Jordan

FY2023 Ex-Post Evaluation Report of Japanese Grant Aid Project

"The Project for Rehabilitation and Improvement of Water Facilities in Tafieleh Governorate"

External Evaluator: Tomoko Tamura, Kaihatsu Management Consulting, Inc.

0. Summary

This project was carried out to improve water supply services in Tafieleh Governorate in Jordan by re-constructing the water distribution system, thereby contributing to improve the living conditions of the local community.

The project was in line with the development policy and needs of Jordan; there were no problems with the plan and approach of the project. The project was consistent with Japan's ODA policy at the time of planning. However, the creation of synergy with the United States Agency for International Development's (USAID's) training program that was envisaged was not confirmed. There was no plan for collaboration with other JICA projects. Accordingly, the relevance and coherence of the project are high.

The project constructed reservoirs and a new pumping station, rehabilitated a pumping station, renewed transmission and distribution pipelines, installed pressure-reducing valves and a distribution monitoring system, and procured pipeline materials. This was conducted largely in line with the plan. The installation of distribution branch pipelines and service pipelines and service connections were conducted and funded by the Jordanian government. The length of pipelines for this work increased by 2.5 times. The project cost was within the plan, but the project period was significantly exceeded. As a result, the efficiency of the project is moderately low.

The project was expected to increase the amount of revenue water and number of days of water supply as operation and effect indicators. However, the performance of these indicators did not reach the target. Study of other indicators of water supply services showed that, of the five distribution zones covered by the project, water pressure, hours of supply, and consumption improved in Bsaira, Tafieleh Lower and Tafieleh Upper,[1] compared to the time of planning and before project completion, which indicate improved water supply services. The impact of the project was also confirmed in these zones in terms of cost savings, and the elimination of inconvenience and concerns in daily life. However, in Qhadesiyeh and Gharandal there were many fewer days and hours of water supply in summer, and this did not improve compared to the situation before completion of the project. The impact on living conditions was also limited. This project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the project are moderately low.

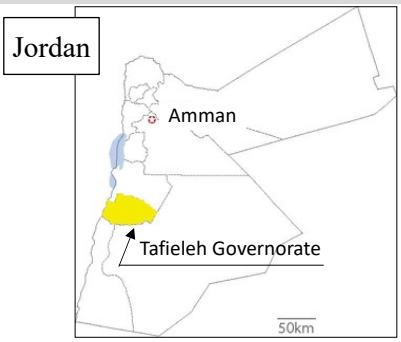
Operation and maintenance of the facilities developed by the project is well done in general. Operation and maintenance of the water distribution monitoring system is not in place, but the

[1] There are two distribution zones in Tafieleh city: the Lower area and the Upper area, which are located to the north and south of Tafieleh city respectively.

prospects for improvement and resolution are high. Therefore, sustainability of the project effects is high.

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

1. Project Description



Project Location

Bsaira Reservoir

Map provided by JICA; photo taken by the external evaluator.

1.1 Background

There was an urgent need to improve water supply facilities in the project area, as they did not supply enough water due to their inadequate capacity. In the Southern region of Tafieleh Governorate (Bsaira, Qhadesiyeh and Gharandal), branch pipelines were connected from the distribution pipelines without proper planning (see Photo 1). Water supply in Tafieleh Lower and Upper was inefficient, as water was distributed by complex pipelines from several distribution reservoirs. Many of the pipes were exposed above ground, and there was a substantial risk of leakage due to damage (see Photo 2). To solve these problems, the Jordanian Government requested grant assistance from the Japanese Government in 2008.

Photo 1: Complex exposed branch pipework

Photo 2: Leakage due to broken pipe joint

Note: Photos are the status at the project planning.
Source: Preparatory Survey Report of the project.

1.2 Project Outline

The objective of this project is to improve water supply services in the southern region of Jordan, Tafieleh Governorate, by reconstructing the water supply and distribution system (including construction of water reservoirs, renewal of distribution pipelines and establishment of distribution zones, installation of pressure reducing facilities and a water distribution

monitoring system, optimizing pump water supply), reducing non-revenue water, and distributing the increased water in a fair manner.[2]

Grant Limit/ Actual Grant Amount	Detailed design 47 million yen and Construction 1,911 million yen/ Detailed design 46 million yen and Construction 1,153 million yen
Exchange of Notes Date /Grant Agreement Date	Detail design January 2011 and Construction June 2011/ Detail design January 2011 and Construction June 2011
Executing Agency	Water Authority of Jordan (WAJ)
Project Completion	February 2021
Target Area	Tafieleh Governorate
Main Contractor(s)	Dai Nippon Construction Co., Ltd.
Main Consultant	TEC International Co., Ltd.
Preparatory Survey	First survey: October - November 2009 Second survey: April - July 2010
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoko Tamura, Kaihatsu Management Consulting, Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2023 - January 2025

Duration of the Field Study: December 2, 2023 - December 14, 2023,
May 18, 2024 - May 31, 2024

2.3 Constraints During the Evaluation Study

From the operation and effect indicators of the project, the number of days of water supply was not measured. Although data was available on the volume of revenue water, it was extremely low, because many households had water meters that were not functioning properly and did not indicate actual water supplied. The non-revenue and leakage rates were not known either, because water distribution in the project area had not been measured. Therefore, this evaluation conducted a household survey and case studies of public institutions and used the results from these as the

[2] Transcribed from the project objectives in the preliminary evaluation report of the project. The objectives and impact of the project were evaluated and analyzed in this evaluation by redefining the objective of the project as 'improving water supply services,' and the impact as 'improving the living conditions of the local community,' with reference to the preliminary evaluation report of the project and the Cooperative Preparatory Survey.

main source of information to assess and analyze improvement in water supply services by the project.[3]

3. Results of the Evaluation (Overall Rating: C[4])

3.1 Relevance/Coherence (Rating: ③[5])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Jordan

Both at the time of planning and ex-post evaluation of the project, the country's development policies, including the *National Agenda* (2006 - 2015) and *Jordan 2025* (2016 - 2025), and the sector strategy, *Jordan Water Strategy* (2008 - 2022 and 2023 - 2040), identified the water sector as an important area, and aimed to provide safe drinking water. The project's objective of improving water supply services was consistent with these development policies and the plans of the country at the time of planning and ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Jordan

At the time of planning there was a major need for improved water supply services in Jordan due to limited water resources and an increased demand for water. In the target area of Tafieleh Governorate inefficient water distribution pipelines had been provided due to emergency expansion of the pipe network in response to an increase in the number of water users. Problems, such as deteriorating water quality and leakage, were also occurring due to insufficient capacity of water supply facilities and ageing distribution pipelines, and there was a great need for improvement.

At the time of planning and post-evaluation, there were no other water sources in the target area, such as shallow wells, and water supply services were essential for the population. At the

[3] A household survey and case studies were conducted as part of the beneficiary survey for this evaluation. The household survey was conducted in May 2024. The sample size for each distribution zone was determined in proportion to the number of households with a water supply connection obtained from the Tafieleh Water Office, which was 20 households from both the southern region of Tafieleh Governorate and Tafieleh city (Lower and Upper), for a total of 40 households. Tafieleh Water Office keeps water user information on a GIS map, and the location of users' households was identified on the map; samples were selected using a quota sampling method. (This is one of the significant sampling methods to intentionally select representative samples from the population that is classified according to sample attributes and selected to have the same proportion as the population.) The sample was selected according to the number of samples allotted for each distribution zone as described above, taking care to scatter their location as much as possible. The evaluator visited the sample households with guidance from staff of from Tafieleh Water Office and conducted face-to-face interviews using a questionnaire. If the sample household was not available, the nearest household was selected for the survey. It should be noted that the survey results may be biased due to the small sample size of 40 households (there are approximately 8,700 households in the project area), and the fact that the sample was selected by quota sampling method and not random sampling.

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory.

[5] ④: Very High, ③: High, ②: Moderately Low, ①: Low.

time of the ex-post evaluation, the project's facilities have become important for supporting water supply in the target area, and the need for this continues.

3.1.1.3 Appropriateness of the Project Plan and Approach

The approach of the project is appropriate, and no problems were found. Lessons learned from similar projects in the past regarding use of a gravity water supply method were also adopted. The project was selected for Tafieleh Governorate, which is one of the least developed and most deprived areas in Jordan, and there was consideration of the high level of poverty and low social development in the area.

3.1.2 Coherence (Rating: ②)

3.1.2.1 Consistency with Japan's ODA Policy

The project aimed to improve water supply facilities, including measures to prevent leakage and deterioration of water quality, and was consistent with JICA's Country Assistance Program Phase 1 (August 2006), which was Japan's assistance policy for Jordan at the time of planning.

3.1.2.2 Internal Coherence

Synergy and complementarity with other JICA projects were not planned and were not realized.

3.1.2.3 External Coherence

At the time of planning, a Geographic Information System (GIS) training under the USAID-supported Water and Sewerage Infrastructure Development Project (2010 - 2015) was scheduled to be implemented in Tafieleh Governorate. Synergy between this and the training component of the project was expected. The USAID and JICA training were implemented, but it was not possible to confirm the synergy between them as there was no information about it.

The project was highly consistent with Jordan's development policy and development needs, and there were no problems with the project plan or approach. Although the project was consistent with Japan's ODA policy at the time of planning, the expected synergy with the training program of the USAID-assisted project was not confirmed. There was no plan for collaboration with other JICA projects. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The main outputs of the project were the construction of water supply facilities, procurement of pipeline materials, and consultancy services. In addition, distribution branch pipelines and

service pipelines were laid, and water supply connection works were carried out at the expense of the Jordanian Government.

(1) Construction of water supply facilities

The project included the construction of reservoirs, construction and renovation of pumping stations, renewal of transmission and distribution pipelines, installation of pressure-reducing valves, and installation of a water distribution monitoring system (Table 1, Figure 1). Details of the construction of the reservoirs, pumping stations and a water distribution monitoring system were as planned. As a result of a detailed survey on pipeline routes, the transmission pipelines were 504m shorter than planned; while the distribution pipelines were 618m longer, an increase of 114m in total length. This is an increase of 0.3% of the planned total length and is largely in line with the plan. Thus, outputs were generally in line with the plan.

Table 1: Planned and Actual Construction of the Main Facilities in the Project

Items	Planned	Actual	Planned vs. Actual
Construction of Bsaira reservoir	1,200m^3	Same as planned	As planned
Construction of Gharandal reservoir	600m^3	Same as planned	As planned
Expansion of Erawath pumping station	・Construction of a new pumping station and installation of two pumps ・Rehabilitation of existing pumping station and installation of two pumps	Same as planned	As planned
Renewal of transmission pipelines	14,220m	13,716m	Decreased by 504m
Renewal of distribution pipelines	29,110m	29,728m	Increased by 618m
Installation of pressure-reducing valves	22 Nos.	Same as planned	As planned
Installation of a water distribution monitoring system	15 flow meters, 3 water pressure gauges, 1 central monitoring unit	Same as planned	As planned

Source: Documents provided by JICA and the executing agency, field survey.

