieved at the end of Phase 1 and 2. The overall goal to reduce NRW was not achieved because of social change and the failure to expand pilot activities; nevertheless, it is difficult to conclude that the project did not contribute to reducing NRW because some of organizational capacity strengthened by the projects and some of NRW activities have been sustained.

### 3.3 Efficiency (Rating: ②)

#### 3.3.1 Inputs

The planned and actual inputs of Phase 1 and Phase 2 are shown in Tables 13 and 14.

<sup>26</sup> “JICA’s Cooperation for Water Sector in Jordan\_30 years history of remarkable achievement”

Table 13. Planned and actual inputs of Phase 1

Inputs	Plan	Actual
(1) Experts	6 people (90 person-months)	8 people (86.2 person-months <sup>*1</sup> )
(2) Trainees received	Unknown <sup>*2</sup>	24 people
(3) Equipment	Electromagnetic flow meter, leakage detector, metal pipe and cable locator, soil corrosion tester, vehicle, etc. (totaling 39 million yen)	Ultrasonic mechanic flow meter, leakage detector, equipment needed for pilot areas, such as a GPS logger, etc. (totaling approx. 39 million yen) Office equipment, training equipment brought by Japanese experts (totaling approx. 15 million yen)
(4) Operational costs	Unknown	36 million yen
Japanese side Total Project Cost	Total 380 million yen	Total 467 million yen
Jordanian side Operational Burdens	Counterparts (12 people), facilities for office work, cost of training in Jordan, cost of pilot activities (actual cost is unknown)	Counterparts (20 people), facilities for office work, construction costs of a training field for water leakage in the Marka Training Center, cost of improvements in pilot areas
Project period	August 2005 – July 2008 (3 years)	August 2005 – July 2008 (3 years)

(Source) Terminal Evaluation Report, JICA documents

\*1 The data from January 2008 to March 2008 was not collected.

\*2 The source is an ex-ante evaluation report. Besides, in the Report of discussions of the implementation of the project, it was reported that a maximum of 10 people x 3 was assumed, but that details would be determined by considering the participants and training content after the beginning of the project.

Table 14. Planned and actual inputs of Phase 2

Inputs	Plan	Actual
(1) Experts	6 people (The number of person-months is unknown <sup>*1</sup> )	8 people (74.5 person-months)
(2) Trainees received	21 people	17 people
(3) Equipment	Pressure reducing valve, water level meter, electromagnetic flow meter, stop valve, water meter, pipe material, etc. (totaling 30 million yen)	GIS equipment for management of water supply network training, equipment for managing water pressure, training materials for the installation of water pipes and meters, etc. (totaling 13.7 million yen)
(4) Operational cost	Unknown	31 million yen
Japanese side Total Project Cost	Total 340 million yen	Total 332 million yen
Jordanian side Operational Burdens	Counterparts (30 people), facilities for office work, construction cost of pilot activities (actual cost is unknown)	Counterparts (36 people), facilities for office work, cost of improving pilot activities (actual cost is unknown)
Project period	2009 – 2011 (2 years and 6 months)	February 2009 – August 2011 (2 years and 6 months)

(Source) Terminal Evaluation Report, JICA documents

\*1 Source is ex-ante evaluation report. In the plan of operation held in the JICA Knowledge sites, it is reported that the input of experts came to 71 person-months.

<http://gwweb.jica.go.jp/km/ProjDoc424.nsf/VW02040102/22E4651AC0C2FB924925768E00061413> (April 2015 accessed)

#### 3.3.1.1 Elements of Inputs

Various aspects of Phase 1 and Phase 2 inputs are analyzed together because there were no major differences between them.

As for the Japanese experts, they were provided by Nihon Suido Consultants Co., Ltd., a company commissioned by JICA through Phase 1 and 2. According to interviews at the time of the ex-post evaluation, the technical expertise of these Japanese experts was very much admired by personnel at WAJ headquarters and in GWAs. In addition, it was confirmed that communication between these Japanese experts, the WAJ headquarters and GWAs was intentionally close<sup>27</sup>, and the mutual trust was regarded as excellent. Thus, the provision of Japanese experts was generally satisfactory.

As for trainees received (training in Japan), it was designed to enable WAJ and GWA stakeholders to visualize techniques intended for use on local projects. Therefore, this Japanese training included exposure to good practice in the Japanese context. Mainly WAJ leaders and managers, and GWA technical staff members participated in this training. According to the ex-post evaluation interviews, the techniques and knowledge gained through training were very relevant for project pilot activities. Some participants commented that the training had function to motivate GWA staff members to commit to project activities. Thus, the training in Japan was consistent with project activities, and facilitated those activities.

