Ex-Post Project Evaluation 2023
Package II-2 (Bhutan, Jordan)
Evaluation Reports

January 2025

JAPAN INTERNATIONAL COOPERATION AGENCY

KAIHATSU MANAGEMENT CONSULTING, INC.
MITSUBISHI UFJ RESEARCH AND CONSULTING CO., LTD.

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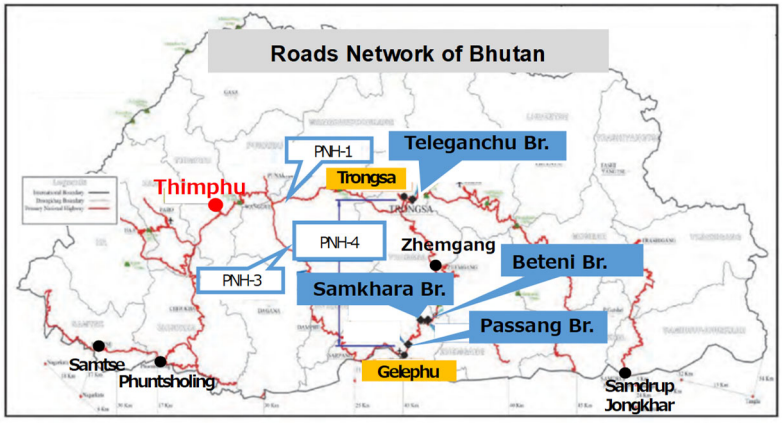
FY2023 Simplified Ex-Post Evaluation Report of Japanese Grant Aid Project
External Evaluator: Keiko Watanabe, Mitsubishi UFJ Research and Consulting Co., Ltd.
Duration of the Study: October 2023–January 2025
Duration of the Field Study: February 26, 2024 – March 17, 2024

Country Name	The Project for Reconstruction of Bridges on Primary National Highway No. 4
Kingdom of Bhutan	



Location of the Project site
(Source: Information provided by JICA[1])

Samkhara Bridge
(Source: Photo taken by the evaluator)

I. Project Outline

Background	In Bhutan, the majority of the national land is mountainous, and road transport is the most important means of transportation. Bhutan's road network consists mainly of the national highway network, with a total of five primary national highways; one east-west (Primary National Highway No.1 (PNH-1)) and four north-south (PNH-2 to PNH-4 and Asian Highway (AH 48)). The Primary National Highway No. 4 (PNH-4)[2], the target of this project runs southward from Trongsa, about halfway along PNH-1, to Gelephu on the Indian boarder. A national project, the Mangdechu Hydroelectric Power Plant, was under construction along the route. PNH-4 plays an important role in facilitating the construction of the power plant and promoting Bhutan's economic growth. On the other hand, most of the bridges on PNH-4 were constructed before 1980s and many became old, damaged, and did not meet Bhutan's current design standards for both width and load capacity.			
Objectives of the Project	The objective of this project is to ensure stable traffic by reconstructing four bridges (Teleganchu Bridge, Beteni Bridge, Samkhara Bridge and Passang Bridge) in Trongsa and Sarpang districts and improving performance and safety of these bridges, thereby contributing to the promotion of regional economic revitalization and improvement of living conditions in rural areas.			
Contents of the Project	1. Project Site: Trongsa District (Teleganchu Bridge) and Sarpang District (Beteni Bridges, Samkhara Bridge and Passang Bridge) 2. Japanese side: 1) Construction Works: Reconstruction works of the four bridges on PNH-4 (including slope protection works and foot paths), and construction of approach roads, 2) Consulting Services: Detailed design, bidding assistance, and construction management 3. Bhutan side: Construction-related: Removal and relocation of obstructing objects that affect construction works, provision of land for soil disposal sites and construction waste disposal sites, relocation and installation of electricity, water, drainage, and other ancillary facilities to the vicinity of the site Others: Exemption from customs duties and clearance fees for imported products, application for and approval of environmental clearance, removal of the existing Teleganchu Bridge and detour road of Beteni bridge within three years after the project, etc.			
Implementation Schedule	E/N Date	December 16, 2016	Disbursement Date	
	G/A Date	December 26, 2016	Completion Date	December 15, 2000 (Handover Date)
Project Cost	E/N Grant Limit / G/A Grant Limit: : 2,156 million yen, Actual Grant Amount: 2,133 million yen			
Executing Agency	Department of Roads, Ministry of Works and Human Settlement: DoR[3]			
Contracted Agencies	Main Contractor(s): Dai Nippon Construction Main Consultant(s): Oriental Consultants Global Co., Ltd./INGEROSEC Corporation (JV)			

[1] The map is processed from information provided by JICA.
[2] PNH-4 was renamed PNH-5 at the time of ex-post evaluation, following the restructuring of the national highway network in 2020. However, in this report, PNH-4 is used as it was at that time.
[3] In December 2022, due to the reorganization of ministries, the executing agency was renamed the Department of Surface Transport, Ministry of Infrastructure and Transport. However, this report uses the name as it was then.

	Agent: None

II. Result of the Evaluation

Summary

The project aimed to ensure smooth traffic by reconstructing four bridges on Primary National Highway No.4 and improving bridge performance and safety, thereby contributing to the promotion of local economic revitalization. In Bhutan, road traffic is the most important means of transportation and PNH-4 leading to southern part of the country is one of the most important trunk roads. This objective, therefore, was consistent with the policies and needs of the country at the time of project planning. The project plan and approach were appropriate, emphasizing safety aspects such as consideration for people who are vulnerable to traffic accidents and measures to protect cut surfaces. Although specific collaboration with non-JICA projects was not planned, the project was in line with ODA policy of Japan. In addition, the project collaborated with other JICA projects, and concrete results were confirmed. Therefore, relevance and coherence are high. Outputs were delivered mostly as planned. Both the project cost and the project period were within the plan. Therefore, the efficiency is very high. The quantitative effect indicators set at the time of planning mostly achieved their goals. Based on the interviews conducted to the executing agency and bridge users, it was confirmed that the project has ensured the safety of bridges, promoted logistics through stable transportation, and contributed to the revitalization of the local economy, each with concrete evidence. In addition, interviews with residents and users in the vicinity of the bridges also confirmed that the project has contributed to improving the living conditions of rural areas. Other impacts, such as contributing to the development of construction-related human resources in Bhutan, were confirmed. Based on the above, the effectiveness and impact are high. No issues have been observed in the policy/system, institutional/organizational, technical, financial, and environmental and social aspects, including the current status of operation and maintenance. Future risks have been well mitigated. Therefore, sustainability of the project effects is very high.

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

Overall Rating[4]	**A**	**Relevance & Coherence**	**③**[5]	**Effectiveness & Impacts**	**③**	**Efficiency**	**④**	**Sustainability**	**④**

<Special Perspectives Considered in the Ex-Post Evaluation／Constraints of the Ex-post Evaluation>

None

1 Relevance/Coherence

<Relevance>

・Consistency with the Development Policy of Bhutan at the Time of Ex-Ante

The *Road Master Plan (2007-2027)* of Bhutan stipulates the implementation of road widening and maintenance/repair and reconstruction of bridges on national and district roads. *The 11th Five-Year Plan (2013-2018)* prioritizes the improvement of national road networks and access to the construction sites of hydroelectric power plants. The reconstruction of the four bridges of this project was included in the plan. The Mangdechu hydroelectric power plant construction project on PNH-4 was a national project. Improving the bridges on PNH-4 was a priority issue as a route to bring in materials and equipment needed for the project. Therefore, the project was in line with the Bhutan's development policies.

・Consistency with the Development Needs of Bhutan at the Time of Ex-Ante

As mentioned in "Background" above, PNH-4 is the one of major trunk roads in Bhutan transport network and the only arterial road with no alternative route between Trongsa in the central region and Gelephu in the south. However, most of the bridges on PNH-4 were aging, damaged and had insufficient load carrying capacity. There was an urgent need to improve the aging bridges in order to facilitate the smooth flow of materials and equipment for the construction of a national hydroelectric power plant project. The Bhutanese government had identified eight bridges on PNH-4 as priority bridges for reconstruction in its *11th Five-Year Plan*. Four of the bridges in this project were technically challenging due to their length, height of bridges, and surrounding topographical conditions, and required technical assistance from outside the country. Therefore, the project was in line with the development needs of the country at the time of planning.

・Appropriateness of Project Design/Approach

In the past ex-post evaluation for similar projects, the lesson learned was to take care to ensure that the bridge plan and maintenance plan fully take into account the executing agency's response capacity and current status regarding maintenance. In this project, maintainability was one of the criteria for selecting the bridge type, accessories, approach road, and revetment work. In addition, it was confirmed that lessons learned were taken into account in the design of the project, such as the fact that the basic maintenance and management of the bridge would not require major repair or reinforcement for 20 to 30 years, considering the organizational and financial capacity of the executing agency. Furthermore, the bridge reconstruction projects in Bhutan supported by Japan, including this project, were planned to protect cut surfaces with higher standards than those usually implemented by the Bhutanese government, thus enhancing safety in Bhutan, where landslides are common. In addition, on the Passang Bridge, which is located near a residential area and has many pedestrians, foot paths at both ends were constructed at the request of the executing agency. In this way, the project planned to ensure the safety of vulnerable road users such as children,

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

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

the disabled, and the elderly. Thus, the project plan and approach were appropriate, taking into consideration the lessons learned in the past and the ability of the executing agency to respond to the project, as well as the design that emphasizes consideration for vulnerable traffic and safety in the slope protection measures.