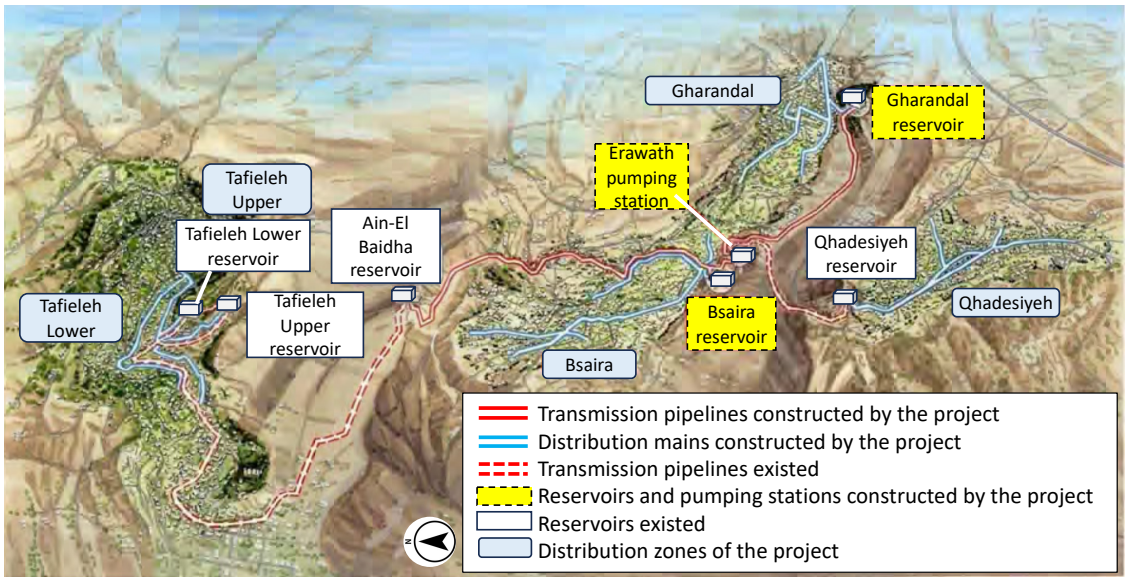


Figure 1: Map of Location of the Facilities Constructed by the Project

Source: Prepared by external evaluator based on the Preparatory Survey Report.

(2) Procurement of pipeline materials

JICA procured the pipeline materials, valves and valve chambers required for the work to facilitate construction of water distribution branch pipelines, laying service pipelines and installing water supply connections, which were planned to be implemented by the Government of Jordan. The planned and actual pipeline material procured was 50,600m and 54,530m respectively, an increase of 3,930m (7.8% more than planned). This was the result of detailed examination of the pipeline routes to ensure that the pipelines did not cross main roads.

(3) Consultancy services

Consultancy services included detailed design, construction management, and implementation of the training components. All were implemented as planned. The training was conducted to improve the capacity of staff of WAJ Tafieleh office in water distribution and non-revenue water management. There were no problems with the training delivery methods or outcomes.

(4) Construction conducted by the Government of Jordan

The Government of Jordan installed distribution branch and service pipelines and conducted water supply connection as planned. The planned length of the pipelines was 50,100m and the actual length was 127,008m, approximately 2.5 times more. This was because the detailed design survey revealed that the pipeline length would be longer than originally estimated. All pipeline materials, valves and valve chambers procured by JICA were laid and installed, and the shortfall was procured by WAJ.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost was 1,958 million yen from Japan and 967 million yen from Jordan, totaling 2,926 million yen. The actual project cost was 1,200 million yen from Japan and 254 million yen from Jordan, totaling 1,454 million yen. However, this actual project expenditure of 254 million yen from the Jordanian government is their total expenditure from January 2013 to completion of the project. There may have been some expenditure in 2011 and 2012, but records were not kept, and the amounts were not known. This evaluation compared the planned and actual project expenditure of Japan and concluded that the project cost was within the plan (61% of the plan) because the actual project expenditure by Jordan is incomplete, as mentioned above. The main reason for the reduction in project costs was the reduction in construction costs for the facility, because of competitive bidding.

3.2.2.2 Project Period

The planned project period was 36 months (3 years), from January 2011 to December 2013. The actual project period was 122 months (10 years and 2 months), from January 2011 to February 2021 (339%; 7 years and 2 months extension). According to the plan, JICA and the Jordanian Government were to carry out their works in parallel, and to complete at the same time. The JICA works were completed in May 2014, but part of the Jordanian Government works was delayed, resulting in completion in February 2021 (Table 2). This was the cause of the delay. As noted above, the pipeline extension for the Jordanian Government-funded works increased by a factor of 2.5, but this increase is not commensurate with the significant delay in the project duration of 7 years and 2 months. The project duration is therefore considered to have been significantly exceeded.

Table 2: Time of Completion of Installation of Distribution Branch and Service Pipelines; and Water Supply Connection Conducted by the Government of Jordan

Distribution Zones	Time of Completion
Bsaira 1: Construction by the initial contractor	December 2014
Bsaira 2: Construction by second contractor	February 2021
Qhadesiyeh	March 2015
Gharandal	March 2015
Tafieleh Lower area	July 2018
Tafieleh Upper area	July 2018

Source: Documents provided by the executing agency.

WAJ head office explained that the main reason for the delays in construction was that more time than expected was required for the following tasks:[6]

(a) Survey for laying distribution and service pipelines
(b) Securing the necessary budget for the procurement of additional pipeline materials, as identified in the survey
(c) Contractual procedures for the change of contractor for the works in Bsaira
(d) Obtaining road excavation permits from the Municipal offices.

The background to the above factors is as follows.

(a) Survey for laying distribution and service pipelines

When the schematic design was carried out in the cooperative preparatory survey, pipeline drawings for the subject area were only partially available, so the project's consultant and WAJ staff carried out interviews in the subject area and calculated the pipeline extension. However, after the start of the project, WAJ carried out a survey for the detailed design and calculated the pipeline extension, and found this to be significantly longer than the length calculated at the time of planning. The lack of sufficient information on the pipeline at the time of planning was probably the main reason for the difference in the pipeline extension.

(b) The budget required for procurement of additional pipeline materials identified in the survey

As the pipeline extension was longer than planned, the pipeline materials procured by JICA were found to be insufficient. Budget had to be secured to purchase new pipeline materials, which took time.

(c) Contractual procedures for changing the construction contractor in Bsaira

As the construction contractor selected and contracted in Bsaira was not satisfactory, WAJ terminated their contract and procured another contractor. It took a lot of time to terminate this contract and procure another contractor. It should be noted that the Jordanian side of the work was procured by a contractor on a package per distribution zone. As there was not a large amount of work, a Grade 4 contractor from Jordanian national construction contractors was procured, in accordance with WAJ regulations.[7] The conditions allowed for the selection of a relatively low-capacity contractor. This may have led to the selection of a relatively low-capacity contractor, and contributed to the delays.

[6] Although the number of months of delay in relation to each factor was not recorded or known, WAJ considers these to have been the main causes of delay, as each factor caused a delay ranging from months to years.

[7] In Jordan, the Ministry of Public Works and Housing has graded contractors from grade 1 to 6 according to their construction experience, technical staff, equipment owned, financial status, and others. WAJ determines the grade of contractor that can bid according to the project scale.

(d) Obtaining road excavation permits from municipalities

The construction experienced delays in obtaining road excavation permits from municipalities. This was due to the municipalities' concern that the road had been excavated once during the construction work by Japan, and that repeated excavating would impede traffic. We asked the WAJ officials in charge of the project at its implementation whether it would be possible to coordinate parallel implementation of construction work by Japan and Jordan, so that excavation would not be needed twice. The officials were of the view that coordination and parallel implementation was not possible, because it would be very difficult to match the speed of the Japanese tenders and contracts and those of Jordan, and the same construction site cannot be handed over to two contractors at the same time as it would make their responsibility for defects unclear.

Therefore, efficiency of the projects is moderately low.

3.3 Effectiveness and Impacts[8] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 3: Actual and Status of Target Achievement of the Operation and Effect Indicators

Indicators	Baseline value in 2010	Target value (2 years after completion)	Actual value in 2023 (2 years after completion)	Status of target achievement
(1) Per capita per day revenue water amount (ℓ/person/day)	84	96	65	Not achieved
(2) Reduction in non-revenue water ratio (%)	47	35	No data	Unknown
(3) Reduction in leakage ratio (%)	25	15	No data	Unknown
(4) Improvement in restricted water supply in Tafieleh South area: Increase in number of days with water supply (days/week)	1 - 3, 1.3 in average	3.5 in average	0.8 in average	Not achieved
(5) No. of service connections	Unknown	Not defined	8,894	Increased

Source: Sources of the baseline and target values are the Preliminary Evaluation Report. Sources for the actual (1) and (5) are provided by executing agency; (4) is the result of the household survey conducted in this evaluation.

Notes:

(a) Indicators (1), (2), (3) and (5) are for the areas where the distribution network, including distribution branch pipelines, service pipelines and water supply connections, were replaced by the project. Indicator (4) is for the Southern region of Tafieleh Governorate, including the three distribution zones of Bsaira, Qhadesiyeh and Gharandal.

(b) Indicator (4): "Number of days with water supply restriction" which shows the days without water supply, was used as an indicator in the Preliminary Evaluation Report. However, the "number of days with water supply", which is generally used in the project area, was used in this evaluation. Both indicators show the frequency of water supply per week. The baseline value set at the time of planning, "days with water supply restriction: 4 - 6 days/week" was converted to "days with supply days: 1 - 3 days/week,"

(c) Indicator (5) number of service connections is set as a supplementary indicator.

(d) At the time of planning, reductions in maintenance costs (target value: 147,834 JD/year) and CO_2 emissions (target value: 2,160 tonnes/year) were also set as operation and effect indicators. However, they were considered as impacts, because they are secondary and conceptual effects of the project.

(1) Per capita per day revenue water amount <Not achieved>

The per capita per day revenue water amount for the project area at the time of the ex-post evaluation was calculated as "annual amount of revenue water/estimated water supply population /365 days," as in the plan. The amount of water shown on invoices issued to households was considered as the annual revenue water amount (hereafter referred to as the "billed amount"). As

[8] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

Table 4 shows, the per capita per day revenue water amount in the target area at the time of the ex-post evaluation was 65 liters on average, which did not reach the target of 96 liters. Per capita per day revenue water amounts in 2021 and 2022 were also examined, and found to be 53 and 66 liters on average respectively, which are more or less similar to 2023 and did not reach the target. It should be noted that in Gharandal the target was exceeded in 2022 and 2023, but the reason for the higher amount in this distribution zone than in the others was not known.