Finally, various pieces of equipment were provided. There were four main categories of equipment: (1) administrative equipment used during the project period (copiers, etc.); 2) equipment used to detect and measure NRW; 3) equipment used for GIS, and 4) materials designed to improve infrastructure in the pilot areas. All of this equipment was essential for the project activities and used regularly. Thus, the procurement of equipment was also consistent with the project.

In this regard, it is clear that the input of Phases 1 and 2 was overall appropriate.

#### 3.3.1.2 Project Cost

##### 1) Phase 1

The actual project cost was 123% of the planned cost, exceeding its planned budget. Some possible reasons for the increase are suggested below.<sup>28</sup>

- 1) The cost of procuring a local consultant to map the pipeline networks during pilot

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<sup>27</sup> According to the ex-post evaluation interview, the trust building was regarded as the first priority, and the major project members was conscious of the attitude listening to different opinions. In addition, Japanese experts and counterparts of the WAJ headquarters always work together and made efforts to visit GWAs as much as possible.

<sup>28</sup> No detailed information about the project cost was acquired. These suggestion are drawn from interviews with the Japanese experts and from project documents.

activities was higher than expected (actual cost unknown<sup>29</sup>) because the maps held in each GWA were insufficient and the need for the mapping greater than expectation in plan (the plan assumed that 4 areas would be mapped, but mapping actually needed to be carried out in 13 areas.)

- 2) The areas for pilot activities were determined using information derived from the mapping mentioned above. During the course of mapping, the number and range of pilot activities expanded, increasingly the cost of procuring equipment, such as CAD and GIS software (by around 15 million yen) (6 areas were included in the plan, but activities were actually carried out in 8 areas.)

Such discrepancies in 1) and 2) have emerged because the detail of the pilot activities expected to be determined in the activity for Output 1 in Phase 1. Thus, it was impossible to conduct a thorough estimate of costs at the time of the ex-ante evaluation because the pilot activities were still evolving. For the thorough estimation, it was necessary to take process that the area to be mapped was blocked out roughly at first, and the specific areas used for the pilot activities was selected after mapping. For this reasons, the estimated costs were rough estimates at best, including some assumptions. In the end, some actual pilot areas were not fitted to the expected area in the plan. Therefore, an increase in project costs was unavoidable.

However, the evaluation judgment cannot overlook this discrepancy, even though the basic infrastructure and available information also increased beyond planned levels, in line with the increased project costs. Because the project aimed to strengthen organizational capacity, the evaluation necessarily focused on the relationship between inputs and capacity development as outputs. Even though the area covered in the pilot activities was expanded<sup>30</sup>, the output such as the number of the staff participants was not increased accordingly. In other words, it is difficult to say that planned outputs were increased due to the increase in project costs.

Given this situation, although the increase of the project cost was unavoidable, it is judged that the project cost was spent more than planned because the output was not increased accordingly.

## 2) Phase 2

The actual project cost of Phase 2 was within the plan (98% of the planned cost). This

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<sup>29</sup> According to the project document, it is possible that about 45 million Japanese Yen was allocated in the plan; the actual amount is unknown. In addition, there is no information about how the estimated cost was arrived at, or what it included. According to the report of Discussion of the Implementation of the project, contracting a local consultant to carry out mapping activities was not clearly fixed in the plan. It is therefore likely that the plan did not take account of the cost of this additional mapping.

<sup>30</sup> Because the areas of improved pipe network were enlarged due to the expansion of the pilot activities, Phase 1 contributed more than planned for overall goal: reduction of NRW rate.

was because the Japanese yen became stronger during the project period<sup>31</sup>. The planned outputs were not changed.

### 3.3.1.3 Period of Cooperation

#### 1) Phase 1

Phase 1 actual project period was exactly (100%) as planned. According to WAJ staff members and the Japanese experts, it took time to build trust with the GWAs at the start of Phase 1. The terminal evaluation report also mentioned that time was needed to raise funds for the pilot activities. Nevertheless, the outputs were generated as planned during the project period; activities were implemented smoothly on the basis of an established relationship of trust. Thus, the project period was appropriate.

#### 2) Phase 2

Phase 2 actual project period was exactly (100%) as planned. As outputs were generated as planned, the period was appropriate. According to the interviews with WAJ staff members, activities were implemented smoothly because there was no drastic structural changes on either the Japanese or Jordanian side from Phase 1. During the second half of the period (around 2010), activities came to a standstill while the WAJ structure was reorganized, and Aqaba Water Company took over the management of Ma'an GWA from the WAJ. However, managers at the WAJ headquarters and the Japanese experts handled this situation well, alleviating the negative impacts.