<Coherence>

・Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation

At the time of planning, the rolling plan for Bhutan states that assistance is provided for the development of road networks and bridges in order to secure efficient and stable transportation and to promote regional economic revitalization. In addition, JICA Country Analysis Paper for Bhutan (March 2013) identified road and bridge construction, which plays an important role in improving accessibility in rural areas, as a priority issue. Therefore, the project was in line with Japan's development cooperation policy at the time of planning.

・Internal Coherence

The internal coherence with "Technical Cooperation Project for Capacity Development in Construction and Maintenance of Bridges" (September 2016 - April 2022) (hereinafter referred to as "CAMBRIDGE") was confirmed. Collaboration was achieved so that the construction site of the project would become a place for on-the-job training by CAMBRIDGE. DoR officers who are responsible for maintenance of the project received training courses provided by CAMBRIDGE to strengthen their capacities. Concrete synergistic effects were also observed, with the outcomes of CAMBRIDGE being used in the maintenance of the project such as utilization of bridge maintenance and inspection manuals developed under CAMBRIDGE.

・External Coherence

No collaboration with other projects was envisioned, and no specific synergistic effects were identified.

<Evaluation Results>

In light of the above, the relevance and coherence of the project are high[6].

2 Efficiency

(1) Project Outputs

The project was to reconstruct four bridges, Teleganchu Bridge, Beteni Bridge, Samkhara Bridge and Passang Bridge and to construct approach roads as shown in Table 1. Foot paths were installed on Passang Bridge where many residents live near the bridge. The slope protection works were implemented on three bridges located in mountainous areas, except for the Passang Bridge[7]. The project outputs were generally as planned.

Table 1: Outputs

Bridge	Length (m)	Total Width (m)	Lane	Sidewalk	Approach Rd (m)*	Total width (m)
Teleganchu Bridge	42.0	14.704～12.220	3.5m x 2 Lanes		53.5+95.5	10.5
Beteni Bridge	30.0	9.909～8.836			81.0+99.0	
Samkhara Bridge	49.5	9.281～11.119			59.0+84.0	
Passang Bridge	41.5	11.140～11.181		1.5m x 2	49.5+50.0	

* : Approach roads were constructed on both sides of the bridges. The number on the left are the distances closer to Trongsa and the numbers on the right are the distances closer to Gelephu.

Source: Results from the questionnaire to DoR

The design of the project was modified to address boulders on the slope of approach road of Samkhara Bridge discovered after the start of construction, and to restore and reinforce the slope of approach road of Teleganchu Bridge after its surface slope collapse due to higher-than-expected rainfall during the rainy season. However, those modifications did not affect the outputs. It was confirmed that the undertaking by the Bhutanese side were also carried out without delay. The former Teleganchu Bridge, which was scheduled to be removed within three years after the completion of the project, was not removed because it was to be used for other purposes by the Trongsa district, which has jurisdiction over the bridge. However, the executing agency and the on-site observation confirmed that there was no vehicle traffic and no particular safety issues.

(2) Project Cost

The actual cost of the Japanese side was 2,133 million yen compared to the planned cost of 2,156 million yen, which was within the plan (99% of the plan). Although additional restoration and reinforcement works were implemented during the project period due to the above-mentioned boulder problems and the surface slope collapse, which were not anticipated. Those works fell under the category of "Unexpected Environmental Conditions, etc." and JICA approved the use of the contingency fund. Furthermore, a landslide occurred during the construction period in the area on PNH-4 (Ossey) between the material yard of Passang Bridge and Samkhara Bridge. The transportation of materials and equipment had to be detoured (originally planned distance of 26 km was extended to 500 km after the detouring). The cost of the detoured transportation was approved by JICA as a "Force majeure" and the use of the contingency fund was approved. The actual project cost on the Bhutanese side could not

[6] Relevance: ③, Coherence: ③

[7] Slope protection work was not implemented for the Passang Bridge because it is a bridge over flat land and has no slope.

be confirmed due to a lack of data from the executing agency.

(3) Project Period

The planned period was 49 months, from December 2016 to December 2020. The actual period was 49 months, from December 2016 to December 2020. However, the construction was suspended approximately one month due to a lockdown order issued by the Bhutanese government during the outbreak of the new coronavirus infection. Since the suspension of construction was a force majeure event, one month was subtracted from the actual period to arrive at a 48-month. Therefore, the project period was within the plan (98% of the plan).

<Evaluation Results>

Although there were unexpected problems during the project period such as the boulder problems, restore and reinforce construction due to the surface slope collapse, detouring of transportation routes and the suspension of construction due to the new coronavirus infection, both the project cost and project period were within the plan by utilization of contingency funds and improving efficiency of construction through parallel work. Therefore, the efficiency of the project is very high.

3 Effectiveness/Impacts[8]

<Effectiveness>

(1) Quantitative Effects

The target values were achieved for average traveling speed, loading capacity, and annual average daily traffic for the four target bridges. The annual average daily traffic between Trongsa and Zhemgang increased significantly in 2020 and 2021, despite the corona period. This was due to the increase in the number of construction vehicles for the Mangdechu hydroelectric power plant in this area as well as the Nikachu hydroelectric power plant, whose construction began in 2016. The traffic volume dropped after construction was completed, but it still reached the target. On the other hand, the traffic between Zhemgang and Gelephu dropped in 2021. This was due to a sharp decrease in the number of vehicles entering Gelephu from India due to the close of the Indian boarder caused by the new coronavirus infection. However, since the border reopened in September 2022, traffic has steadily increased, far exceeding the target.

Annual average daily passengers and annual average daily cargo were not monitored by the executing agency. Although an attempt was made to estimate these indicators based on annual average daily traffic data, the estimated figures could not be simply compared to those in the plan since the baseline data was actually measured. Therefore, they were set as N/A.

(2) Qualitative Effects

The project was envision 1) “improving the safety of bridges and approach roads,” 2) “ensuring pedestrian safety by installing foot paths,” 3) “ensuring stable transportation and traffic,” 4) “revitalizing economy of Trongsa and Sarpang districts,” and 5) “improving the livelihood of rural areas.” The qualitative effects of 1) and 2) together with “improvement of safety” were confirmed through interviews with the executing agency, residents living near the bridges, and drivers using the bridges[9], as well as through on-site inspections, as described below. 3), 4), and 5) were confirmed as impacts.

The project has enabled two-way traffic, the increased load capacity has allowed large vehicles to pass without having to unload once in front of the bridge, and the improved alignment between the approach road and the bridge has allowed large vehicles to safely pass through the bridge without having to turn around. It was confirmed by the Road Safety and Transport Authority in charge, executing agency and residents living near the bridges that no traffic accidents have occurred since the project was completed. Therefore, it can be concluded that the safety has been improved. In particular, many respondents mentioned that landslides and falling rocks, which used to occur around the bridges every year during the monsoon season, have never occurred since the completion of the project due to the implementation of the slope protection works by the project. It was confirmed that the project improved safety and enabled stable traffic. Furthermore, it was confirmed that the construction of foot paths on the busy Passang Bridge has created a psychological sense of security not only for pedestrians, but also for drivers, who can drive with peace of mind.

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

[9] Interviews were conducted with residents near the bridges, shop owners, taxi drivers, school and hospital personnel regarding changes before and after the project (total of 38 people were interviewed (men:26, women: 12 (7 people near Teleganchu bridge, 9 people near Beteni bridge, 6 people near Samkhara bridge, and 16 people near Passang bridge)).

Quantitative Effects

Table 2: Comparison of Qualitative Effects Indicators Before and After the Project

Indicator		Baseline 2015 Planned Year	Target Year 2023 3 Years after completion	Actual 2020 Completion Year	Actual 2021 1 Year after completion	Actual 2022 2 Years after completion	Actual 2023 3 Years after completion
Average Travelling Speed (km/h)*1	Teleganchu	13	20	20	20	20	20
	Beteni	12	20	20	20	20	20
	Samkhara	14	20	20	20	20	20
	Passang	19	60	60	60	60	60
Loading Capacity (t)*2	All four bridges	55	100 *2	100	100	100	100
Annual Average Daily Traffic (vehicle/day)	Trongsa ~ Zhemgang	190	245	592	849	452	278
	Zhemgang ~ Gelephu	233	301	422	180	303	524
Annual Average Daily Passengers (passenger/day)	Trongsa ~ Zhemgang	640	826	N/A	N/A	N/A	N/A
	Zhemgang ~ Gelephu	785	1,014	N/A	N/A	N/A	N/A
Annual Average Daily Cargo (t/day)	Trongsa ~ Zhemgang	382	493	N/A	N/A	N/A	N/A
	Zhemgang ~ Gelephu	469	606	N/A	N/A	N/A	N/A

Source：Ex-ante Evaluation, Questionnaire and interview results from DoR

*1: The values shown are based on field measurements of travel speeds in the section including the approach roads section (approximately 20 m on each side), because the approach roads alignment was poor for all four bridges at the ex-ante stage, and the speeds were slowed down to the point of pausing in front of the bridges.

*2: The IRC standard (Indian design standard) was adopted for the design live load in this project, which indicates that a vehicle with a maximum total axle weight of 100 tons can pass through the target bridges.