Table 4: Per Capita Per Day Revenue Water in the Project Area

Distribution zone	2021				2022				2023			
	No. of connections	Population	Revenue water (m3/year)	Per capita per day revenue water (liter/ person/ day)	No. of connections	Population	Revenue water (m3/year)	Per capita per day revenue water (liter/ person/ day)	No. of connections	Population	Revenue water (m3/year)	Per capita per day revenue water (liter/ person/ day)
Tafieleh upper	1,806	11,473	208,261	50	1,832	11,638	280,616	66	1,912	12,146	287,837	65
Tafieleh lower	2,041	12,966	250,385	53	2,070	13,150	324,934	68	2,273	14,440	341,033	65
Bsaira	1,577	12,260	206,104	46	1,628	12,535	211,469	46	1,740	12,774	304,556	65
Gharandal	1,300	5,421	172,697	87	1,367	5,541	211,469	105	1,460	5,647	250,152	121
Qhadesiyeh	1,417	9,966	163,292	45	1,454	10,187	247,266	67	1,509	10,381	139,626	37
Projet areas total	8,141	52,086	1,000,739	53	8,351	53,051	1,275,754	66	8,894	55,388	1,323,204	65

Sources: Source for number of water connections and revenue water is information provided by Tafieleh Water Office. The population of Bsaira, Gharandal and Qhadesiyeh was obtained from the Statistics Department of Jordan. Consumer population of Tafieleh upper and lower was estimated by multiplying the number of connections with the average population per connection in the other three areas (6.353 persons/connection) since these distribution zones did not correspond to the administrative areas, and therefore there is no data at the Statistics Department.
Note: The amount of revenue water in Gharandal is higher than those in other regions, but the cause of this is unknown. As Figures 3 and 6 show, the number of water supply days in Gharandal was low, and improvements were limited, so there are discrepancies in the data.

The main reason for the actual revenue water amount not reaching the target was that water meters are often faulty, and meter reading and billing is not implemented properly. From the household survey conducted in this evaluation, it was found that the three main reasons for incorrect billing were as follows.

The first factor is that there are many faulty water meters, and usage readings have not been carried out for a long period of time. Of the 40 households surveyed, 11 were not being read because their meters were either not working at all or were not functioning properly. This represents 28% of the households surveyed. Faulty meters need to be repaired or replaced with new ones, but the evaluator found that the meters of these 11 households had not been read for the previous several months or years according to their billing records.

The second factor is that when a meter is not functioning current water usage is estimated and billed with reference to previous billed water usage, but this estimated water usage on the bill is often less than actual usage. The household survey conducted in this evaluation estimated the usage for each household (for estimation method, see "3-3-1-2 1) - (c) Water usage"). The 11 households mentioned above were all billed for less than the amount they used. Specifically, on average the 11 households were billed for 103m^3/household/year and used 343m^3/household/year. The amount of water billed is 30% of what was used, which is significantly less.

A third factor is that some of the meters being read are not working properly. Twenty-nine of the households in the household survey had meters. The annual billed amount and average usage of these 29 households was studied, and it was found that the former was 184m^3/household/year; however, the latter was 294m^3/household/year. The billed amount was only 63% of usage.

It should be noted that Tafieleh Water Office is aware that many water meters are not functioning properly, and therefore, that the meter reading is not being carried out properly. It plans to replace these meters in due course (see "3.4 Sustainability").

The value of this indicator at the time of the ex-post evaluation was below the baseline value. One possible reason for this is that the situation of meter reading and billing at the time of the ex-post evaluation may have been worse than at the time of planning. The baseline value was calculated by dividing the amount of water billed at the time of planning by the population; therefore, the calculation method for the baseline and the actual is the same.

(2) Reduction in non-revenue water ratio <Unknown>

At the time of the ex-post evaluation, the water distribution monitoring system installed under the project was not operational (reasons are explained in "3.4 Sustainability"). In addition, no flow meters were installed in the reservoirs in the project area. As a result, there was no record of water distribution in the project area, and therefore, the actual non-revenue water rate could not be calculated. Thus, the status of achievement of this indicator is unknown. However, non-revenue water ratio is likely to be high due to the extremely low amount of revenue water, as mentioned above.

(3) Reduction in leakage ratio <Unknown>

The actual leakage ratio at the time of the ex-post evaluation could not be calculated because the amount of leakage in the project area had not been measured or estimated. At the time of planning, half of the non-revenue water was estimated as leakage. At the time of the ex-post evaluation the amount of non-revenue water was still not known, so again the amount of leakage could not be estimated. Therefore, the achievement status of this indicator is unknown. As an alternative indicator, an attempt was made to study whether the number of leaks repaired decreased before and after completion of the project, but this was not known either because the number of repairs was not recorded.

(4) Improvement in restricted water supply <Not achieved>

In Jordan, where water resources are scarce, water is generally not supplied every day. Users take water from household water tanks that are filled every few days when water is supplied. This also happens in the project area.

At the time of planning, the number of days of water supply in the Southern region of Tafieleh Governorate ranged from 1 to 2 days per week (1.3 days/week in average). [9] The project aimed to increase it to 3.5 days/week.[10] At the time of the ex-post evaluation, Tafieleh Water Office did not measure the number of days of water supply. Therefore, the household survey conducted in the evaluation asked about this. The average number of days of water supply in the southern region was 0.7 days/week in summer, 1.0 day/week in winter, and 0.8 days/week on average in summer and winter (Figure 2). It did not reach the target of 3.5 days/week.

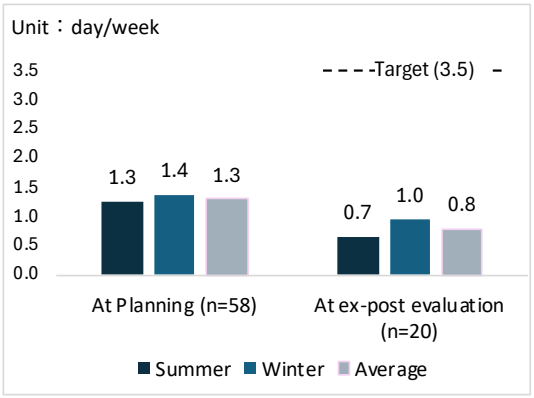


Figure 2: Number of Days of Water Supply in the Southern Region of Tafieleh Governate at the Time of Planning and at the Ex-post Evaluation

Source: Source of the value at the time of planning is the Cooperative Preparatory Survey; that of the ex-post evaluation is the household survey conducted in the ex-post evaluation.

As Figure 3 shows, the actual number is below the target for all distribution zones in the area. In Bsaira, water is supplied 1 day per week in both summer and winter, while in Qhadesiyeh and Gharandal water supply in summer is extremely infrequent, 1 day every 2 to 3 weeks (0.4 to 0.5 days per week). As discussed below, these distribution zones also have less water supply hours and water consumption in summer than the others. On the other hand, Tafieleh Lower and Upper have water supplied 2 days a week in both summer and winter. Although the sample size was small, the director of the Tafieleh Water Office confirmed that the water shortage situation in Qhadesiyeh and Gharandal, as identified in the household survey, can be generalized to households in these areas. Therefore, it was concluded that the target for this indicator has not been met.

[9] Results from a household survey conducted in May - June 2010 during the Cooperative Preparatory Survey of the project. The number of sample households in the survey was 300 in total: 76 in Tafieleh city, 58 in 15 distribution zones located in the south of Tafieleh Governorate, including Bsaira, Gharandal and Qhadesiyeh; and 90 in Ma'an city in Ma'an Governorate. The number of days of water supply mentioned above (1 - 3 days per week, average 1.3 days per week) is the average for summer and winter in the 15 distribution zones in the south of the Tafieleh Governorate.

[10] The number of days of water supply in the southern region of Tafieleh Governorate was set as the project's target at the time of planning. The reason for this to be considered as the target is that the number of days of water supply in this region was less than that for Tafieleh City (2.4 days/week) and needed to be improved.

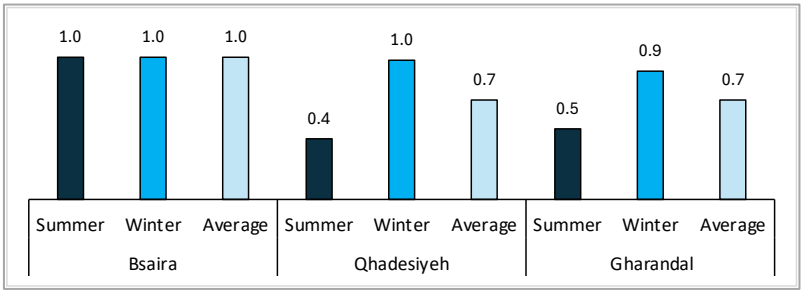


Figure 3: Number of Days of Water Supply in Southern Region of Tafieleh Governorate at the Ex-post Evaluation (unit: days/week, n=20)

Source: Household survey conducted in the ex-post evaluation

The five distribution zones of the project receive water from the Ain El-Baidha reservoir, and have the same water source. Nevertheless, Qhadesiyeh and Gharandal have water supplied on very few days during the summer. Discussions on the reason for this with the Director of the Tafieleh Water Office revealed that the main reason is that the distribution-main pipeline (blue line in Fig. 4) used to distribute water to these zones is not fully functional.

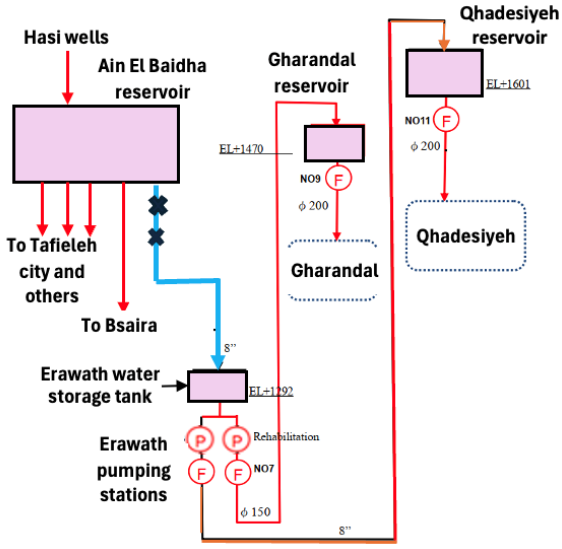


Figure 4: Distribution Diagram of Qhadesiyeh and Gharandal

Source: Illustrated by the evaluator based on document provided by JICA.

Note: The blue line in the figure shows the main distribution pipeline that is not functioning properly. Direct connections to water users are shown as "xx."

This distribution-main pipeline is used to distribute water from Ain El-Baidha reservoir to the Erawath water storage tank attached to the Erawath pumping station. The Director explained that there are several direct connections to water users from this distribution-main pipeline, which reduces the water pressure and volume, and makes it difficult for water to be stored in Erawath water storage tank.[11] As a result, the amount of water stored to be distributed to these zones is not sufficient, and they cannot increase the number of days and hours of water supply. The reason why the number of days and hours of water supply is particularly low during the summer is probably because the demand for water is higher during this season, and more water is consumed in other areas. This further reduces the amount of water available for the zones where it is more difficult for water to reach.

[11] Essentially, there should be no direct connections from the distribution-main pipeline to water users. The timing and reasons for these connections were not known.