In the light of the above, the efficiency of Phase 1 is rated as “fair” because the project period stayed within the plan, but the project cost exceeded the plan. The efficiency of Phase 2 is given a “high” rating because both the project cost and the project period were as planned. Overall, Phase 1 is fair and Phase 2 is high, resulting in a combined efficiency rating of “fair.”

### 3.4 Sustainability (Rating: ②)

When considering sustainability, we examine whether policy and institutional, organizational, technical, and financial aspects of the implementing agency for the sustainability of the “WAJ’s organizational capacity” strengthened through the projects, because Phase 1 and Phase 2 aimed to strengthen organizational capacity for the NRW countermeasures.

In addition, the sustainability of the pilot activities is also examined, because the

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<sup>31</sup> In 2008, 1 Japanese Yen = 0.007 Jordanian Dinar and 0.007 Euro. In 2011, 1 Japanese Yen = 0.009 Jordan Dinar and 0.009 Euro. There was thus an appreciation of the yen.

dissemination of pilot activities was set as a condition for the achievement of the overall goal of Phases 1 and 2. In other words, the dissemination of pilot activities was regarded as essential activities to sustain the project effects.

Table 15. Effects and activities to be sustained

Effects and Activities	Details/positioning, etc.
Organizational capacity of the WAJ	Organizational capacity related to corrective and preventive NRW measures (personal and organizational knowledge, skills and experience, etc.) Other key elements, as mentioned in Table 2, included specialty for NRW countermeasures, planning, budgeting, and project-managing capacity of GWAs, internal training capacity, and ability to build a relationship with people
Pilot activities	Pilot activities are one condition for the achievement of the overall goal. In addition, they are activities compiling various organizational capacities strengthened by the projects, as well as opportunities to utilize use these strengthened capacities.

#### 3.4.1 Related Policy and Institutional Aspects for the Sustainability of Project Effects

As of the ex-post evaluation, the policy and institutional environment have been maintained to sustain the strengthened organizational capacity of the WAJ headquarters and the GWAs. In the “National Agenda 2006–2015,” Jordan’s mid-term development strategy, the water supply sector was regarded as one of the most important sectors in the national development strategy. This strategy emphasized the challenges to address inefficiencies of the water supply, insufficient tariff collection, and private sector participation. In addition, in the “Water Strategy for Jordan 2008–2022,”<sup>32</sup> under the National Agenda, reducing NRW rates was one of targets as mentioned in “3.1 Relevance”. Moreover, the report entitled “Establishing the Post-2015 Development Agenda: Sustainable Development Goals (SDGs) towards Water Security” published by Ministry of Water and Irrigation in 2014, emphasizes the importance of NRW countermeasures and reports on the development of a specific action plan to reduce water leakages. These documents demonstrate that the policy of prioritizing NRW measures has existed continuously.

However, the expansion and sustainability of pilot activities have not been included in policy or institution from the end of Phase 2 to as of the ex-post evaluation; no departments, units, or organizations have proactively promoted the expansion of the pilot activities (This situation will hereinafter be referred to as a “lack of proactive and organizational commitment”). Staff members at the WAJ headquarters have commented that “there was organizational commitment during the project period, but it disappeared after the end. As a

<sup>32</sup> As of the ex-post evaluation, this strategy has been revised; a new “Water Strategy for Jordan 2015–2025” will be launched 2015. Even in the draft of the new strategy, the reduction of NRW rates to 25% was a strategic target.

result, the pilot activities might not be continued.”

One explanation for this lack of proactive and organizational commitment may be that there was never an opportunity to bring together various stakeholders, including, in addition to the WAJ and GWAs, other donor agencies, public companies, and private sector representatives, to share opinions on the content and possible expansion of the pilot activities. This lack of commitment contrasts with the successful institutionalization of a licensing system for private contractors for water pipe and meter installation. A technical working group existed for the activities for the establishment of the licensing system, and the system has been sustained as of the ex-post evaluation. By contrast, the pilot activities were not supported by such a technical working group; their activities were discontinued. Without a technical working group, the continuation and expansion of the pilot activities may not become common consensus among stakeholders. In addition, it may be difficult to coordinate or harmonize pilot activities with other donor activities. Moreover, stakeholders may not clearly understand the relevance or significance of particular pilot activities. As a result, few stakeholders were proactively interested in continuing or expanding the pilot activities.

To sum up, there is a policy environment to sustain the organizational capacity for NRW countermeasures, but equivalent proactive, organizational commitment to sustaining the pilot activities was insufficient after the end of Phase 2. This represents a minor political and institutional challenge.

### 3.4.2 Organizational Aspects of the Implementing Agency for the Sustainability of Project Effects

The organizational structure established and strengthened during the project period, in which NRW countermeasures was put forward, and operational and maintenance activities and NRW countermeasures were dealt with equally, was weakened once as a result of the organizational reform of the WAJ headquarters<sup>33</sup>. But it was reconstructed in 2012 when a new NRW unit was established in the WAJ (Figure 3).