<Impacts>

1. Intended Impacts

Regarding 3) and 4) set in the above qualitative effects, since 3) “ensuring stable transportation and traffic” leads to 4) “revitalization of the local economy (Trongsa and Sarpang districts),” the impact of the two together was confirmed as “revitalization of the local economy.” In addition, 5) “improvement of livelihoods in rural areas” was confirmed as follows.

1) Revitalization of local economy

The conditions of bridges other than the project’s bridges on PNH-4 were also confirmed through interviews with the executing agency and on-site inspections, as these bridges also have an impact on ensuring stable transportation and traffic. As the results, although some bridges were one-sided traffic, all bridges have a load capacity of 40 tons or more, and there were no bridges that could serve as bottlenecks. In addition, it was found that according to Bhutan’s trade statistics, the percentage of imports entering from Gelephu, where PNH-4 connects to the Indian border, increased after the completion of the project compared to other major regions along the border (from 6.1% (2018) to 9.5% (2023)). This can be attributed to the improved accessibility of PNH-4, which is used as a means of transportation from Gelephu to central and eastern Bhutan. Since there are no bottleneck bridges on PNH-4 and the annual average daily traffic, effect indicator, has increased, it is considered that project has secured stable transportation and traffic, thereby revitalizing the local economy.

Furthermore, the Bhutanese government has launched a major plan to develop a special administrative district in Gelephu at the end of 2023, called the “Gelephu Mindfulness City” concept, to create a new economic center[10]. The widening of PNH-4 is also planned in the *13th Five-Year Plan (2024-2029)*. If this initiative centered on Gelephu goes into full swing in the future, Gelephu will become the second center of Bhutan and the impact of this project on revitalizing the local economy is expected to be even greater.

[10] The vision is to create not just a special economic zone, but a special administrative region in an area of over 1,000 km^2 in Gelephu along the Indian border, based on Bhutanese culture, Gross National Happiness Index (GNH) principles, and the country's strong spiritual heritage, blended with modern living. It aims to lay the foundation for the country's future growth and create economic opportunities for its people through investments in green technology, education, and infrastructure. The master plan includes a spiritual center, an international airport, railway connections, and a hydroelectric dam. (SPA Business, dated on 20 December 2023, https://www.spabusiness.com/wellness-news/Bhutanese-King-unveils-Mindfulness-City-masterplan-for-Southern-Bhutan/352357)

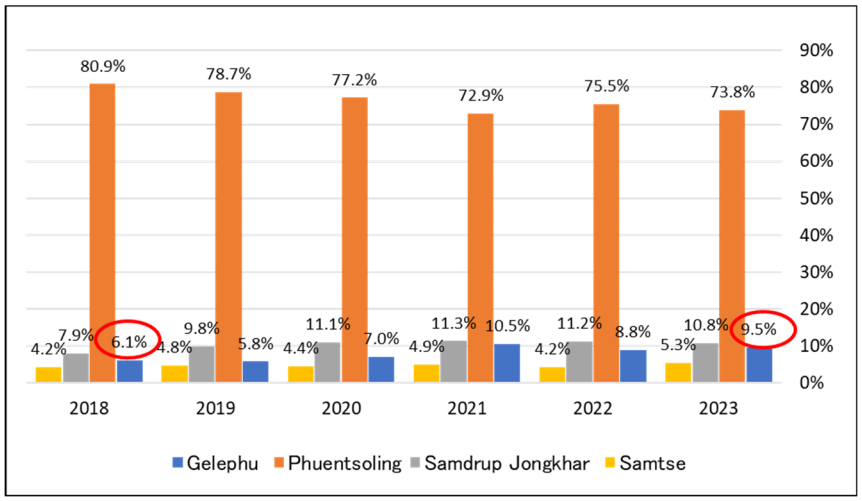


Figure 1: Percentage of Imports from the Four Indian Border Regions

Source: Prepared by the external evaluator from Bhutan Trade Statistics (each year)

2) Improvement of livelihoods in rural areas

From the interviews with owners of shops and restaurants and bridge users in the vicinity of the bridges[11], many indicated that the increase in traffic has led to an increase in the number of customers, which in turn has led to increased income. In addition, residents near the bridges were employed as construction workers and clerks for the project, which increased their income and improved their skills. After the project, some respondents said that they could build their own houses, and some said that their income opportunities expanded such as through engaging necessary construction works for their villages. Prior to the project, it lacked convenience such as that the aging bridges was unstable, making it dangerous to pass through especially at night. In the event of a landslide, the bridges were closed to traffic until the debris was removed. Many of residents interviewed indicated that after the project these problems had disappeared and that access to a larger towns, hospitals, and schools had improved, with reduced travel times. In particular, hospital personnel said that ambulances and other emergency vehicles can now pass through without problems and can respond to emergency situations. From the above, it can be said that this project has contributed to a certain extent to improving livelihoods in rural areas.

2. Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

The project does not fall under the category of large-scale projects in the road and bridge sector listed in the JICA Guidelines for the Confirmation of Environmental and Social Consideration (April 2010). It was determined to fall under Category B because the undesirable environmental impact was judged to be insignificant and it does not fall within the sensitive characteristics and sensitive areas listed in the Guidelines.

Environmental clearance was granted prior to the start of construction (October 2017) (Beteni, Sarpang, and Passang bridges for January 2017, Teleganchu bridge for May 2017). According to the executing agency, during the construction, air pollution, water pollution, noise/vibration and waste were monitored as planned and appropriate measures were taken. After construction, DoR regional office in charge of the bridge has been monitoring noise, odor, etc. during bridge inspections, and confirmed that no particular problems have occurred so far. Based on the results of interviews with local residents, it was confirmed that there were no problems with the natural environment during and after the project.

(2) Resettlement and Land Acquisition

Resettlement and land acquisition did not occur in this project.

(3) Gender Equality, Marginalized People, Social Systems and Norms, Human Well-being and Human Rights

In this project, foot paths and guard rails were installed on both sides of Passang Bridge, where there are many pedestrians. In addition, it was confirmed that pedestrians, especially vulnerable people in traffic such as elderly and people with disabilities were taken into consideration, as the sidewalk entrances and exits are sloped with no steps.

(4) Unintended Positive/Negative Impacts

<Development of local human resources in construction-related areas>

Several residents living near Beteni and Sarpang bridges were employed as construction workers by the Japanese contractor for this and past bridge projects of Japanese grant aid. According to them, a network had developed among these people who had been employed by the Japanese contractor in the past, and when any employment opportunity arose, they would be called upon and such information would be available through horizontal connections. In addition to income, the villagers employed by this project indicated that their construction skills had improved, and that they had all acquired “quality-oriented” and “safety-first” attitude. It was confirmed that these basic attitudes of the construction industry have been penetrated through employment by the Japanese contractor.

[11] Interviewees were the same as in footnote 9.

In addition, according to the executing agency, Japan's longstanding cooperation on bridges has improved the skills of DoR officers and other local contractors, which has improved the bridge construction techniques used in Bhutan's own projects. In fact, local contractors in Bhutan have gained skills and experience through Japan's cooperation, and are now able to implement important national projects other than bridges. Therefore, it can be said that not only this project but also the past Japanese bridge projects have contributed to the quality of construction and the development of related human resources in Bhutan.

<Reinforcement of sense of unity of the community>

Since many villagers were involved in the construction of the bridges, many said they were proud of them as bridges in their own villages, fostering a sense of ownership of the bridges. In addition, interviews with local residents also revealed that all of them responded that the project bridges are beautiful and that they have become familiar, with picnics held near the bridges. The bridges have become landmarks and a source of pride for local residents. Thus, it can be said that the project has contributed to a certain extent to strengthening the sense of unity of the local community.

<Evaluation Result>

This project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

4 Sustainability

・Policy and System

According to the executing agency, the widening of PNH-4 has been planned in the *13th Five-Year Plan (2024-2029)*, although it has not been publicized at the time of ex-post evaluation. As mentioned above in "Impacts," the Bhutanese government has given high priority to the development of roads leading to Gelephu based on the King's "Gelephu Mindfulness City" concept. Therefore, the road network, including the bridges reconstructed by this project, continues to be of high importance. In addition, anticipating monsoon damage, a system is in place to allocate emergency response costs and repair costs according to damage to DoR regional offices every year. In light of the above, the policy and institutional sustainability have been ensured.

・Institutional/Organizational Aspect

There is no change in the roles of maintenance from the time of planning. Basically, the DoR regional office in the district where the bridge is located conducts routine inspections (cleaning, removal of sediment, etc.) and periodic inspections. The head office monitors the regional offices. The Maintenance Department of the head office inspects the condition of roads and bridges after monsoons and makes judgments on the necessity of repairs. Trongsa Regional Office is in charge of Teleganchu Bridge, and Sarpang Regional Office is in charge of Beteni Bridge, Samkhara Bridge and Passang Bridge. A certain number of civil engineers are stationed at the head office and each regional office, and the system is in place to handle emergency repairs. The cleaning of roads, including bridges, is carried out by Bhutanese workers (National Work Force (NWF)) registered with the executing agency. NWF is cleaning the roads in its assigned section, including bridges. From the above, it can be judged that there are no particular problems with the institutional/organizational aspects.