The Director of the Tafieleh Water Office mentioned that another reason for less water supply days in summer to these zones was that there had not been an additional water source from a nearby cement factory for two years. These zones had been receiving water from a cement factory in Qhadesiyeh since 2015, and this was an additional water source in summer. However, in 2022 and 2023 the plant was unable to sign a contract for this supply for their own reasons, and the supply was stopped. However, during the household survey residents in both wards did not state that water supply was particularly poor during the two years mentioned above, and therefore the evaluator could not know the extent of the impact of the water supply suspension on water shortages in these zones.

Due to delays in completion, the target year for the project has been changed from 2016 to 2023. The evaluators checked whether the population had increased or the capacity of the facilities had become insufficient during the time of the delay. The construction of the distribution pipelines and water supply connections in Qhadesiyeh and Gharandal was completed in March 2015. Therefore, the evaluator questioned in the household survey whether the water supply services had improved at that time but then worsened. Then, all of the households surveyed answered that this was not the case. In addition, the water tanks constructed in the project have never been filled to capacity, and the pumps are not always in operation. Therefore, there is no shortage of facility capacity. The target year was 2016, but the pumping stations and distribution pipelines of the project were designed to fulfil the demand in 2025. There is also no evidence that the population has increased at a faster rate than planned. From these facts, it seems that the delay in the completion of the project cannot be said to be the factor to the water shortage in these areas.

It is possible that the situation at the time of the ex-post evaluation was worse than at the time of the planning, since the value at the ex-post evaluation was below the baseline value. In addition to the problems with the distribution-main pipeline mentioned above, urbanization and population growth may have increased water consumption of surrounding households, making it even more difficult for water to reach these areas. The baseline value was calculated based on the results of a household survey conducted at the time of planning (see footnote 9). Therefore, the calculation method for baseline and actual values is the same, although the sample size was different.[12]

[12] The evaluator conducted a follow-up survey on August 22, 2024 by telephoning the households that had been surveyed in these zones since she had received notification from the Tafieleh office confirmed that water supply from the Qhadesiyeh cement factory had resumed at the end of May 2024. In Qhadesiyeh, three of the six households surveyed answered the phone, and of these, two said that the water supply services (frequency, hours, water pressure) had improved, while one said that there had been no change. Once the water supply from the cement factory begins, the water from the Erawath water storage tank can be sent to Gharandal on a priority basis, so it was hoped that the water supply services in Gharandal would also improve. The evaluator also called the seven households in Gharandal that were surveyed, and five of them answered the phone, but all of them said that there had been no change in the water supply services. It seems that the resumption of water supply from the cement factory alone has not led to a fundamental solution to the water shortage.

(5) Number of water supply service connections <Increased>

An increase in the number of water supply service connections was set as an additional indicator and was studied. It was found that the number increased from the time of project completion to the time of the ex-post evaluation (Figure 5). The Director of the Tafieleh Water Office explained that the improved water supply services have facilitated an increase in population and housing, which has resulted in more applications for water connections. However, data on the number of water connections at the time of planning was not available, and comparisons before and after project implementation could not be made. The number of water connections is an additional indicator. No target was set, and, therefore, the level of achievement is not known.

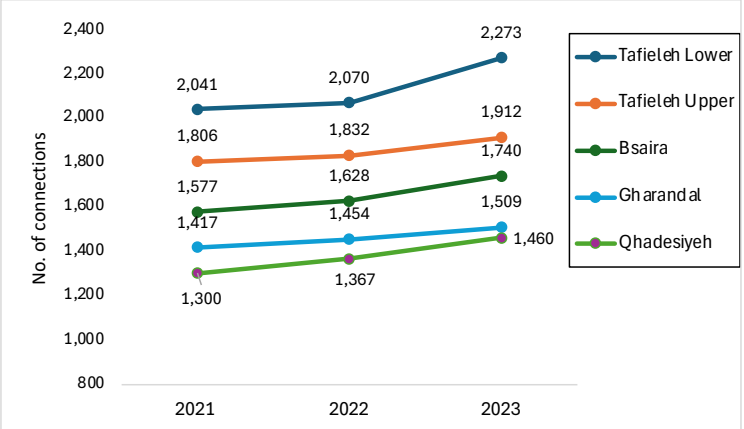


Figure 5: Number of Water Supply Service Connections in the Project Area

Source: Document provided by the Executing Agency.

3.3.1.2 Qualitative Effects

To investigate whether water supply services had improved since the project was implemented, a household survey of residents in the project area (see footnote 9 for details) and case studies of public institutions were conducted.[13]

1) Household Survey

The household survey looked at water supply services before project completion and at the time of the ex-post evaluation, including any improvements, number of water supply days, water supply hours, water pressure, water usage, sufficiency and satisfaction. The survey results showed that water supply improved after project implementation in Bsaira and Tafieleh Lower and Upper, with an increase in the number of days and hours that water was supplied. However, in Qhadesiyeh and Gharandal the water supplied in summer is not sufficient, and improvement due to the project was limited. The findings of the survey are described below.

[13] The evaluator visited nine public institutes in the target area with guidance from staff of the Tafieleh Water Office, and interviewed representatives of the institutes face-to-face using a questionnaire.

1)-(a) Were there any improvements?

The question - "Has water supply improved after the project compared to previously?" was asked in the household survey. A total of 65% of the households in the project area mentioned that the situation had improved (Figure 6). More households in Bsaira and Tafieleh Lower, 86% and 82% respectively, mentioned that it had improved. Less than half of the households in Qhadesiyeh and Gharandal said it had improved. The reasons for this are described in "3.3.1.1. Quantitative Effects (Operation and Effect Indicators) (2) Improvement in restricted water supply".

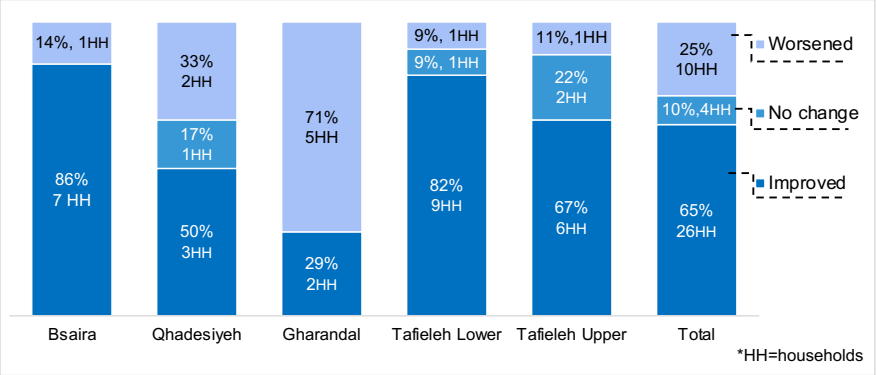


Figure 6: Status of Improvement of Water Supply Services (n=40)

Source: Household survey conducted in the ex-post evaluation

The 26 respondents who indicated that the water supply services had improved were asked for more details. The most common responses were water supply pressure, water supply days, hours of water supply, and water quality, in that order. In Bsaira, it is considered that the new Bsaira reservoir constructed by the project, and the fact that water is now distributed by gravity flow, contributed to these improvements. In Tafieleh city, the complex piping structure was replaced and streamlined by the project, which is considered to have contributed to improvement in the water supply pressure. The improvement in water quality can be attributed to the fact that, at the time of planning, rust and foreign particles in the old pipelines were sometimes in the water. The project has renewed the pipelines and prevented this.

1)-(b) Hours of water supply

Respondents were asked about hours of water supply at the ex-post evaluation and before the project was completed. The results show that Qhadesiyeh and Gharandal have extremely few hours of water supply in summer. (Figure 7)

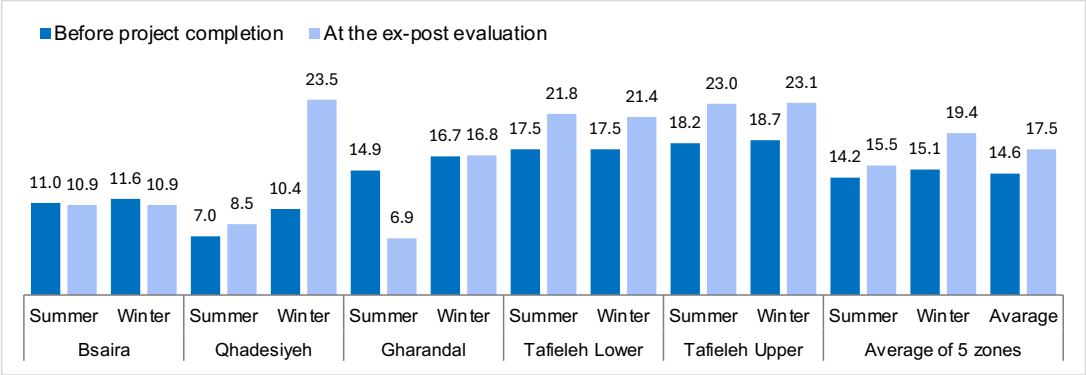


Figure 7: Hours of Water Supply at Ex-post Evaluation (Unit: hours/week, n=40)

Source: Household survey conducted in the ex-post evaluation

1)-(c) Water usage

Each household was asked questions about the number of family members, number and capacity of water tanks they own, number of days of water supply, whether the water tanks are full when water is supplied, and how much water they use before water is next supplied. Based on these responses, the usage per person per day was calculated (Figure 8). These results also show that water usage in Qhadesiyeh and Gharandal is extremely low in summer. It should be noted that, according to the Cooperative Preparatory Survey for this project, the Jordanian government had set a target of 120 liters of water usage per person per day in 2012. Water usage in Qhadesiyeh and Gharandal is significantly less than this target.

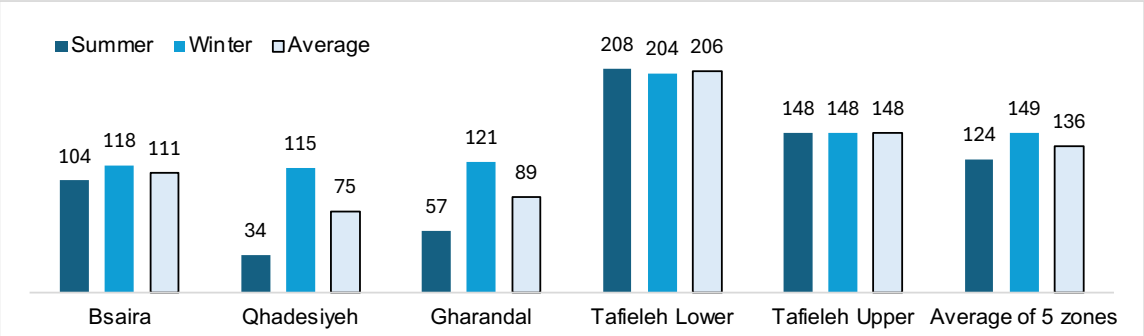


Figure 8: Water Usage per Person Per Day at the Ex-post Evaluation

(Unit: liters/person/day, n=40)

Source: Household survey conducted in the ex-post evaluation.