As of the ex-post evaluation, the NRW unit at the WAJ headquarters has begun activities with one director and two technical staff members. According to staff members of the WAJ headquarters, numbers of staff members will increase in future. The relationship with the GWAs has not been different from the project period, when practical actions were carried out by GWAs, under the supervision of the NRW unit at WAJ headquarters. According to interviews to staff members of the WAJ headquarters, the WAJ completed the

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<sup>33</sup> In 2010, the last half of Phase 2, the unit specializing in NRW countermeasures lost its clear remit as a result of organizational reform at the WAJ. In the end, the technical unit assumed responsibility for NRW countermeasures. Despite this, NRW countermeasures were one of special activities, not returned to the Operation and Maintenance Unit.

reconstruction so that outputs and outcomes can be revitalized through this organizational structure.

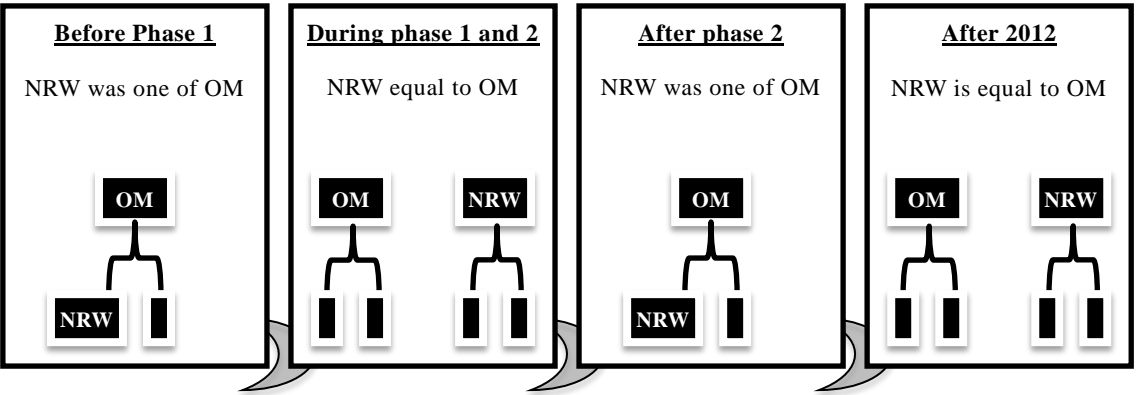


Figure 3 Organizational structure for NRW countermeasures  
 Notice: OM... Unit for operation and maintenance, NRW...Unit for NRW

In addition, the Marka Training Center, the WAJ’s unique training organization, retains the same structure, continuing to provide training for WAJ staff members under the supervision of the training unit. This has not changed since the project period. Even in the training curriculum, topics relevant to NRW countermeasures continue to be included, as shown in Table 17. In addition, training for private contractors receiving licenses for water pipe and meter installation has also remained the same.

As for the retention of staff, about 70% of the staff of the WAJ, GWAs, and the Marka Training Center has remained in those organizations, suggesting that the experience and knowledge gained through the project can still be shared with other staff members in this organizational structure. For example, 8 of the 10 staff members of the WAJ headquarters who participated in the project remain in the WAJ. As for the GWAs, 21 of the 38 participants have stayed in the GWAs, as shown in Table 16. As well, the size of these organizations has not changed. Although not all of these staff members still work in units or positions related to NRW countermeasures, most of them still work in the relevant area to operations and maintenance. At the Marka Training Center, all of the five lecturers who worked on the projects have continued to work as lecturers.

As mentioned above, given the structure and staffing of the WAJ headquarters and GWAs, it is clear that the WAJ has an organizational structure that will allow knowledge, skills, and experiences gained through the projects to be used.

Table 16. Number of GWA staff members

(Unit: Person)



	2010	2011	2012	2013	2014	Participants in projects (During project→as of ex-post evaluation)
Zarqa	-	411	459	478	535	5→4
Madaba	250	250	250	250	190 <sup>*1</sup>	7→7
Barka	-	-	656	651	654	5→2
Karaq	-	-	-	-	600	5→2
Tafilah	235	248	252	256	262	10→4
Ma'an	-	-	-	176	176	6→2

(Source) Interviews at WAJ headquarters and the GWAs

\*1 Some staff members transferred to public companies.