・Technical Aspect

Each Regional Office has a sufficient number of civil engineers (18 in Trongsa Regional Office and 22 in the Sarpang Regional Office) to handle maintenance and management, and they have the ability to perform maintenance of minor damage and emergency response. If there are technical problems, they can get advice from the engineers at the head office. The technical training is basically focused on OJT, but even after the completion of the CAMBRIDGE project, the DoR continues to improve technical skills through internal training programs. The bridge inspection manuals introduced in CAMBRIDGE are being used. Each regional office has inspected the condition of bridges under its jurisdiction and updated the information twice a year in a database (Bridge Management System[12]) connected to the head office for use in asset management. In addition, a routine-based maintenance plan[13] for the bridges introduced in CAMBRIDGE has been developed and the annual required amount has been submitted to the Bridge Division of the DoR head office for budgeting. There were three engineers in Trongsa Regional Office and 20 engineers in Sarpang Regional Office who had received training by CAMBRIDGE at the time of ex-post evaluation. Based on the above, there are no particular problems with the technical sustainability.

・Financial Aspect

The maintenance budget has been shrinking since 2020 as shown in Table 3 due to the impact of the new coronavirus infection and tight government finances, but the budget for routine maintenance and maintenance for minor damage has been secured. The overall maintenance budget for roads including bridges, has increased significantly since FY 2022 due to an increase in the maintenance budget for national highways, while the annual maintenance budget for bridges has remained unchanged at approximately 4 million Nu (approximately 7 million yen[14]) in recent years. According to the executing agency, with limited budgets, each regional office is devising ways to address bridges with high needs by prioritizing them and using the money saved through bidding to cover maintenance costs. In cases where serious repairs are needed, the budgets of other regional

[12] The system that monitors the conditions of bridges by inspecting them twice a year according to the guidelines and updating the information, which is useful for asset management. This allows the priorities for maintenance to be identified. However, according to DoR, it is not possible to produce unit costs for repairs because conditions vary by region even for the same damage. Therefore, the budget has not been calculated from the information in the Bridge Management System yet. Separate budget requests are made for bridges that require major repairs.

[13] Routine based maintenance plan is a budget plan for simple maintenances such as mowing the surrounding area, painting bridges, cleaning debris, etc., performed by the regional offices.

[14] 1 Nu = 1.76 Yen (August 2024)

offices can be passed on through the head office. In addition to the regular maintenance budget, 3 million Nu (approximately 5.3 million yen) is allocated to each regional office at the beginning of each year as a monsoon emergency response, and additional repair costs are added as necessary after the post-monsoon inspection. The bridges reconstructed under the project are still new, and unless major damage occurs, no major maintenance costs will be required in the immediate future.

As described above, although maintenance costs are not sufficient, basic maintenance is being carried out with a limited budget, and there are no immediate financial problems for the bridges under this project unless they are severely damaged. Therefore, there are no particular problems with financial sustainability.

Table 3: DoR Maintenance Costs (Unit: million Ngultrum (Nu))

Year	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
Maintenance Cost for Bridges	8.27	5.064	4.236	4.65	4.097
Total Maintenance Cost	35.572	22.786	19.624	175.525	185.000

Source: Questionnaire results from DoR head office

・Environmental and Social Aspect

As analyzed in "Impact," no environmental nor social issues were identified during or after the completion of the project, and no concerns were found at the time of ex-post evaluation.

・Preventative Measures to Risks

At the time of planning, it was assumed that "no large-scale natural disasters would occur" as an external condition. The area on PNH-4 which had to be detoured to transport materials and equipment due to a major landslide during the project period, has been experiencing landslides every year even after the project was completed. According to the executing agency, since the area was geologically infeasible for reinforcement, a detour has been planned. The construction of the detour has been included in the *13th Five-Year Plan*, and a detailed design study have already been conducted at the time of ex-post evaluation. Therefore, preventive measures to risks have been in place.

・Current Status of Operation and Maintenance

The maintenance status is considered to be generally good. It was confirmed by inspection that there were no major damages on any of the four bridges, and the drainage outlets on the bridges surface, which are important for maintenance, had been thoroughly cleaned. On the other hand, during the first field survey, several potholes (indentations) were found on the surface of the approach roads of Teleganchu and Beteni bridges. In addition, cracks in the liner plate (earth retaining) of Passang Bridge were observed. The executing agency repaired the damage at these three locations as pointed out by the external evaluator. The completion of repairs was confirmed by photographs of the repaired areas submitted by the executing agency.

Each regional office in charge conducts daily inspections and before and after the monsoon without fail. Bridge surfaces are cleaned and mowed once a week by the NWF. Based on the above, no problems were found in the maintenance status of the bridges.

<Evaluation Result>

No issues have been observed in the policy/system, institutional/organizational, technical, financial, and environmental and social aspects, including the current status of operation and maintenance. Risks have been well mitigated. Therefore, sustainability of the project effects is very high.

III. Recommendations & Lessons Learned

・Recommendations to Executing Agency

Minor damages such as potholes in the approach roads and cracks in the liner plates were identified during the field inspection. Although the repairs have been carried out in response to the finding during the field survey of the ex-post evaluation, even minor damages such as this that does not affect the bridge itself should be addressed as soon as it is discovered, before the damage escalates.

・Recommendations to JICA

None

・Lessons Learned

<u>Establishment of effect indicators in accordance with the difficulty of obtaining and actual situation for the executing agency, and clarification of definition of indicators</u>

"Annual average daily passengers" and "annual average daily cargo" were set as part of effect indicators for this project. Although the executing agency measures annual average daily traffic every year, the number of passengers or the amount of cargo loaded were not measured. In the ex-post evaluation, the estimated figures of passengers and cargos were calculated based on the annual average daily traffic, but could not be simply compared to the actual measured values at the time of planning. It is desirable to set and evaluate effect indicators that can be monitored continuously in accordance with the degree of difficulty and actual situation of obtaining data by the executing agency. If an indicator is to be set that has not been monitored continuously by the executing agency, it is important to clarify the definition of the indicator from the ex-ante evaluation stage (for example, using a breakdown of annual average daily traffic by vehicle type, the capacity of a heavy vehicle is defined as one passenger,

it load capacity as 8 tons, etc.). It is also important to agree on the indicator setting and calculation methods with the executing agency well in advance.

IV. Non-Score Criteria

・Additionality

When bridges are constructed with the Japanese grant aid, bridge, approach roads and, if the bridge is located in a mountainous area, measures to prevent slopes on the cut surface on the approach roads, are implemented as a set. On the other hand, in bridge construction usually carried out by the Bhutanese side, due to the budget constraints, measures are taken to keep the slope angle within the specified range depending on the soil type of the slope, but not as extensive as the cutting measures work to be carried out through Japanese grant aid. As a result, even after the construction, rockfalls and landslides can occur during the monsoon season. In comparison, in the vicinity of Teleganchu, Samkhara, Beteni bridges, where cutting measures works were implemented in this project, no such accidents have occurred after the project. The bridge reconstructed project funded by Japanese grant aid is a high value-added project that will not only reconstruct bridges but also implement slope protection works in the surrounding area, thereby further increasing safety and effectiveness of the project.

Slope Protection Works at Beteni Bridge
(Source: Photo taken by the evaluator)

Repair works of potholes of approach road of Teleganchu Bridge (Source: DoR)

(end)

Jordan

FY2023 Ex-Post Evaluation Report of Japanese Grant Aid Project
"The Project for Improvement of Waste Management Equipment
in Northern Region Hosting Syrian Refugees"

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

0. Summary

This project was carried out to improve waste management in the northern region of the country, which is hosting Syrian refugees. The project procured the necessary equipment for transfer stations (hereafter referred to as 'TSs') and final disposal sites (hereafter referred to as 'DSs'), thereby helping to improve the sanitation and living conditions in the region.

The project was in line with the development policy and needs of Jordan, consistent with Japan's ODA policy at the time of planning, and there were no problems with the plan and approach of the project. There was no plan for collaboration with other JICA projects. As planned, coordination with the United Nations Development Program (UNDP) enabled a rapid response to urgent needs. Accordingly, the relevance and coherence of the project are high.

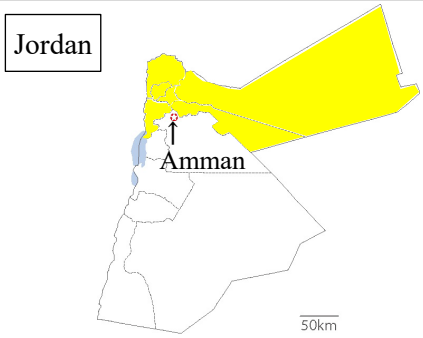
Equipment was procured as planned, including the compactors and semi-trailers required for the TSs to compact and transfer waste, and the excavators and bulldozers required at the DSs for final disposal. The project period exceeded the plan, but the project costs were within the plan. As a result, the efficiency of the project is high.

As operation and effect indicators, the project was expected to increase the amount of waste transferred by the TSs, and the amount handled for final disposal by the DSs. At the time of the ex-post evaluation these amounts had not reached the targets. A slowdown in economic activity and target values being too high are considered the main reasons for not achieving the targets. The expected qualitative effects, such as improving the environment around the TSs and hygienic landfill in the DSs, have generally been achieved. The project contributed to the improvement of sanitation and living conditions in the northern region to a certain extent, which was expected as an impact. It was not possible to identify any examples that the project directly helped improving the living conditions of refugees. This project has only achieved its objectives to a certain extent. Therefore, the effectiveness and impacts of the project are moderately low.