A comparison of water usage at the planning and post-evaluation shows a significant increase in Tafieleh city (Figure 9). There was a significant increase in winter and decrease in summer in the Southern region of Tafieleh Governorate.[14]

[14] As mentioned earlier, the number of days of water supply in the southern region of Tafieleh Governorate was less than at the time of planning (Table 3), but water usage in the region increased from the time of planning except in

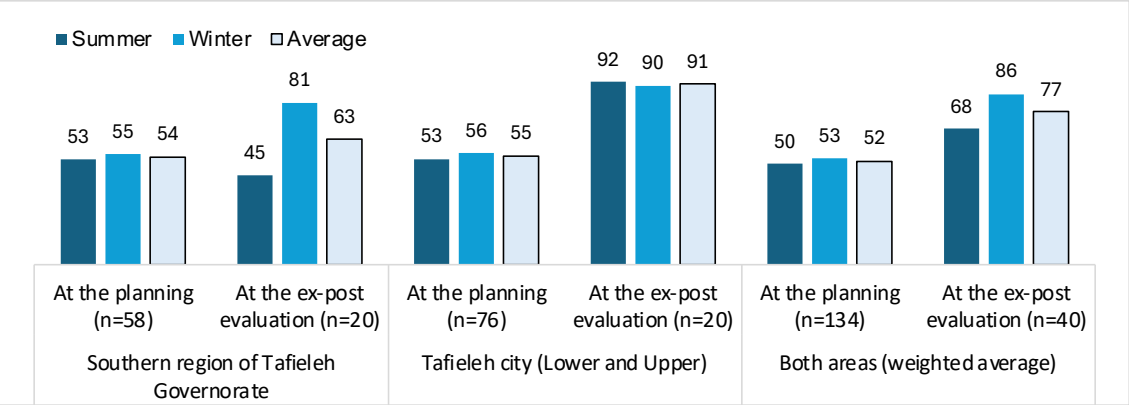


Figure 9: Water Usage per Household at the Time of Planning and at Ex-post Evaluation

(Unit: m^3/3 months/household)

Sources: Source of the value at the time of planning is the Cooperative Preparatory Survey, and that of the ex-post evaluation is the household survey conducted in the ex-post evaluation.

1)-(d) Satisfaction with water supply

Next, to determine whether enough water if supplied, households were asked four questions in the household survey: 1. if they obtain the amount of water they need for daily living from water services; 2. if they use a water lorry; 3. if they can fill their water tanks when water is supplied; and 4. if they use all the water in their water tanks before water is supplied again.

(d) 1. Whether they obtain the amount of water they need for daily living from water services (Figure 10)

All but one household did not receive an adequate amount of water supply in summer in Qhadesiyeh and Gharandal. All households received an adequate amount of water supply in both summer and winter in Tafieleh Lower and Upper. It is evident that water is not being distributed fairly.

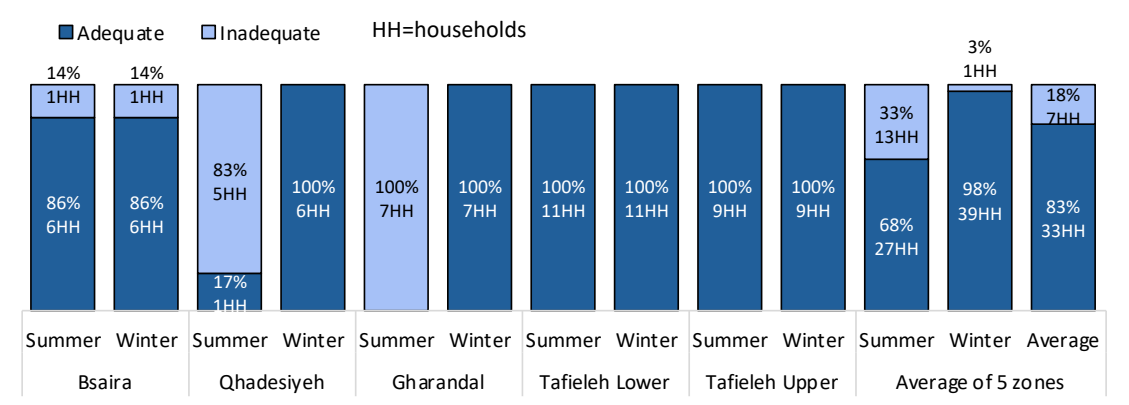


Figure 10: Are you Getting an Adequate Amount of Water for Your Daily Life? (n=40)

Source: Household survey conducted in the ex-post evaluation.

summer, as shown in Figure 9. This seems to be inconsistent. It is possible that the number of water supply days was higher, but the amount of water supplied per day was less at the time of planning than at the ex-post evaluation. But there was not enough information to confirm this.

(d) 2. Usage of water lorries

In Jordan, people call a water utility or private company to ask for a water lorry and purchase water when water is not supplied on a water supply day, or when water in the tank at home runs out. The same is true in the project area. Thus, the use of water lorries is an indicator of the sufficiency of water supply. In the household survey respondents were asked whether they used water lorries, and the amount of water they had purchased in the previous year. As Table 5 shows, 13 of the 40 households had used a water lorry in the previous year (33%). The areas with the largest number of households using water lorries were Qhadesiyeh and Gharandal.

A comparison of water usage from water lorries at the time of planning and at the time of the ex-post evaluation showed a significant decrease in both areas (Figure 11). This indicates that water supplies were more adequate in both regions at the time of the ex-post evaluation than at the time of planning.

Table 5: Usage of Water Lorries

(Unit: Households)

Distribution Zones	Used	Not Used	Total
Bsaira	1	6	7
Qhadesiyeh	6	0	6
Gharandal	4	3	7
Tafieleh Lower	1	10	11
Tafieleh Upper	1	8	9
Total	13	27	40

Source: Household survey conducted in the ex-post evaluation.

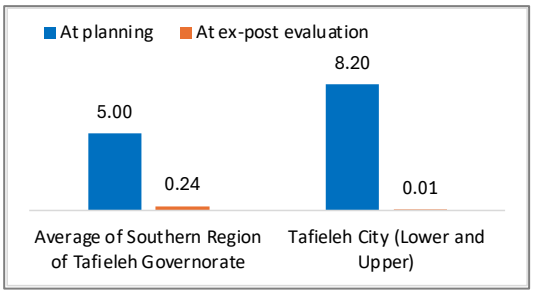


Figure 11: Amount of Water Supplied by Water Lorries (Unit: m^3/household/month)

Source: Source of the value at the time of planning is the Cooperative Preparatory Survey, and that of the ex-post evaluation is the household survey conducted in the ex-post evaluation

(d) 3. Whether they can fill their water tanks

In Tafieleh city, all households indicated that they could fill their water tank in both summer and winter. In Gharandal, all respondents indicated that they cannot fill their tank in summer. The inability to fill up the water tanks was due to insufficient water supply quantity, water pressure, water supply time, or all of these.

(d) 4. How much water stored in the tank will be used before the next water supply day

Six out of 7 households in Bsaira and all households in Qhadesiyeh and Gharandal responded that they would use all the water in the tank. In Tafieleh city, 8 out of 20 households responded that they are not using the entire amount. This indicates that these households have an extra amount of water supplied.

1)-(e) Satisfaction with water supply services

On average, across the target area, 60% and 73% of households were satisfied with water supply services in summer and winter, respectively. Qhadesiyeh and Gharandal had less households satisfied in summer, with only one household each (17% and 14%). Both Tafieleh Lower and Upper were highly satisfied, both in summer and winter, 82% and 89% respectively.

2) Case studies of public institutions

In December 2023, a total of nine public institutions, including five schools, three health centers, and one vocational training school in the target area were visited, and representatives of the institutions were interviewed regarding changes in water supply before and after implementation of the project. As Table 6 shows, water volume and water pressure increased at all institutes because of the project, indicating that sufficient water is being supplied for operation of the institutes. In addition, the number of days and hours of water supply improved at four institutes, and water quality improved at eight institutes. Before the project, tap water was contaminated with rust and dust, but after the project clear water was being supplied.

Table 6: Results of the Case Studies for Public Institutes on Improvement of Water Supply Services

Zones	Institutes	Volume	Pressure	Supply hours and frequency			Quality	Getting adequate water for operation of the institute?
				Status	Before the project	After the project		
Bsaira	School	Improved	Improved	Improved	1 day/2 weeks	24 hours/1 week	Improved	Yes
	School	Improved	Improved	No change	24 hours/1 week	24 hours/1 week	Improved	Yes
	Health Center	Improved	Improved	Improved	Almost no supply	12 hours/1 week	Don't know*	Yes
Qhadesiyeh	School	Improved	Improved	No change	24 hours/2weeks	24 hours/2 week	Improved	Yes
	Health Center	Improved	Improved	No change	48 hours/2 weeks	48 hours/2 week	Improved	Yes
Gharandal	School	Improved	Improved	Improved	Uncertain	5 days/17 days	Improved	Yes
	Health Center	Improved	Improved	Improved	Less than 24 hours/ 3 weeks	24 hours/12 days	Improved	Yes
Tafieleh Lower & Upper	School	Improved	Improved	No change	48 hours/1 week	48 hours/1 week	Improved	Yes
	Vocational Training Center	Improved	Improved	No change	48 hours/1 week	48 hours/1 week	Improved	Yes

Source: Household survey conducted in the ex-post evaluation.
Note: The health center in Bsaira was not sure if the water quality improved after the project because it had very little water supplied and relied on water lorries before the project.

3.3.2 Impacts

3.3.2.1 Intended Impacts

It was expected as an impact of the project that the living conditions of the local community would improve due to the improvement in water supply. This evaluation confirmed examples of this impact through the household survey and case studies of the public institutions.

1) Impact on reduction of cost due to improvement in water supply

The 26 households that said in the household survey that their water supply services had improved were asked if there were cost savings due to the improved water supply. Examples of impact included: the need to purchase water from water lorries was eliminated or reduced (8 households), and the cost of electricity to pump water was eliminated or reduced (3 households). Five out of 9 public institutes gave a similar response as mentioned above.

2) Changes brought about by the improved water supply in the lives and psychological conditions of the residents

In this evaluation, questions were asked about items appropriate for Jordan from the 12 items in the Individual Water Insecurity Experiences Scale (IWISE), a tool proposed by the International Water Association (IWA)[15] to measure the degree of water scarcity. This analyzes whether the improvement of water supply through this project has relieved inconvenience and psychological burdens in the lives of the residents. Specifically, respondents were asked whether they had experienced any inconvenience or worry in their daily lives, such as not being able to go out, wash dishes, clean the house, take a shower, or wash clothes as planned due to a shortage of water, or worry about running out of water, during the most recent one-year period before the ex-post evaluation and at the time of project completion. The survey revealed that households' daily inconvenience and worries were mostly resolved in Bsaira, but not in Qhadesiyeh. They became rather more severe in Gharandal, as Figure 12 shows. In Tafieleh Lower and Upper, there were few livelihood inconveniences and concerns even before the project, and there were no such problems at the time of the ex-post evaluation.