However, when it comes to improving the mechanism of water supply, sustainability for the future, particularly the expansion of the pilot activities is concerned. As of the ex-post evaluation, the WAJ has promoted the mechanism of the use of public companies and transformed it adapted performance-based contract of the water supply with private water suppliers. In this mechanism, the service provision and efforts to raise the performance are based on the decision of public company and private water supplier, not of the WAJ headquarters and GWAs. It means that it is difficult for WAJ headquarters or GWAs to expand the pilot activities easily.

Particular for the promotion of the use of public companies, according to the interviews with staff members of WAJ headquarters, the WAJ has had intention to orient this structure since the late-1990. In practice, starting in the mid-2000, the WAJ established public companies including the Aqaba Water Company, Miyahuna, or and Yarmuk <sup>34</sup>, as organizations under the direct control (investment) of the WAJ. These public companies have taken over a part of water supply services in Aqaba, Barqa, Zarka, Ma'an, Karaq, Tafilah, and the four northern governorates. In 2011, when WAJ Act Provision No 28 was amended and the GWA corporatizing GWA became approval, the decision was made clear that improvements to the water supply would be promoted by public companies.

Within this mechanism, each public company, as an independent public company, operates water supply services in each area, partially receiving bulk water supply from the WAJ. Because of being an independent company, the public company is responsible for organizational management, internal regulations, working practices, the employment of staff members, and human resources development in order to improve service performance.

Thus, the choice of the approach to improve service performance, for instance, the decision about whether or not to use "approaches initiated during the pilot activities", is decided by the public company. It means that it is difficult for the WAJ headquarters to be fully involved in the public company's decision on whether or not to expand pilot activities. In addition, it is natural that WAJ cannot have strong motivation to expand the pilot

<sup>34</sup> They were established in 2004, 2007, and 2011 respectively.

activities. It seems that this is the mechanism not to secure the expansion of the pilot activities easily.

However, according to staff members at the WAJ headquarters, the knowledge and skills strengthened through the projects complement this mechanism of public company. In addition, if a GWA is fully corporatized as a public company, most staff members will be transferred from the GWA to the company. If a GWA demarcates services with a public company, some staff members will be transferred to the public company. Thus, the knowledge and skills strengthened by the project can be used within the public company. Concerns about the orientation and expansion of performance-based management only relate to the expansion of pilot activities.

In summary, given the structure in which NRW countermeasures was put forward and functioned in Phase 1 and phase 2, and presence of the staff members who participated in project activities, it is justified that the WAJ has an organizational structure that can utilize knowledge, skills, and experiences gained through the projects. However, the mechanism of water supply has been transformed to the one that cannot ensure the expansion of the pilot activities; therefore there is a minor challenges in the organizational aspects.

### 3.4.3 Technical Aspects of the Implementing Agency for the Sustainability of Project Effects

Through utilization of the materials and guidelines developed during Phase 1, enhanced knowledge and skills have remained in the WAJ as organizational knowledge. In addition, interviews with WAJ and GWA staff members suggest that most of this expertise is highly appreciated because it can be used for various activities including the operation and maintenance of water supply facilities (one of the GWAs' main tasks), and not just for the pilot activities. The implication is that these skills are useful for the daily work of the GWAs.

As for the knowledge, skills, and experience gained in Phase 2, the situation is almost the same. Materials and guidelines developed during Phase 2 have been used in WAJ headquarters and GWAs. Although the opportunities to practice preventive NRW measures have been limited since the pilot activities were stopped, staff members acquired knowledge and skills, and certified trainers have remained in the GWAs as a resource. According to the interview to WAJ headquarters and GWAs, they can practice the same activities as the pilot activities any time if there is direction from WAJ headquarters and/or financial backing. Although the rates of the self-assessment (as shown in Tables 4 and 5) have been declined as of the ex-post evaluation because supports from WAJ headquarters have not provided with the same level during the projects, they have remained their capacities the higher level than they were at the beginning of Phase 1. This implies that the

strengthened capacity still remains in the WAJ.

The Marka Training Center as the technical resources available to WAJ staff continues to provide training by using the outputs and equipment of the projects. As of the ex-post evaluation, the Marka Training Center has provided training for the licensing of private contractors and NRW-relevant trainings needed practice, among different training planned by the WAJ (table 17). Although theoretical training is provided at the WAJ headquarters or in neighboring facilities, lecturers from the Marka Training Center are sometimes dispatched to provide instruction on particular topics. As of the ex-post evaluation, the training plan shown in Table 17 has been developed; the Marka Training Center will continue to be used in the future. Moreover, according to the interviews with the WAJ headquarters, the training curriculums and materials relating to NRW countermeasures have been reviewed at the time of the ex-post evaluation; their outputs and project-based knowledge will be incorporated even into future materials.