There are some minor problems in the operation and maintenance of the facilities of the project in terms of environmental and social considerations, 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 satisfactory.

1. Project Description



Project Location

Equipment Procured by the Project
(Rabiet Al-Kura TS)

Map provided by JICA; photo taken by the evaluator.

1.1 Background

The Syrian crisis started in 2011 and led to a large influx of Syrian refugees into Jordan. In response, many international organizations and donors provided emergency assistance to Jordan to support the reception of refugees. JICA recognized that the problem of waste management was becoming more serious due to the increase in population caused by the influx of refugees. JICA identified needs through information gathering and verification surveys and confirmed how other organizations were providing support to improve waste management. As other agencies were planning to support the construction of TSs and DSs, JICA decided to procure the equipment required for efficient operation of these facilities, and to strengthen their capacity. This assistance could be implemented quickly under the scheme of grant assistance.

1.2 Project Outline

The objective of this project is to improve waste management in the northern region of the country, which is hosting Syrian refugees, by procuring the equipment needed for TSs and DSs, thereby contributing to improve the sanitation and living conditions in the region.

Grant Limit/Actual Grant Amount	1,631 million yen/1,183 million yen
Exchange of Notes Date/Grant Agreement Date	May 2018/May 2018
Executing Agency	Ministry of Local Authority
Project Completion	February 2021
Target Area	Northern region of Jordan (Irbid, Mafraq, Ajloun, Zarqa and Balqa governorates)
Main Contractor	Toyota Tsusho Corporation
Main Consultant	Kokusai Kogyo Co., Ltd.
Preparatory Survey	October 2017
Related Projects	None

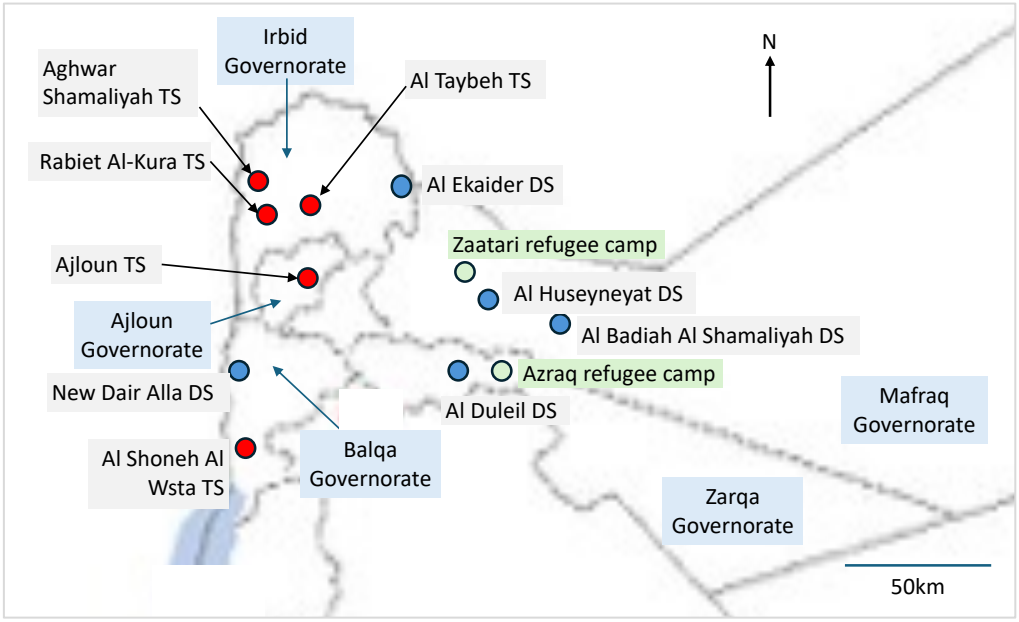


Figure 1: Location of TSs and DSs Assisted by the Project

Source: Illustrated by the evaluator.

<Waste Management Flow in Jordan>

To facilitate understanding of this report, the basic flow of management of municipal waste (hereafter abbreviated as 'waste' where appropriate) in Jordan is shown in the figure below.

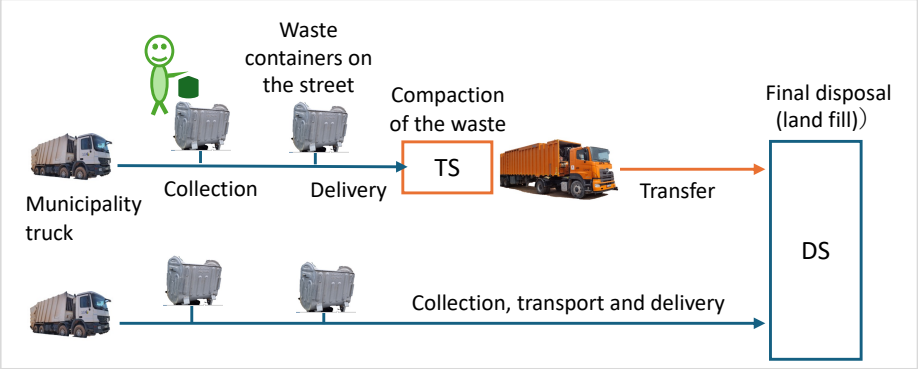


Figure 2: Waste Management Flow in Jordan

Source: Illustrated by the evaluator.

- Citizens put their waste into waste containers on the street.
- The municipality collects waste in the containers by truck and delivers it to the TS or DS.
- The TS compresses the waste that comes in with a compactor and transfers it to a DS.
- The DS puts the waste brought in by the TS or municipality into landfills for final disposal.

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: February 3, 2024 - February 16, 2024,
July 6, 2024 - July 12, 2024

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance/Coherence (Rating: ③[2])

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 policy is *Jordan 2025* (2016 - 2025). The policy emphasizes the environmental sector, with targets such as reducing the rate of solid waste disposal to landfills and increasing the rate of management and re-use of solid waste. The country's sectoral plan for both time periods, the *National Municipal Solid Waste Management Strategy* (2015-2034) (hereafter referred to as the 'National Strategy'), intends to establish a modern and comprehensive urban waste management system, improve municipal waste management, and urgently address the waste problem caused by the refugee influx. The project, which aims to improve waste management and help solve the waste problem caused by the influx of Syrian refugees, is consistent with the country's development policies and plans 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 most of the equipment in Jordanian TSs was obsolete and could either not be used or broke down frequently, which hindered its operation. The DSs were not able to properly dispose of waste in landfills due to lack of equipment and inadequate landfill planning. The inadequate treatment capacity of the TSs and DSs was exacerbated by the increase in population due to the influx of Syrian refugees. The treatment of waste could not keep up, which led to a situation where the city was littered with waste. Immediate assistance was needed to prevent the host community from becoming dissatisfied with the decline in waste management services due to the influx of refugees.

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

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

Although the growth in the Syrian refugee population has been reduced, waste management is still an essential service for civilian life at the time of the ex-post evaluation. In addition, the TSs and DSs developed under the project are important waste management facilities in the northern region, and the need for these facilities continues.

3.1.1.3 Appropriateness of the Project Plan and Approach

As waste management is a public service, and host communities and refugees benefit equally, the project was appropriate as support in a conflict-affected country, and from an equity perspective.

At the time of planning the location of the new TS was changed from Jerash to Al Taybeh, following opposition from residents. In Al Taybeh there were no houses nearby, and there was no opposition to the new construction. There was no impact on the effectiveness of the project due to the change; and therefore, the change was appropriate. Lessons learned from similar projects in the past were applied in this project, and equipment was procured to enable the supply of spare parts and after-sales service.

The approach taken by the project was appropriate, and no problems were observed.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

This project corresponds to the key objective of the *Development Cooperation Policy for the Hashemite Kingdom of Jordan* (July 2017) of the Ministry of Foreign Affairs, "Stabilization of the region," and the specific measure "Contribute to reducing the burden on Jordanian society in the field of social services such as education, healthcare, water and sanitation, which are under heavy burden due to the reception of refugees from Syria and other countries." The project was consistent with Japan's aid policy at the time of planning.

Active contribution of the Japanese Government in the promotion of the Middle East peace process, and its support for Jordan, which is receiving many refugees from Syria and other neighboring countries, was highly significant in terms of contributing to peace and stability in the Middle East region and ensuring energy security of Japan.

3.1.2.2 Internal Coherence

Synergy and complementarity with other JICA projects were not planned and not realized. General Grant Assistance of the Ministry of Foreign Affairs 'Economic and Social Development Project (FY2015)' has also procured equipment for waste management in the country. Some equipment was procured by the program for New Dair Alla DS and Al Duleil DS, which were assisted by this project. There is no problem of duplication with the equipment of this project; both are being utilized.

3.1.2.3 External Coherence

At the time of planning the reception of Syrian refugees was an international challenge, and it was important to coordinate between donor agencies. Coordination with UNDP was planned and achieved in this project. In Al Taybeh TS, UNDP constructed the building, and the project procured and installed the indoor compaction equipment. In Al Ekaider DS, the project procured some equipment for the sanitary landfill that UNDP was constructing with Canadian government funds. Coordination between the two organizations for the construction of the new Al Taybeh TS was particularly important for a rapid response to the urgent need for comprehensive support to improve the efficiency of waste management in the northern region.