[15] Validity of an abbreviated Individual Water Insecurity Experiences Scale (IWISE) for measuring the prevalence of water insecurity in low- and middle-income countries, Journal of Water, Sanitation & Hygiene for Development, September 7, 2022.
https://iwaponline.com/washdev/article/12/9/647/90783/Validity-of-an-abbreviated-Individual-Water
Of the 12 IWISE items, 1) worry, 3) washing clothes (laundry), 4) plans, 5) food, and 7) washing body (bathing) were selected. For 4) planning, the respondents were asked mainly about planning to go out. 5) For food, they were asked about washing dishes. Cleaning was added because in Jordan people use water to wipe floors, etc., at home. Although this tool was originally intended to measure and compare the degree of water scarcity in each country, it was used to compare the situation before and after completion of the project in this evaluation.

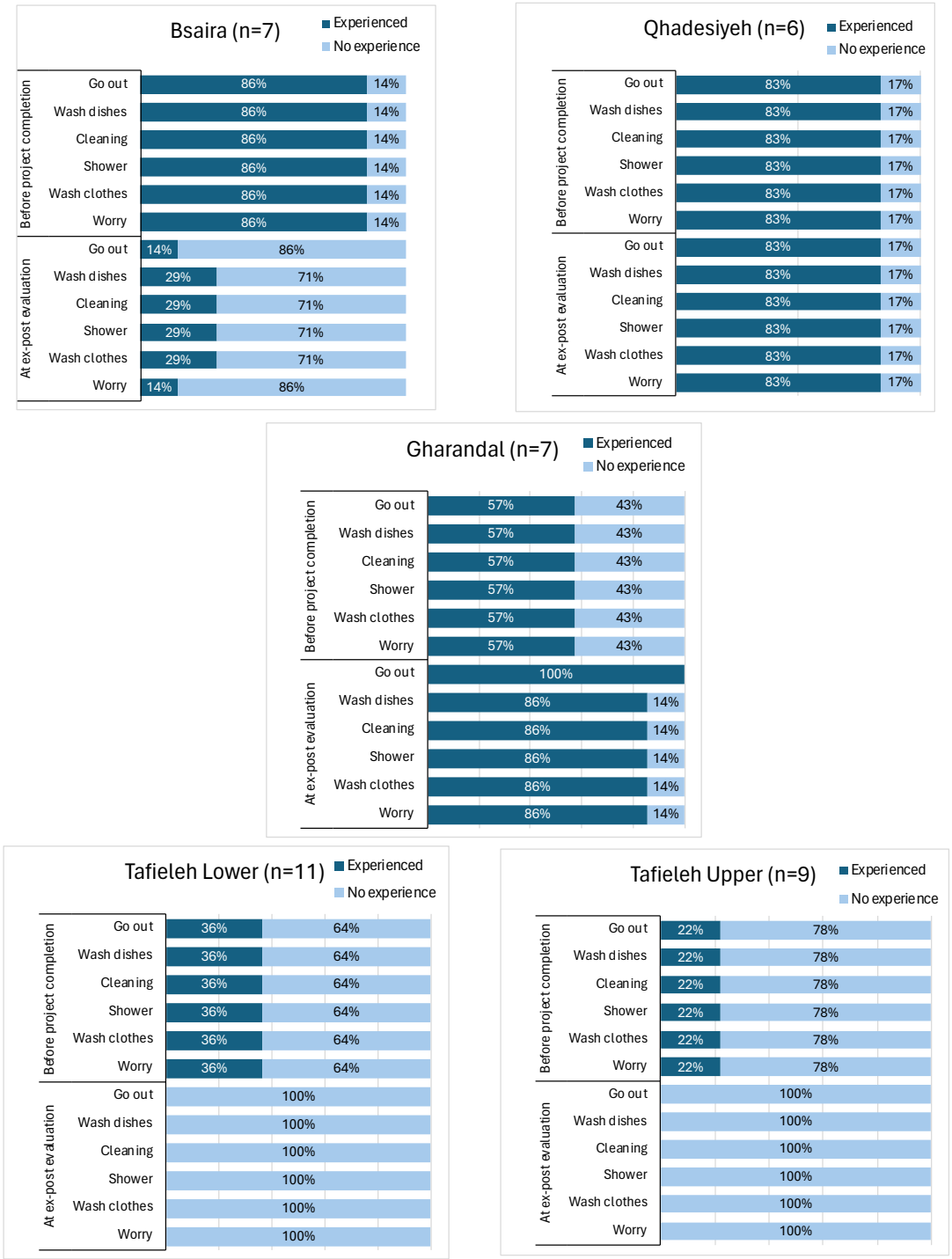


Figure 12: Whether the Improved Water Supply by the Project has Relieved the Inconvenience and Psychological Burden on Residents in their Daily Lives

Source: Household survey conducted in the ex-post evaluation.

<Examples of a household with improved water supply>

A man in his 60s living in Tafieleh Lower zone who stated that the water supply services has improved

As before water is supplied twice a week, but we are very grateful for the higher water pressure. On water supply days, we have to go up to the rooftop, open the water tank valve, wait for the water supply to start, and make sure the water tank is full. Earlier, because of low water pressure, it took about two hours for the tank to fill up. During that time, we had to climb up to the roof several times to check. It was tiring, and we could not go out. After the project, the water pressure increased and the tank was filled in 30 minutes, making it very convenient. We have the amount of water we need for our daily life and have no inconvenience.

Photo 3: The man opening the tap for the water tank

<Examples of a household with no improved water supply>

A woman in her 50s living in Qhadesiyeh zone who stated that there was no change in the water supply services

Water is supplied once a week for 24 hours in winter, which is adequate. However, water is supplied only once every 15 days and for only 10 to 12 hours in summer, making it impossible to fill up the water tanks during the supply. We are always worried in summer that we will run out of water. It is also painful to have to do the laundry for a family of seven and clean the house on days when water is supplied. When water runs out, we call for a water lorry. But it is frustrating because the lorry often does not arrive immediately. I need an improvement in the number of days and hours water is supplied in summer.

3) Impact of water supply improvements on public institutes

Operation and service delivery of the institutes were able to continue without hindrance, and concern about running out of water was removed as a result of improved water supply at all nine institutes visited. Some institutes mentioned that water tank needed to be cleaned less often as a result of improved water quality; there was no need to pump up water to the rooftop tank as a result of improved water pressure (Table 7).

Table 7: Case Study of the Public Institutes on the Impact of the Improved Water Supply

Area	Institutes	Impact of the Improved Water Supply
Bsaira	School	Water for hand washing and cleaning became always available. Schools are cleaner because of better cleaning.
	School	Water for hand washing and cleaning became always available. Schools are cleaner because of better cleaning. I no longer have to worry about running out of water.
	Health Center	Dental clinic and laboratory require particularly large amounts of water, and in the past consultations had to be stopped or delayed due to lack of water. After the project was implemented, this is no longer the case.
Gharandal	School	Drinking water is now always available and school activities and cleaning can be carried out without hindrance. Water quality has improved, and the frequency of water tank cleaning has decreased.
	Health Center	There is no longer a need to stop or delay medical consultations due to lack of water.
Qhadesiyeh	School	Water for drinking and cleaning became always available. School is cleaner.
	Health Center	There is no longer a need to delay medical consultations due to lack of water.
Tafieleh city	School	There is no longer any fear of running out of water.
	Vocational training Center	Water needed for drinking, toilets and cleaning the practice room is always available. The anxiety and stress of running out of water has been dispelled. In the past, the lack of water sometimes made it impossible to carry out practical training in the cooking for the hotel course and hairdressing classes. Currently, there are no such problems.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

In accordance with the JICA Guidelines for the Confirmation of Environmental and Social Consideration (established in April 2010), this project was determined to fall under Category C because it had minimal undesirable effects on the environment. An environmental impact assessment or initial environmental study was not required, and there were no specific monitoring items. There were no negative environmental impacts, problems, or complaints because of the project. Traffic control was enforced, and safety measures were implemented using a construction safety checklist. No accidents occurred.

2) Resettlement and Land Acquisition

Resettlement was not planned and has not occurred. Land acquisition for the reservoirs (government-owned public land) and access roads (private land) occurred. Acquisition and payment of compensation were made for these acquisitions in accordance with legal procedures. There were no complaints.

3) Gender Equality

When the evaluator asked the 26 households that stated that their water supply services had improved in the household survey whether the improvements had solved problems faced by women in the household, 12 households (46%) responded "yes" to the question. Specific examples given were "I/she no longer worries about running out of water", and "I/she no longer has to worry about running out of water for cleaning and housework." However, some respondents said that these were not limited to women, but also applied to men. Four respondents (10%) answered "disagree," and 10 (25%) answered "don't know."

4) Marginalized People

The household surveys and case studies confirmed that the project has had a positive impact on households that had difficulty receiving water or had not received water because they are at the end of the distribution network or at a high elevation, and are now receiving water. However, in Qhadesiyeh and Gharandal, the amount of water supplied in summer is very small, and the project effect has not been fully provided.

5) Social Systems and Norms, People's Well-being and Human Rights

Household surveys and case studies confirmed examples of the impact of the project in improving water supply and relieving people from the worry, stress, and inconvenience of running out of water.

6) Unintended Positive/Negative Impacts

According to maintenance staff of Bsaira, the burden of operation and maintenance tasks, such as responding to users' complaints, distributing water by lorries, and repair of old pipes, has been reduced because of the project.

The reduction in maintenance costs (JD/year) and reduction in CO_2 emissions (tons/year) were set as operation and effect indicators at the time of planning and were considered as "other impacts" in this evaluation. They could not be calculated because the amount of reduced water leakage in the project area was not known. The reduction in electricity consumption per unit flow due to reduced leakage, which was set as an alternative to these indicators, could not be calculated either because the amount of leakage and water distribution in the subject area was not measured.

There was a remarkable improvement in the water supply services in Bsaira and Tafieleh Lower and Upper due to the project. Examples of impact in terms of cost reduction and elimination of

inconvenience and concerns in daily life were also observed. However, water supply in Qhadesiyeh and Gharandal is inadequate in summer, and the improvement in the water supply aimed by the project was not realized. The target of operation and effect indicators, including amount of revenue water and days of water supply, had not been met.

This project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the project are moderately low.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

The importance of the water sector and importance of supplying safe drinking water in the national development plans and sectoral strategies at the time of the ex-post evaluation, as noted in "relevance," is expected to continue to support the sustainability of the effect of the project. There are no issues regarding policy and systems relating to sustainability of the project effect.

3.4.2 Institutional/Organizational Aspect

At the time of planning, WAJ was responsible for the operation and maintenance of water supply and sewage facilities in Tafieleh Governorate, as well as development work such as renewal of facilities and new construction. Aqaba Water Company was responsible for these tasks at the ex-post evaluation. The Company is a state-owned water utility established in 2004 in accordance with Jordan's policy of spin-off and privatization to improve the efficiency of operation of waterworks. WAJ owns 85% and the Aqaba Development Company and Aqaba Special Economic Zone Authority own 15% of the shares of the Company. Since its establishment, the Company has been responsible only for Aqaba Governorate, but in April 2022 it signed a contract with WAJ for the operation and maintenance of water and sewage facilities in Tafieleh, Ma'an, and Karak Governorates. The contract is for a period of four years, after which the operations of the three governorates will be officially transferred from WAJ to the Company if both parties agree.