Table 17. Training plan of the WAJ

(Unit: Person)

	2015		2016		2017		2018	
	the WAJ	Private sector	the WAJ	Private sector	the WAJ	Private sector	the WAJ	Private sector
Total trainees	1,110	430	1,035	415	830	479	780	460
Training courses: <u>Pipe networks</u> , pump essentials, pump characteristics and selection, pump operation and preventive maintenance, pump operators, chlorination, <b>leakage detection</b> , waste water operators, computer skills, waste management, lab technicians, <b>electrical technicians</b> , <b>water meters</b> , <b>safety regulations</b> , time management, communication skills								

(Source) the WAJ documents

Bold: Topics related to corrective NRW measures, Underlined: topics related to preventive NRW measures.

In the light of above, the materials and guidelines developed during Phases 1 and 2 have been used. Interviews and self-assessment results from the ex-post evaluation also confirm that skills and expertise have been sustained. Training provided by the WAJ continues to transmit the skills, knowledge, and experiences generated by the projects. Therefore, its strengthened capacity has been sustained.

#### 3.4.4 Financial Aspects of the Implementing Agency for the Sustainability of Project Effects

As of the ex-post evaluation, operation and maintenance expenses and total operation expenses have increased slightly. In addition, from these operation and maintenance expenses and total operation expenses, some budgets have been regularly allocated for the corrective measures strengthened during Phase 1, the training activities of the Marka Training Center cooperatively developed during Phases 1 and 2, and the licensing system

for private contractors developed during Phase 2. In addition, these expenses have increased in the last five years (table 18).

However, no budgets were allocated for the pilot activities. According to the interviews as of the ex-post evaluation, some GWA staff members cited the lack of budget to explain why the pilot activities were stopped. In practice, as Table 18 shows, the WAJ has had a chronic deficit. In addition, the budget for the procurement of equipment and materials has been limited, because the most of operation and maintenance budget has been allocated for the electricity due to the escalation of electricity bill. In such unfavorable situation in finance, it may difficult to allocate sufficient budgets for the pilot activities without proactive and organizational commitment<sup>35</sup>

Table 18. The WAJ's financial situation

(Unit: One Million Jordan Dinars)

Year	2008	2009	2010	2011	2012
Total revenues①	152.1	142.4	150.2	170.1	174.3
Operation and maintenance expenses② (expenses needed for operation and maintenance activities for water supply facilities. It includes expenses for electricity, equipment and materials and others.)	90.7	87.1	85.9	98.3	97.4
Electricity	51.3	51.1	53.0	62.3	63.7
Equipment and materials	0.9	0.3	0.3	0	0
Total operation expenses③(Personnel expenses and other indirect expenses are added to ②)	138.0	134.2	135.2	156.1	155.0
Operation ratio④ (%) <sup>*1</sup>	1.10	1.06	1.11	1.09	1.12
Total expenses⑤	218.4	259.1	230.3	260.3	270.1
Total deficit ⑥	-66.3	-116.7	-80.0	-90.2	-95.9
Total cost recovery ratio (%) ⑦ <sup>*2</sup>	69.7	55.0	65.2	65.3	64.5

(Source) the WAJ documents

Notice \*1 ④=① ÷ ③ \*2 ⑦=① ÷ ⑤

In summary, while some activities have been funded, with the WAJ covering increased operation and maintenance costs, funding for other activities such as including the pilot activities has stopped, due to the financial situation. The organization therefore faces minor financial problems.

As discussed above, some minor problems have been observed in relation to the policy background, and organizational and financial aspects of the implementing agency. Therefore, the sustainability of the projects is rated as "fair."

#### 4. Conclusion, Lessons Learned and Recommendations

<sup>35</sup> Nevertheless, the WAJ has allocated budget for the activities that is needed to preserve the water supply. For example, the WAJ has implemented large-scale projects such as the Disi Project (the project cost is about 1.1 billion US dollars, procured through BOT mechanism). This suggests that the WAJ's internal funding deficit does not always influence the budget allocations.

#### 4.1 Conclusion

The projects strengthened the WAJ's organizational capacity to organize NRW countermeasures through by establishing an organizational structure and system, improving the technical ability of staff members through training, introducing pilot and community awareness-raising activities, and developing a training curriculum and materials. In particular, Phase 1 focused on corrective NRW measures, and Phase 2 focused on preventive NRW measures. The relevance of the projects is high because both of phase 1 and phase 2 were consistent with national development policy including "Water Strategy for Jordan 2008-2022", and with development needs to overcome high NRW rates, as well as with Japanese assistance policy prioritizing the enhancement of water supply capacity. Although NRW rates were not reduced enough to achieve the overall goal, the strengthening of the organizational capacity targeted by the project purpose was achieved, and organizational capacity and some activities improved by the project have been sustained. Thus, the effectiveness and the impact can be rated as "fair." Efficiency is also "fair" because the project cost of Phase 1 exceeded the plan, although the project period of Phase 1 and both the project period and cost of Phase 2 were as planned. Sustainability is rated as "fair" because some minor problems were observed in relation to the policy background and to organizational and financial aspects of the implementing agency.