The project was highly consistent with development policy and development needs of Jordan, and there were no problems with the project plan or approach. The project was consistent with Japan's ODA policy at the time of planning. There was no plan for collaboration with other JICA projects. As planned, there was collaboration with the UNDP, and the expected outcome was created. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

(1) Procurement of Equipment

In the project equipment, including compactors, semi-trailers and others for compaction and transfer of waste, were procured for the TSs (Table 1), and excavators, bulldozers and others for final disposal were procured for the DSs (Table 2), with the aim of improving waste treatment capacity and efficiency. Equipment was procured in line with the plan, both in terms of type and number.

Table 1: Equipment Procured for the TSs (All as Planned) (Unit: Number of units)

Name of the equipment \ TS	Aghwar Shamaliyah	Rabiet Al-Kura	Ajloun	Al Shoneh Al Wsta	Al Taybeh	Total
Outdoor-type hopper and compactor	0	1	1	1	0	3
Tractor-head	5	5	5	3	0	18
Semitrailer (50㎥)	5	6	5	3	0	19
Indoor-type hopper and compactor	0	0	0	0	1	1
Arm roll truck	0	0	0	0	6	6
Container (35㎥)	0	0	0	0	7	7
Tractor	1	1	1	1	0	4
Sprayer	1	1	1	1	0	4
Skid steer loader (0.6㎥)	1	1	1	1	0	4
Snow removal blade	0	1	1	0	0	2
Wastewater collection truck (8,000 liters)	0	0	1	0	1	2
Water tanker (8,000 liters)	1	1	1	1	0	4
Air compressor (30 liters)	1	1	1	1	0	4
High pressure car washing machine (15 litres/minute)	1	1	1	1	0	4

Source: Documents provided by JICA and the executing agency, field survey.
Note: Items with capacity specifications are indicated in brackets in the equipment name.

Table 2: Equipment Procured for DSs (All as Planned) (Unit: Number of units)

Name of the equipment \ DS	Al Ekaider	Al Huseyneyat	Al Badiah Al Shamaliyah	Al Duleil	New Dair Alla	Total
Bulldozer (28t)	4	1	0	0	1	6
Excavator (0.7㎥)	2	0	0	0	0	2
Excavator (0.5㎥)	0	1	1	0	1	3
Tipper truck (10㎥)	2	0	1	0	1	4
Tractor	0	1	1	1	1	4
Sprayer	0	1	1	1	1	4
Skid steer loader (0.6㎥)	1	1	0	0	0	2
Snow removal blade	1	1	0	0	0	2
Water tanker (8,000 liters)	1	1	1	1	1	5
Air compressor (30 liters)	1	1	1	1	1	5
High pressure car washing machine (15 litres/minute)	1	1	1	1	1	5

Source: Documents provided by JICA and the executing agency, field survey.
Note: Items with capacity specifications are indicated in brackets in the equipment name.

Tractor Head and Semi-trailer

Waste Compactor

Skid Steer Loader

High Pressure Car Washing Machine and Air Compressor

Bulldozer

Excavator

Photos: Taken by the evaluator.

The following problems occurred after the equipment was procured, and equipment parts were replaced or repaired.

- Due to Covid-19 the attendance of government employees was suspended, which delayed measures for duty exemption and customs clearance. Equipment was stored in bonded warehouses for about a year. During this period, the batteries in the dump trucks and water trucks ran down, and the cab-tilt cylinders in the tractor heads developed a fault; therefore, these parts were replaced.
- After the TSs started using the tractor heads, the gears on the shafts of 8 of the 18 vehicles were repaired because they were damaged. It was because excessive strain put on the tractor head coupling when vehicles are moving as the roads in Jordan are very uneven. It was found that the damage could be avoided by loading less waste than the maximum loading weight. Accordingly, the load for the vehicles had been restricted up to 18.7 tons, although the maximum capacity of them was 23 tons.
- Parts placed at the joint between the tractor head and semi-trailer, such as tire covers and step plates, were repaired because they were damaged. This was because the height of the coupling for these pieces of equipment did not match. Subsequently some improvements

were made by TS staff, such as increasing the height and thickness of the tractor head connecting plate and increasing the size of the driving shaft.

At the time of the ex-post evaluation, all the equipment was utilized without any problem.

(2) Consultancy Services

The consultancy services included detailed design, tender support and procurement management, all of which were carried out as planned. Under the training component, training was provided on the operation and maintenance of equipment, and the operation of the TSs and the DSs. As entry into Jordan from abroad was prohibited due to Covid-19, guidance was provided by local consultants under the direction of a Japanese consultant. In addition, the training schedule was shortened and the number of locations and participants reduced to prevent the spread of infection. Despite these changes, the expected results were achieved through sufficient prior consultation and the recruitment of highly competent local consultants.

For matters borne by the Jordanian Government, Covid-19 caused delays in arranging tax exemption, customs clearance and domestic transfer of the equipment, but there were no changes or problems in other matters.

From the above, the project outputs were considered largely in line with the plan.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost was 1,631 million yen from Japan and 6 million yen from Jordan, totaling 1,637 million yen. The actual project cost was 1,183 million yen from Japan and 9 million yen from Jordan, totaling 1,192 million yen. The project cost was within the plan (73% of the plan). The actual project cost of Japan was less than planned, due to a reduction in equipment procurement costs resulting from competitive bidding. The increase in project costs for Jordan compared to the plan was due to additional storage and insurance costs incurred due to the equipment being stored in a bonded warehouse for approximately one year.

3.2.2.2 Project Period

The planned project period was 21 months, from May 2018 to January 2020. The actual project period was 33 months, from May 2018 to January 2021. The main reasons for delay in the project were a delay in the start of bidding due to needing to wait for completion of the environmental impact assessment for Al Taybeh TS, the time taken by the Ministry of Local Administration (MOLA) to confirm with the Ministry of Finance whether the project equipment was eligible for tax exemption, and the impact of Covid-19, which delayed tax exemption measures, customs clearance and domestic transport of the equipment.

In this evaluation, of these factors the 81 days (approximately 3 months) from March 17, 2020 to June 6, 2020 when inter-governorate travel was prohibited to prevent the spread of Covid-19, and when tax exemption, customs clearance and domestic transfers were not possible at all, were deemed an unavoidable delay. The project period was deemed to be 30 months - 33 months minus 3 months. As a result, it was evaluated that the project period exceeded the plan (143%).

Therefore, efficiency of the projects is high.

3.3 Effectiveness and Impacts[3] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The performance of the operation and effect indicators of the project is shown in Table 3. They are below the target.

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

Indicators	Baseline value in 2017	Planned target value (3 years after completion)	Revised target value	**Actual value in 2023** (3 years after completion)	Status of achievement of the revised target
(1) Amount of waste transferred by TSs (ton/day)	374	1,052	967	**486**	50%
(2) Amount of waste handled by the DSs for final disposal (ton/day)	2,625	3,977	4,172	**2,324**	56%

Source: Sources of the baseline and planned target values are the Preliminary Evaluation Report. Revised targets were calculated by the evaluator. Sources for actual values are provided by the executing agency.
Note: The baseline value for indicator (1) is the sum of the amount of waste delivered to the four existing TSs, excluding the newly constructed Al Taybeh TS. The baseline value for indicator (2) is the total quantity of waste delivered to Al Ekaider DS and Al Huseyneyat DS, where disposal was being implemented hygienically.

Definition of indicators: Indicators at the time of planning were defined as follows.

- Indicator (1): Average daily quantity of waste delivered to TSs.
- Indicator (2): Average daily quantity of the waste delivered to DSs and disposed of hygienically. Hygienic disposal is defined as leveling, compacting and covering the waste with soil.

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

Baseline values: Estimated from results of the questionnaire survey conducted for each facility in the Preparatory Survey at the time of planning.

Target values: At the time of planning the target values were calculated by multiplying '(a) the population of the municipality' that will use each facility in the target year by '(b) per capita waste generation rate' (the amount of waste produced per capita per day). For '(a) population,' the population statistics of municipalities that were planned to use the project's facilities in the target year in the national strategy were applied. For '(b) per capita waste generation rate,' the rates in 2022 defined in the national strategy were applied - 1.16 kg/person/day for urban areas, and 0.94 kg/person/day for rural areas.

Revised target values: The evaluator studied the municipalities using each facility at the time of the ex-post evaluation and found these to be partially different to assumptions made at the time of planning.[4] These differences were made by considering the efficiency of transportation. In this evaluation, revised target values were set in accordance with this difference in the user population of the facilities. Specifically, to calculate the revised target values in Tables 4 and 5, the names of municipalities using the TSs and DSs of the project at the time of the ex-post evaluation in February 2024 were studied. The population of these municipalities in 2023 was confirmed by the statistics and multiplied by the per capita waste generation rate in 2023 stated in the national strategy (1.19 kg/person/day in urban areas, and 0.95 kg/person/day in rural areas).

[4] For example, the national plan was to use the nearest TS, but the plan was changed to use a different TS because the road from the municipalities to the TS was a steep uphill slope, so the speed of transportation was slow, and the tires of the vehicles wore out excessively.