At the time of the ex-post evaluation, the Tafieleh Water Office of the Company was in charge of maintenance and management of the facilities constructed by the project. The office was under the jurisdiction of WAJ at the time of planning, but, as mentioned above, it has been under the jurisdiction of Aqaba Water Office since April 2022, when the Company began to perform operations in Tafieleh Governorate. The office has the necessary personnel for operation and maintenance of the main water supply facilities constructed in the project, namely the reservoirs, pumping stations, and transmission and distribution pipelines. The roles and responsibilities of the institute are clear. There were no institutional problems that would hinder sustainability.

However, at the time of the ex-post evaluation, the water distribution monitoring system installed by the project was not in use, and no one was in charge of operation and maintenance.

The system had operated using the skills transferred under the training component of the project when it was installed, but this was no longer in use due to the lack of a concrete plan for its utilization and no one being charge of its operation and maintenance. It was unclear when the system stopped being used.

During this ex-post evaluation being carried out, Tafieleh Water Office, with the assistance of experts from the ongoing technical cooperation, "The Project for Enhancing Non-Revenue Water Management Capacity in Southern Governorate" (February 2023 -), examined the operational status and potential utilization of the equipment of the system. The results showed that 5 of the 15 flow meters were in operation, and capable of measuring the volume and velocity of water distribution. The other 10 flow meters and three water pressure gauges were found to require repair or replacement of wires and batteries of UPS (uninterruptible power supply). The central monitoring system would need to have its software reinstalled and a contract with a telecommunications company is needed to be able to collect data from a remote location. The Director of the office understood the importance of monitoring water distribution and reducing non-revenue water and based on the findings of this study he intended to take the necessary budgetary measures to repair and utilize the system.

There are some minor problems with the institutional/organizational aspect of operation and maintenance, but there is a high potential for improvement.

3.4.3 Technical Aspect

The main facilities, such as transmission and distribution pipelines, reservoirs, and distribution pumps constructed in the project, are common facilities for water supply, do not require any special technology, and there are no problems in sustainability with technical aspects at the time of the ex-post evaluation. There is no equipment or facilities that are not in use or are used extremely infrequently due to technical problems. In addition, the Tafieleh Water Office has introduced GIS-based management of pipeline data and customer information by the Aqaba Water Company, which is improving the efficiency of management information and customer management.

3.4.4 Financial Aspect

Aqaba Water Company's balance of payments has improved over the last three years, and it was profitable in 2022. This is because the balance of operating items has become profitable, and the amount of deficit in the balance of non-operating items has decreased. This indicates that the company can cover its maintenance and management costs with its water sales revenue.

Table 8: Financial Status of Aqaba Water Company (from 2020 to 2022)

(Unit: JD)

Account Item		2020	2021	2022
Operating	Revenues	19,524,286	21,439,552	21,579,319
	Expenses	19,956,038	18,710,741	19,611,535
	Deficit from operating activities	-431,752	2,728,811	1,967,784
Non-operating	Revenue	4,831,026	3,723,788	1,930,802
	Expenses	5,296,157	6,465,111	3,668,408
	Deficit from non-operating activities	-465,131	-2,741,323	-1,737,606
Profit/ Deficit		**-896,883**	**-12,512**	**230,178**

Source: Documents provided by WAJ (summarized by the evaluator).

Note: 1) Non-operating income mainly comprises profits arising from contracts for the operation of pumping stations and water treatment plants, while non-operating expenses mainly comprise depreciation and expected bad debt losses.

2) With regard to the management contract for Aqaba, Tafieleh Governorate, Ma'an and Karak, the company does not receive any commission from WAJ and is expected to operate on an independent basis.

Tafieleh Water Office operated with a profit from April to December 2022, with operating expenses covered by water and wastewater revenue. Operation and maintenance expenses are secured for security, fuel, maintenance, insurance, transportation, and others. The budget for operation and maintenance of the facilities constructed by the project has been allocated.

Table 9: Financial Status of Tafieleh Water Office

(from April 2022 to December 2022)

(Unit: JD)

Account items		Apr. - Dec. 2022
Operating Revenue	Revenue from water supply	2,588,664
	Revenue from sanitation service	83,069
	Total operatiing revenues	**2,671,733**
Operating Expenses	Operation and maintenance	209,018
	Administration	85,389
	Salaries, wagies, etc.	1,766,944
	Total operating expenses	**2,061,351**
Gross operating profit		**610,382**
	Other revenue	22,687
Net profit		**633,069**

Source: Documents provided by WAJ (summarized by the evaluator).

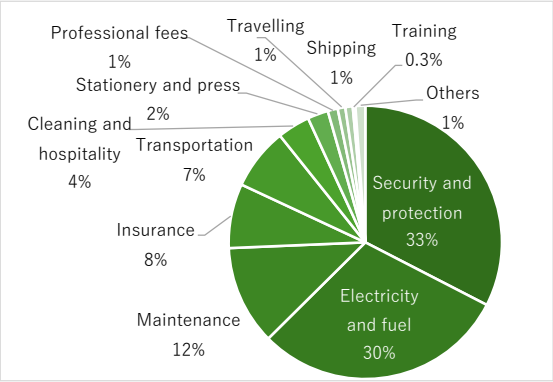


Figure 13: Breakdown of the Operation and Maintenance Costs of Tafieleh Water Office

(From April 2022 to December 2022)

As noted in "3.4.2 Institutional/Organizational Aspect," Aqaba Water Company has replaced WAJ in the operation and maintenance of water and wastewater facilities in Tafieleh Governorate since 2022. However, at the time of the ex-post evaluation, Aqaba Water Company was operating

and maintaining the facility based on a management contract with WAJ, and the formal transfer had not yet been implemented. Therefore, WAJ's finances were also studied, as described below.

WAJ has been continuously operating at a loss in recent years and is dependent on government subsidies. It has been working to improve its finances with support from the International Monetary Fund (IMF). As a result, the deficit in net income decreased continuously in 2019, 2020, and 2021 (see table below). There was a slight increase in the deficit of the net income in 2022 compared with the previous year. This was because, although the deficit in operating income decreased, the deficit in non-operating income slightly increased from the previous year.[16] and the valuation gain on foreign loans was less than in the previous year. Yet, the amount of deficit was smaller than in 2020 and 2019. WAJ's financial situation is expected to improve in the future as management improvements are underway.

Table 10: Financial Status of WAJ

(Unit: JD)

Account Item		2019	2020	2021	2022
Operating	Revenue	289,127,180	269,859,889	292,793,966	300,360,526
	Expenses	395,713,418	356,136,177	373,885,117	380,579,243
	Deficit from operating activities	-106,586,238	-86,276,288	-81,091,151	-80,218,717
Non-Operating	Revenue	8,015,009	11,455,643	17,440,097	12,134,686
	Expenses	165,053,688	127,429,061	129,722,111	128,585,393
	Deficit from non-operating activities	-157,038,679	-115,973,418	-112,282,014	-116,450,707
Deficit before financing expenses and tax		**-263,624,917**	**-202,249,706**	**-193,373,165**	**-203,137,811**
Loss /gain of foreign loans revaluation		12,334,652	-43,539,808	33,402,078	27,005,314
Financial cost		59,652,714	45,735,530	37,305,929	33,473,811
Deficit before tax		**-310,942,979**	**-200,053,984**	**-197,277,016**	**-203,137,811**

Source: Documents provided by WAJ (summarized by the evaluator)

Note: WAJ's financial statements are consolidated with its subsidiaries, and the income statement shown in the table above is also consolidated with the income statements of WAJ and its subsidiaries. The income statement for 2022 includes the profit and loss of Miyahuna, Yarmouk Water Company and Aqaba Water Company, in which WAJ has invested, as well as Tafieleh, Ma'an and Karak Governorates, which are contracted to Aqaba Water Company for operation and maintenance; and Barka Governorate, which are contracted to Miyahuna for operation and maintenance, are consolidated.

The Jordanian government has prioritized financial subsidies to WAJ and Aqaba Water Company under its policy of keeping water rates low, and operating water and sewage services as a public utility in terms of civil stability. This policy and financial subsidies are expected to continue in the future.

Based on the above, it can be concluded that there are no financial issues that would hinder the sustainability of the project.

[16] This is partly due to taking more provisions than the previous year for expected credit losses (expected credit losses on financial instruments with significantly increased credit risk).

3.4.5 Environmental and Social Aspect

The external evaluator did not identify any negative environmental or social impacts that would happen in future because of the projects.

3.4.6 Preventative Measures to Risks

No risks were identified that could hinder the continued effectiveness of the projects.

3.4.7 Status of Operation and Maintenance

Except for the water distribution monitoring system, all of the major facilities installed under the project are well utilized, in good operating and maintenance condition, and no problems have occurred.[17] According to the maintenance manager of the southern region of Tafieleh Governorate, the strainers of the pressure-reducing valves are cleaned about twice a year. Pumps and motors are inspected weekly, and reservoirs are inspected twice a year. Consumable parts, such as rubber parts for the pumps, are purchased with the maintenance budget allocated to Tafieleh Water Office by the Aqaba Water Company. When replacement parts are needed, the office applies to Aqaba Water Company for budget and procures them. There was no problem with a shortage of spare parts.

Several minor cracks had developed on both side walls of Bsaira reservoir, allowing water to seep out at the time of the ex-post evaluation. It is believed that the ground of the reservoir has settled slightly, and the side walls distorted spontaneously, considering the fact that the reservoir is nine years old. This could be repaired by injecting a non-stretch material, such as epoxy resin. Tafieleh Water Office plans to implement this repair with the 2025 budget.

When asked in the household survey if they had filed a complaint with the Tafieleh Water Office in the previous year, 27 of the 40 households said they had. Complaints in the southern region were related to water supply, while those in the Tafieleh Lower and Upper were about leaks from pipes in the street. Old distribution branch pipelines remain in both distribution zones for unknown reasons; some of them have not been buried underground and are on the street. They can be damaged by passing vehicles, resulting in leaks. During the household survey, some households were identified as receiving water supply from both the old distribution branch pipelines and the distribution network installed by the project. The Tafieleh Water Office is aware of this problem, and plans to start streamlining the pipelines at the end of 2024.

WAJ head office explained that the distribution-main pipeline from the Ain El-Baidha reservoir to the Erawath water storage tank, which is causing water shortages in Qhadesiyeh and Gharandal, will be renewed under a USAID-supported project.[18] Faulty water meters of the consumers are

[17] The motor of one of the two new pumps at the Erawath pumping station had failed and was replaced with a new one in 2021 with WAJ's budget.