In light of the above, this project is evaluated as "partially satisfactory."

#### 4.2 Recommendations

##### 4.2.1 Recommendations to the Implementing Agency

1. **【It is necessary to absorb and maintain knowledge of the projects within the WAJ】**

The Project Management Unit (hereafter referred to as "PMU"), a focal unit of the Jordanian sides of Phase 1 and Phase 2, should share the knowledge and empirical results of the pilot activities with the NRW unit by December 2015<sup>36</sup> in order to maintain project knowledge of Phase 1 and Phase 2 in the future. On this occasion, it is essential for PMU not only to hand over the documents but also to hold an orientation for several days for thorough transfer.

##### 4.2.2 Recommendations to JICA

None

#### 4.3 Lessons Learned

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<sup>36</sup> This is six months after sharing the results of the ex-post evaluation with implementing agencies, because it is necessary to take action as soon as possible. It is assumed that planning of the orientation requires two months, preparation requires one month, review requires one month, and contingency requires two months.

1. 【Proactive and organizational commitment for the project is essential for the sustainability and extension of the pilot activities】

The project approach does not always receive proactive and organizational commitment from a recipient country and/or stakeholders, even though it involves cost-effective and/or empirically effective approaches such as pilot activities of the projects.

In order to receive proactive and organizational commitment, it is necessary to develop consensus for the extension among stakeholders not only through information collection and sharing but also through improvement of “the quality of relationship”<sup>37</sup> by involving various stakeholders (policy makers, technicians and practitioners, donors, private companies, people, etc.) as much as possible from the planning stage to implementation of the project.

The following two efforts are possible approaches to involve stakeholders at the planning stage.

- It is desirable to organize workshops with all stakeholders, such as policy makers, technicians and practitioners, donors, private companies, and residents.<sup>38</sup> In particular, it is essential that a workshop is not limited to project orientation and information sharing but provides participants with opportunities to discuss and listen to each other’s ideas and visions. Such a workshop can trigger the development of trust among various stakeholders and improve the quality of their relationships rather than only allowing stakeholders to grasp the context of the project. Trained, knowledgeable, skillful, and experienced facilitators should be appointed to make workshops more effective.
- It is advisable to create a communication management plan to develop a relationship between implementing agencies and other relevant agencies and allow them to share information. This was recommended in JICA’s “Project Management Handbook” (2007). Generally, a recipient of information can lose track of specifics in ambiguous communication because it becomes difficult to distinguish between important and unnecessary details. Intentional sharing and dissemination of information within a communication plan can separate important details from background material and attract stakeholders to the most important information.

In addition, the following two efforts can be made at the implementing stage.

- It is desirable to regularly hold meetings involving all stakeholders (policy makers,

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<sup>37</sup> “The quality of relationship” is defined as the degree of mutual understanding and sympathy. That is, a “good” quality of relationship indicates a situation in which there is mutual understanding and sympathy and in which people respect each other. In this connection, the lesson learned is based on the hypothesis that values and vision are not shared vertically and horizontally in many organizations, and thus, mutual understanding, sympathy, and respect are not born. As a result, such situations make people disinterested in or opposed to a certain activity (the pilot activities in the projects), making it difficult to secure sustainability.

<sup>38</sup> Based on the hypothesis mentioned above, it is essential to provide opportunities for various stakeholders to gather and have a dialogue, not just workshops that target stakeholders separately.

technicians and practitioners, donors, private companies, people, etc.), such as a technical working group for the licensing system for private contractors. By creating opportunities for all stakeholders to discuss and listen to each other's ideas and visions, such meetings make it easier for a project to gain proactive and organizational commitment through the building of trust and the improvement of relationship quality, rather than just sharing information. In addition, such meetings can induce developments such as cooperation from stakeholders during unexpected issues that the project members cannot handle alone. However, in order to secure the sustainability of the meetings, it is important during a project to make them regular meetings in which Japanese experts do not participate. For that purpose, it is necessary to strengthen the management and facilitation capacity of the implementing agencies and to transfer to them the responsibility of organizing the meetings.

- At the implementing stage, it is desirable to appeal to the all the stakeholders (policy makers, technicians and practitioners, donors, private companies, people, etc.) through meetings and documents focused on positive changes rather than on any problems that may have happened during the implementation. Generally, positive feelings and relationships attract people. In practice, it is necessary to take actions such as disseminating information about the positive changes that happen during a project through newsletters as well as through positive appraisals of activities of stakeholders and admiration for project activities during the regular meetings mentioned above.