Table 4: Calculation of the Revised Target Values for the TSs

Name of TS	(a) Municipalities using the TS as of 2023	(b) Population in 2023	(c) Ratio of urban population (%)	(d) Ratio of rural population (%)	Revised target figures in 2023 (ton/day)
Aghwar Shamaliyah	Mo'az Bin Jabal	48,677	92	8	57
	Tabaket Fahil	50,061	92	8	59
	Khalid Bin Al Walid	35,914	92	8	42
	Wastyyeh	51,350	92	8	60
	Sub total	**186,002**			**218**
Rabiet Al-Kura	Burqush	71,982	92	8	84
	Deir Abi Saheed	95,268	92	8	112
	Rabiet Aru Kura	27,580	92	8	32
	Sub total	**194,830**			**228**
Ajloun	Greater Ajloun	71,362	84	16	82
	Al Junaid	38,512	84	16	44
	Kafrangeh	64,170	84	16	74
	Oyoon	26,240	84	16	30
	Al Shafa	30,216	84	16	35
	Sub total	**230,500**			**265**
Al Shoneh Al Wsta	Al Shoneh Al Wsta	58,737	82	18	67
	Swaimah	4,853	82	18	6
	Sub total	**63,590**			**73**
Al Taybeh	Al Taybeh	62,130	92	8	73
	West Irbid	94,069	92	8	110
	Sub total	**156,199**			**183**
Grand Total		**831,121**			**967**

Sources: (a) Documents provided by executing agency, (b) Department of Statistics, Jordan, (c) and (d) Preparatory Survey Report.

Note: Method of calculation of the revised target values: (((b) x (c)/100 x 1.19) + ((b) x (d)/100 x 0.95))/1,000.

Table 5: Calculation of the Revised Target Values for the DSs

Name of DS	(a) Municipalities using the DS as of 2023	(b) Population in 2023	(c) Ratio of urban population (%)	(d) Ratio of rural population (%)	Revised target figures in 2023 (ton/day)
Al Ekaider	Great Irbid	1,013,942	92	8	1,187
	Al-Merad	44,557	77	23	51
	Burma	14,929	77	23	17
	Hosha	33,230	70	30	37
	Al-Sarhan	34,820	70	30	39
	Al-Basalyia	8,248	70	30	9
	Al-Saro	27,713	92	8	32
	Ramtha	200,861	92	8	235
	Sahl Al-Houran	86,849	92	8	102
	Al Mazar	94,610	92	8	111
	Yarmouk	29,622	92	8	35
	Sho'leh	18,542	92	8	22
	Bab Amman	20,390	92	8	24
	Jerash	119,364	77	23	135
	Al-Naseem	27,330	77	23	31
	Manshyiate Bani Hassan	16,210	70	30	18
	Al-Kafrat	47,199	77	23	54
	Ajloun TS	230,500	84	16	265
	Sub total	**2,068,916**			**2,404**
Al Huseyneyat	Umm Al Jimaal	37,190	70	30	42
	Sabha Wa Dafyaneh	22,470	70	30	25
	Balama	47,120	70	30	53
	Erehaab	31,600	70	30	35
	Greater Mafraq	166,505	70	30	186
	Khaldeieh	52,150	70	30	58
	Prince Hussain Bin Abudulla	22,707	70	30	25
	Za-atariwa Al Manshieh	24,340	70	30	27
	Manshiet Bani Hasan	16,210	70	30	18
	Za'atari Camp	85,220	70	30	95
	Sub total	**505,512**			**565**
Al Badiah Al Shamaliyah	Bani Hashim	8,867	70	30	10
	Dair Al Kahlf	14,450	70	30	16
	Salhleh Wa Nayfeh	27,429	70	30	31
	Umm Al Gtain Wa Al Mkaifteh	17,570	70	30	20
	Sub total	**68,316**			**76**
Al Duleil	Bereen	29,963	96	4	35
	Al Duleil	61,448	96	4	73
	Al Hallabat	16,304	96	4	19
	New Hashmeyeh	97,187	96	4	115
	Azraq	20,571	96	4	24
	Sub total	**225,473**			**266**
New Dair Alla	Sharhabil Bin Hasna	48,832	92	8	57
	Ma'adi	27,055	82	18	31
	Dair Alla	61,585	82	18	71
	Al Shona Al Wsta TS	63,590	82	18	73
	Al Taybe TS	156,199	92	8	183
	Rabiet Al Kura TS	194,830	92	8	228
	Agwar Shamaliyah TS	186,002	92	8	218
	Sub total	**738,093**			**861**
Grand total		**1,537,394**			**4,172**

Sources: (a) Documents provided by executing agency, (b) Department of Statistics, Jordan, (c) and (d) Preparatory Survey Report.

Note: Method of calculation of the revised target values: (((b) x (c) /100 x 1.19) + ((b) x (d) /100 x 0.95))/1,000.

Actual values in 2023

Information provided by MOLA about the amount of waste transferred by TSs was taken as the actual values. The evaluator observed operation of the facilities and interviewed facility managers to confirm the reliability of the information. At the time of the ex-post evaluation the weighing bridges for Al Shoneh Al Wsta TS, Al Taybeh TS, Al Ekaider DS, Al Huseyneyat DS and New Dair Alla DS were functioning; the amounts weighed were provided to the evaluator. However, for the other five facilities, although the weighing bridges were in place, they were not in use as they were not working properly or awaiting inspection, and the amount of waste transferred was not measured. Therefore, transfer values provided by MOLA for these facilities were estimates, made by multiplying the number of municipal delivery trucks by the capacity of these trucks.

The main reasons why the actual value of the indicators at the time of the ex-post evaluation were less than the target values are as follows:

(1) Amount transferred by the TSs

Achievement of the actual amount transferred for each TS against the revised target ranges from 38% to 79% (Table 6).

Table 6: Details of the Amount of Waste Transferred by TSs

Name of the TSs	Revised Target Value in 2023 (ton/day)	Actual Values (ton/day)					Ratio of the revised target achieved
		2020	2021	2022	2023 (Target year)	2024	
Aghwar Shamaliyah	218	117	117	117	117	90	54%
Rabiet Al-Kura	228	117	117	117	117	81	51%
Ajloun	265	107	109	111	124	99	47%
Al Shoneh Al Wsta	73	32	48	58	58	45	79%
Al Taybeh	183	70	70	70	70	81	38%
Total	967	442	460	473	486	394	50%

Sources: Revised targets were calculated by the evaluator; actual values were provided by executing agency.
Note: Values for 2024 are the average for six months from January to June. These were less than those in 2023, apart from Al Taybeh TS. MOLA states that this is due to seasonal factors and that the total transfer amount in 2024 over the year is expected to be the same or slightly higher than in 2023.

At the time of the ex-post evaluation the TSs are accepting waste from all municipalities that want to deliver it. All waste delivered to the TSs is compacted and transported to the DSs. In this way, the TSs are operating without any problems. Therefore, the reduced transport volume of TSs

compared to the revised targets can be attributed to the surrounding environment of the TSs as follows:

(a) Slowdown in economic activity: Economic activity in Jordan has slowed since Covid-19. This may have weakened the purchasing power of citizens and reduced the amount of waste generated.[5]

(b) Targets set too high: It is possible that the per capita waste generation rates in the national strategy used to set targets at the time of planning were too high. MOLA explained that when the national strategy was developed there was no data on waste generation in Jordan, so the rates were set based on examples from European countries. However, as they were very likely to have been too high, MOLA was reviewing the rates at the time of the ex-post evaluation.[6]

(c) Waste collection rate is not 100%: MOLA explained that sometimes waste is not collected in some areas of the municipality, due to lack of supervision by the staff in charge in the municipalities.

(2) Amount of waste handled by the DSs for final disposal

The amount of waste handled by the five DSs for final disposal is shown in Table 7. While Al Duleil DS has achieved its target the other DSs have not achieved the revised targets, with achievement ranging from 37% to 83%.

[5] Jordan's GDP growth rate was as high as 8% in 2005 - 2007, but gradually declined to 2% - 3% from 2010 onwards; in 2020 it was -1.1%, due to Covid-19. The recovery of economic activity has been slow since then, with GDP growth remaining stagnant around 2% - 3% from 2021 to 2024. The unemployment rate also increased year on year. It was 11.9% in 2014, and 22.9% in 2022 (source: International Monetary Fund website). From late 2023 tourism has also declined due to the situation in Palestine and Israel.

[6] The revised per capita waste generation rates were not available. For reference, examples of the rates are 900 g/person/day in Japan (2021), and an average of 1.4 kg/person/day in OECD member countries in Europe (2020).(https://www.union.tokyo23-seisou.lg.jp/kikaku/kikaku/iken/ikenkokan/documents/gomigentani.pdf https://stats.oecd.org/index.aspx?DataSetCode=MUNW#)

Table 7: Details of the Amount of Waste Handled by the DSs for Final Disposal

Name of the DSs	Revised Target Value in 2023 (ton/day)	Actual Values (ton/day)					Achievement ratio of the revised target
		2020	2021	2022	2023 (Target year)	2024	
Al Ekaider	2,404	1,297	1,306	1,319	1,356	1,209	56%
Al Huseyneyat	565	185	196	207	207	187	37%
Al Badiah Al Shamaliyah	76	59	62	63	63	39	83%
Al Duleil	266	362	367	371	373	286	140%
New Dair Alla	861	140	210	340	325	291	38%
Total	4,172	2,043	2,141	2,300	2,324	2,012	56%

Sources: The revised targets were calculated by the evaluator; actual values were provided by the executing agency.
Notes: (1) For Al Huseyneyat DS and Al Duleil DS respectively, 75% and 85% of the final amount of waste disposed of were deemed to be disposed of in a hygienic manner and considered as the actual values.
(2) The values for 2024 are the average from January to June 2024. As with TSs, the full year is expected to be similar to or slightly higher than the values in 2023.