[18] Fixed Amount Reimbursement Agreement (FARA) project.

also scheduled for replacement, and procurement of 4,000 meters was underway at the time of the ex-post evaluation.

After completion of the project, the distribution network was extended and a new Qhadesiyeh reservoir of 1,130m^3 was constructed in the project area. They have future plans, such as installation of flow meters in reservoirs and pumping stations in the project area, introduction of the SCADA system,[19] and renewal of the Hasi wells, which is the water source in the project area. These are expected to contribute to the sustainability and further development of the effect of the project.

Slight issues have been observed in the institutional/organizational aspects of operation and maintenance; however, there are good prospects for improvement and resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was carried out to improve water supply services in Tafieleh Governorate in Jordan by re-constructing the water distribution system, thereby contributing to improve the living conditions of the local community.

The project was in line with the development policy and needs of Jordan; there were no problems with the plan and approach of the project. The project was consistent with Japan's ODA policy at the time of planning. However, the creation of synergy with the USAID's training program that was envisaged was not confirmed. There was no plan for collaboration with other JICA projects. Accordingly, the relevance and coherence of the project are high.

The project constructed reservoirs and a new pumping station, rehabilitated a pumping station, renewed transmission and distribution pipelines, installed pressure-reducing valves and a distribution monitoring system, and procured pipeline materials. This was conducted largely in line with the plan. The installation of distribution branch pipelines and service pipelines and service connections were conducted and funded by the Jordanian government. The length of pipelines for this work increased by 2.5 times. The project cost was within the plan, but the project period was significantly exceeded. As a result, the efficiency of the project is moderately low.

The project was expected to increase the amount of revenue water and number of days of water supply as operation and effect indicators. However, the performance of these indicators did not reach the target. Study of other indicators of water supply services showed that, of the five distribution zones covered by the project, water pressure, hours of supply, and consumption

[19] SCADA is an abbreviation for Supervisory Control and Data Acquisition. It is a type of industrial control system that performs system monitoring and process control by computer. It can collect information on, for example, flow rates and pressure of pipelines, control valves, and can detect abnormalities.

improved in Bsaira, Tafieleh Lower and Tafieleh Upper, compared to the time of planning and before project completion, which indicate improved water supply services. The impact of the project was also confirmed in these zones in terms of cost savings, and the elimination of inconvenience and concerns in daily life. However, in Qhadesiyeh and Gharandal there were many fewer days and hours of water supply in summer, and this did not improve before completion of the project. The impact on living conditions was also limited. This project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the project are moderately low.

Operation and maintenance of the facilities developed by the project is well done in general. Operation and maintenance of the water distribution monitoring system is not in place, but the prospects for improvement and resolution are high. Therefore, sustainability of the project effects is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Improvement of water supply in Qhadesiyeh and Gharandal in summer

This evaluation found that in Qhadesiyeh and Gharandal the number of days and hours of water supply in summer are less than in other areas, and the necessary amount of water for daily life is not provided. These areas did not fully benefit from the project effect either. Tafieleh Water Office should improve water supply services in these areas by ensuring the contract for additional water supply from the cement factory every summer; and by replacing the distribution-main pipeline from the Ain El Baidha reservoir to Erawath water storage tank urgently. In addition, Aqaba Water Company should make the necessary budgetary provision, WAJ should supervise implementation of the same.

It is also important for WAJ to monitor and report regularly to JICA on the improvement of revenue water and water supply restrictions, which were not achieved in the ex-post evaluation. In particular, it is recommended that household surveys be conducted again in Qhadesiyeh and Gharandal, which have water shortages, and that the results be reported to JICA.

(2) Utilization of water distribution monitoring system

Although the water distribution monitoring system installed in the project was not in use at the time of the ex-post evaluation, some of the equipment was in operational condition and other equipment could probably be utilized with necessary repairs and maintenance. The Tafieleh Water Office should make the necessary repairs and actions to reutilize the system, develop a utilization plan, and assign supervisors and workers to make the system operational again. In this regard, the Aqaba Water Company should take the necessary budgetary and staffing measures; and WAJ should oversee that the above-mentioned measures are taken.

(3) Streamlining the distribution network in Tafieleh Lower and Upper

It was found that some old distribution branch pipelines remained in Tafieleh city even after they were renewed by the project. Some of the old distribution branch pipelines have not been buried, and are exposed above the ground, causing leakages. Some households receive water supply from both old and new pipelines, which is irrational. The Tafieleh Water Office should study the current situation and proceed with the survey and construction work as soon as possible, so that all households in the distribution zones can be connected to the distribution pipelines installed by the project. In addition, above-ground piping, which causes leaks, should be eliminated.

(4) Replacement of consumers' water meters

The amount of revenue water in the project area was very small, and the household survey showed many instances of non-functioning water meters. For example, 86% and 56% of the households in Gharandal and Tafieleh Upper distribution zones respectively did not have functioning meters. Tafieleh Water Office should ensure that the planned meter replacement is implemented, and that water bills are collected fairly and reasonably.

(5) Repair of Bsaira reservoir

It was found in the ex-post evaluation that several small cracks had developed on both side walls of Bsaira reservoir, and water was seeping out. Tafieleh Water Office should take the necessary budgetary measures to carry out the repair without delay. Aqaba Water Company should also take the necessary budgetary measures for the repair; WAJ should oversee that the repair is conducted.

4.2.2 Recommendations to JICA

JICA should receive reports from WAJ regularly on implementation of the above recommendations, and especially monitor whether the water supply services in Qhadesiyeh and Gharandal have improved.

4.3 Lessons Learned

(1) Utilization of water distribution monitoring systems requires organizational efforts to reduce non-revenue water

The water distribution monitoring system installed in the project is useful equipment that enables monitoring of the amount and ratio of non-revenue water in each distribution zone, and efficiently reducing non-revenue water. In the project, the equipment was installed as planned and guidance was provided in the training component, but the system gradually fell into disuse because staff at the Tafieleh Water Office, where the system was installed, did not find the system useful, and no one was assigned to be responsible for its operation and maintenance. This was mainly because there was no institutional effort to reduce non-revenue water at Tafieleh Water

Office at the time the system was installed. In future, when considering the installation of a water distribution monitoring system for a project in the water supply sector, it is necessary to confirm that the branch office of the water utility where the system will be installed has an institutional approach to reducing non-revenue water, and that the operation and maintenance management system for the equipment is in place. It should also be noted that it is difficult to introduce an institutional approach for non-revenue water reduction, or to establish an operation and maintenance system, only through guidance provided in the training component of a Grant Assistance project.

(2) For urgent projects, carefully consider whether construction work to be undertaken by the grant recipient government is a risk factor for delays

It was planned that JICA's and WAJ's work would be carried out in parallel and completed at the same time in this project. In reality, however, WAJ's construction work was significantly delayed, and accordingly, the realization of the project's benefits was significantly delayed. This evaluation found that there were the following issues with the planned simultaneous implementation and completion of both construction works:

- It may not be possible to perform both works in line with each other, since the timing of procurement of each contractor may be different.

  Normally, after construction of distribution pipelines is complete, the construction of the branch pipelines that connect to the distribution pipelines is carried out. When the same contractor performs both works, the latter can be carried out almost simultaneously by starting the latter soon after the former is completed. However, if a JICA contractor is undertaking the former and a WAJ contractor is undertaking the latter, procurement timing of these contractors may not be the same due to delays in approval of bid documents, unsuccessful bids, or re-bidding; these works may not be executed simultaneously.
- The construction site cannot be handed over to two contractors at the same time.

  Prior to construction, WAJ needs to hand over the construction site to the contractor. In WAJ's opinion, even if the procurement of JICA's and WAJ's contractors proceeds simultaneously, the construction site cannot be handed over to two contractors at the same time, because liability for defects would not be clear. Therefore, it is still difficult to proceed with the construction of distribution pipelines and branch pipelines almost simultaneously.
- The road will need to be excavated twice, which will delay obtaining the excavation permit.

  When different contractors undertake the construction of distribution pipelines and branch pipelines they will have to excavate the road twice, because it is difficult to carry out the two construction works at the same time, as mentioned above. In such a case, as

experienced by this project, obtaining excavation permits from the local government can be difficult due to concern about the repeated inconvenience to traffic. This may delay the project period.

- WAJ has difficulty responding to urgent construction work

  WAJ explained that it usually takes four years for them to go through the process of securing a budget, bidding, and contracting; it is difficult to implement construction work at the speed expected for implementation of an urgent project.

  When planning construction work to be undertaken by the grant recipient government in a project, it is necessary to carefully consider whether it will be possible to carry out construction work by JICA and the recipient government simultaneously, whether there will be delays caused by two contractors carrying out the work, and whether the agency in the recipient government is ready to implement the urgent work in a timely manner. In addition, if the project is extremely urgent and there is a risk of significant delays due to the costs borne by the recipient government, it should be considered if JICA can implement the entire project instead of including costs for some works to be carried by the recipient government.

(3) Early determination of construction quantities and appropriate setting of procurement conditions for contractors are important to promote construction work to be undertaken by the grant recipient government

The lessons learned from this project are as follows for the smooth implementation of a project when the project component includes construction work to be undertaken by the grant recipient government.

(a) Ascertain the quantity of the construction work to be undertaken by the grant recipient government at the time of project planning

In this project, the extension of the distribution branch pipelines significantly increased from the assumption at the time of the basic design after the survey study for water supply connection was conducted. Then, it took time to secure a budget for the purchase of additional pipeline materials. An increase in the quantity of construction work could be a risk factor for delays in starting construction. It is advisable to conduct a detailed survey at the time of planning so that the quantity of construction work to be borne by the grant recipient government can be ascertained as accurately as possible.

(b) Procurement conditions should allow the selection of a contractor with the capacity to carry out the work without delay.

In this project, the progress of some of the work undertaken by the grant recipient government was slow, and it took a lot of time to terminate the contract of the contractor who had undertaken the work and to select another contractor. In this project, the work

undertaken by the grant recipient government was divided into five packages, which resulted in a smaller scale of work, and, therefore, according to WAJ regulations, the procurement conditions allowed a contractor with a relatively low rating to be selected. This may have contributed to the delay. The executing agency should take the urgency of the construction work into account and consider putting together packages, so that they can procure construction companies with higher capacity. JICA may check the procurement conditions in advance to avoid any risk factors that may cause delays and provide advice as necessary.

(4) Study if any people are left out from the project effects after the water distribution system has been reconstructed

The project involved reconstruction of the water distribution system in five distribution zones. It was found in the ex-post evaluation that two of the distribution zones were not receiving sufficient water in summer. This was primarily due to problems with the existing distribution-main pipeline. If information on existing distribution pipelines is not available at the time of planning, it may be impossible to anticipate problems that may occur once the new distribution system is in operation. In projects to reconstruct a water distribution system, the executing agency needs to investigate the status of water distribution and water supply services after the project is completed, to ensure that no one is left behind from the project effects, and work to resolve any problems with the existing facilities as soon as possible. JICA should also monitor to ensure that such investigations and actions are implemented.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None.

5.2 Additionality

None.

(END)