## 2. 【It is best to take alternative indicators into consideration when describing the NRW situation】

Although the projects used the NRW rate as an indicator, it is difficult to say that possible positive changes of NRW situation generated by the projects were fully captured. Using a rate, the denominator of which is the amount of the system input, as the project evaluation indicator for NRW might not always capture the effect of the NRW countermeasures appropriately, because the influence of the increase and decrease of the system input is not directly related to the NRW countermeasures. Even the International Water Association has pointed this out. Thus, the use of indicators described by “volume,” not by “rate,” such as the volume of NRW per length of pipe network and per day ( $\text{m}^3/\text{km}/\text{day}$ ) and the NRW per connection in the pipe network per day ( $\text{m}^3/\text{connection}/\text{day}$ ), should be considered.<sup>39</sup> As mentioned in “3.2.2.1 Overall Goal,” it is possible to provide a more detailed analysis of a

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<sup>39</sup> These indicators describing the NRW situation are included in the Guidelines of the International Water Association and are set as performance indicators in Jordan, as mentioned in indicator ② of the project purpose of Phase 1. However, it is better not to use such indicators alone, because their accuracy and precision are not always high. The lesson mentioned here should also be considered for projects in other countries, although it might not be suitable for the Jordanian situation.

project and to capture the positive influence more by using “volume” indicators in the evaluation judgment.

END



## Appendix Achievement of Outputs

Achievements of outputs are described below.

### 1) Phase 1

Output	Achievement
1. The preparation for the formulation of the project is completed.	<p>It is judged as achieved.</p> <p>In the activities for this output, the formulation of the project was prepared through the clarification of the roles and relationships of the WAJ headquarters and GWAs, the project orientation, and trust building among stakeholders.</p>
2. WAJ engineers and technicians acquire the essential concepts and technology for NRW reduction.	<p>It is judged as achieved.</p> <p>Engineers acquired the basic skills and concepts needed for NRW measures through training. Basically, because the engineers had received technical education and the basic skills and knowledge of NRW countermeasures overlapped with the basic skills and knowledge of operation and maintenance, it was not difficult for the engineers to acquire the skills and concepts.</p> <p>Technicians improved their knowledge and skills during the training. According to the evaluation by Japanese experts and a technical examination after the training, technicians learned the basic skills and knowledge from the project activities and gained the ability to practice them without any difficulties.</p>
3. WAJ engineers acquire the implementation capability of internal training courses on NRW reduction.	<p>It is judged as achieved.</p> <p>Through Phase 1, training and certification of training structures, development of materials, and procurement of the equipment of the Marka Training Center were conducted, and training preparation by the trained instructors was completed.</p>
4. WAJ engineers and technicians acquire practical technology for NRW reduction through field work in pilot areas.	<p>It is judged as achieved.</p> <p>The pilot activity was conducted by the staff members of the GWAs in a self-reliant manner, with the assistance of Japanese experts. As a result, the staff members experienced the practices of the NRW countermeasures.</p>
5. WAJ strengthens a public awareness activity on NRW countermeasures.	<p>It is judged as achieved.</p> <p>Through Phase 1, the WAJ fulfilled the organizational structure and tools needed for the activity to raise community awareness. In addition, the WAJ experienced the management of supervising and working with CBOs through outsourcing parts of activities.</p>

2) Phase 2

Outputs	Achievement
1. WAJ's utilities' capacity of water network management is enhanced.	<p>It is judged as achieved.</p> <p>In Phase 2, the WAJ learned the skills and knowledge of preventive NRW countermeasures that had not been practiced in Jordan and gained practical experience through the training and pilot activity. The pilot activity was conducted by the staff members of the GWAs with the support of Japanese experts. The NRW ratio was successfully reduced by the preventive NRW countermeasures in addition to the corrective NRW measures.</p>
2. The mechanism for service-pipe and meter installation is developed.	<p>It is judged as achieved.</p> <p>In Phase 2, the system for service-pipe and meter installation was established through the development of the licensing procedures for private contractors. The system was drafted through technical working groups for the licensing system for private contractors. At the same time, training materials and a training curriculum were also prepared.</p> <p>The system was approved by the Secretary General of the WAJ just before the end of Phase 2. In addition, in May 2011, the official notice to begin training private contractors for water pipe and meter installation was issued.</p>
3. The relationship between WAJ and people for reduction of NRW is strengthened.	<p>It is judged as achieved.</p> <p>The staff members worked directly with CBOs in Phase 2. This was different from Phase 1. As a result, staff members could acquire experience and knowledge based on the people's views, including an understanding of the preparation and management of workshops and an awareness of the people.</p>