As with the TSs, some reasons for the targets not being achieved can be attributed to the surrounding environment of the DSs. These include a decrease in the waste generated due to a slowdown in economic activity, targets for the indicator being set too high, and a waste collection rate of less than 100%. The following factors also contributed to targets not being achieved.

- The definition of this indicator was ‘quantity disposed of hygienically. However, for Al Huseyneyat DS and Al Duleil DS, there were some areas where hygienic disposal was not implemented at the time of the ex-post evaluation. Therefore, based on the evaluator’s observations during the visit, and the opinions of the person in charge of MOLA and the two DSs, hygienic disposal was set at 75% and 85% of the actual values for Al Huseyneyat DS and Al Duleil DS respectively. Therefore, for Al Huseyneyat DS, the fact that some of the waste delivered was not disposed of in a hygienic manner was also a factor for that target not being achieved.
- The planned construction of a large-scale sanitary landfill in Al Ekaider DS has been delayed for about two years due to unsuccessful tenders and other factors, so the existing landfill site continues to be used. The volumes transferred to the DS cannot be increased much because it has a limited capacity; this is another reason why this DS has not achieved its targets.

The actual quantity for Al Duleil DS was higher than the target, although only the amount of waste being disposed of hygienically was considered. The DS is next to an industrial zone and a free trade zone, and a large amount of waste is delivered from business entities in these zones in addition to waste from the municipality.

3.3.1.2 Qualitative Effects

(1) Qualitative Effects Expected from the TSs

Table 8 shows the qualitative effects expected from the TSs that the evaluator identified based on issues at the time of planning. It also shows the extent to which these effects have been realized, as found through the inspection visits of the evaluator and interviews she had with stakeholders during the ex-post evaluation.

Table 8: Status of Realization of the Qualitative Effects Expected from the TSs

Expected Qualitative Effects	Status at the time of Ex-post Evaluation
(a) Closure of the adjacent DS and improvement of the surrounding environment due to the closure.	The effect has been realized in all three TSs concerned.
(b) Reduced waiting time at the TSs for waste collection vehicles due to provision of an additional compactor and several semi-trailers and tractor heads.	The effect has been realized in all four TSs concerned.
(c) Improvement of the environment around the TSs due to reduced waiting times for municipal waste collection vehicles.	The effect has been realized in all four TSs concerned.
(d) Operation of the TSs after it has snowed.	The effect was realized in 1 of the two TSs concerned, but the effect was not confirmed in one TS because it had not snowed.
(e) Extending the life of vehicles by cleaning them with high pressure car washing machines.	The effect was realized in two of the four TSs concerned. The other two TSs are cleaning vehicles, but the machine procured by the project was not being used.

(a) Closure of the adjacent DS and improvement of the surrounding environment due to the closure

At the time of planning there were DSs near Aghwar Shamaliyah TS and Rabiet Al-Kura TS. This had led to a lot of waste lying around and bad smells, and residents in the area had complained. These DSs should have been closed, but at the time the TSs did not have sufficient capacity to handle all the waste brought in so the DSs continued to be used.

Based on the assumption that the project would improve the TSs' capacity, these DSs were to be closed. The DSs were closed in 2019, as planned by UNDP with funding from the Government of Canada. At the time of the ex-post evaluation, the DS sites had been covered with soil, vegetation had returned, there was no dumping or scattering of waste, landfill gases, leachate, fires, bad smells or dust, and the environment had improved significantly.

In this evaluation, nine residents living in the vicinity of these two TSs were asked for their views on the changes to their environment and their lives due to the closure of the DSs.[7] They all said that the living environment used to be very bad, with waste being scattered around the DS, bad smells, smoke from fires and many flies. After the DS was closed, these problems were solved, the environment improved, and outdoor activities could easily be carried out. There was also a positive impact on livelihoods because of the improved environment: people started building houses and cultivating land, crops grew better, and roads around the TSs were improved and more convenient. At the time of planning there was also a DS at the construction site of the Al Taybeh TS that nearby residents had complained about, but the DS was closed when the new TS was built.

As mentioned above, the project has contributed to improving the surrounding environment of the TSs through the closure of the adjacent DSs.

(b) Reduced waiting time at the TSs for waste collection vehicles due to provision of an additional compactor and several semi-trailers and tractor heads

At the time of planning, Aghwar Shamaliyah TS, Rabiet Al-Kura TS, Ajloun TS and Al Shoneh Al Wsta TS only had one hopper and one waste compactor. As a result, when several waste collection vehicles arrived from the municipalities they had to wait for one to one and a half hours to discharge waste into the compactor. This was causing a problem with waste being scattered around, and a bad smell from the waiting vehicles.

At the time of the ex-post evaluation, waste collection vehicles were discharging waste one after the other into the hopper at the TSs, and there were no vehicles waiting. As a result of the project, there are now two hoppers and two compactors at each DS (see photo below). The number of semi-trailers and tractor heads that transport waste to the DS after compacting has also increased, resulting in an increased capacity for receiving, compacting and transporting waste, with almost no waiting time.

Ajloun TS at the Time of Planning

Ajloun TS at the Time of the Ex-post Evaluation

Sources: Photo at the time of planning was taken from the Preparatory Survey Report, and the photo at the time of the ex-post evaluation was taken by the evaluator.

[7] Residents were interviewed in July 2024. The head of each TS was asked to gather residents living around the DS who could describe the situation before and after closure of the DS. There were 5 participants from Aghwar Shamaliyah TS, and 4 from Rabiet Al-Kura TS. Six of the participants were farmers, and 1 each were in the police, sewing and tourism industries. All participants were men, as it was difficult to find women who were willing to participate in the interviews.

(c) Improvement of the environment around the TSs due to reduced waiting times for municipal waste collection vehicles

At the time of the ex-post evaluation there were almost no bad smells or waste being scattered at the four TSs, and the sites were kept clean. The reduced waiting time for collection vehicles at the TS has contributed to this. In addition, the project's skid steer loader was effectively used in the cleaning operation to collect litter that had been scattered around when the waste was discharged into the compactors.

(d) Operation of the TSs after it had snowed

It sometimes snows in Ajloun TS and Rabiet Al-Kura TS, but at the time of planning neither TSs had the equipment needed to remove snow. Their operations were sometimes delayed after it had snowed. Since completion of the project, Ajloun TS has been able to clear snow from the TS premises and delivery road using snow removal attachments procured under the project, and the operation of the TS has not been disrupted. After completion of the project and up to the time of the ex-post evaluation it had not snowed in Rabiet Al-Kura TS due to a mild winter climate and the snow removal attachments had not been used, so the effectiveness of the project for this could not be verified.

(e) Extending the life of vehicles by cleaning them with high pressure car washing machines

At the time of the ex-post evaluation, Al Shoneh Al Wsta TS and Ajloun TS were using high pressure car washing machines that had been procured to clean their vehicles. Staff at the TSs said that cleaning vehicles as soon as they returned from the DS had reduced the amount of vehicle defects. Aghwar Shamaliyah TS and Rabiet Al-Kura TS were not using the machines of the project at the time of the ex-post evaluation, but they were cleaning vehicles of the project appropriately with a larger capacity high pressure car washing machine of their own.

(2) Qualitative Effects Expected from the DSs

Table 9 shows the qualitative effects expected from the DSs that the evaluator identified based on issues at the time of planning, and the status of realization of these effects that were found through the evaluator's inspection visits of and interviews she had with stakeholders during the ex-post evaluation.

Table 9: Status of Realization of the Qualitative Effects Expected from the DSs

Expected Qualitative Effects	Status at the time of Ex-post Evaluation
(a) Procured equipment enabled adequate waste leveling and contributed to extending the life of the DSs.	The effect has been realized in three of the five DSs concerned. The effect has been realized to some extent in two DSs.
(b) Procured equipment enabled the implementation of sufficient soil cover and improved the environment around the DSs.	The effect has been realized in three of the five DSs concerned. The effect has been realized to some extent in two DSs.
(c) Operation of the DSs after it has snowed.	The effect has been realized in all two DSs concerned.
(d) Extending the life of vehicles by cleaning them with high pressure car washing machines.	The effect was realized in four of the five DSs concerned; the other DS is cleaning vehicles, but the machine procured by the project is not being used.

(a) Procured equipment enabled adequate waste leveling and contributed to extending the life of the DSs

Waste leveling is the process of excavating a final disposal site, placing the waste and then compacting it with heavy machinery. At the time of planning, the DSs of the project did not have the necessary equipment and the waste was not sufficiently leveled.

At the time of the ex-post evaluation, waste leveling was properly implemented in Al Badiah Al Shamaliyah DS and New Dair Alla DS, using equipment procured by the project. Although it was not possible to visit Al Ekaider DS due to public safety measures, it was confirmed through discussions with the DS manager that the excavation and leveling had been carried out properly. Proper leveling in these DSs has contributed to extending the life of the DSs.[8] As mentioned above, in Al Duleil DS and Al Huseyneyat DS, the leveling was not totally conducted adequately. This was because there is little land at these DSs for the amount of waste they are receiving, and the rocky terrain made excavation difficult.

(b) Procured equipment enabled the implementation of sufficient soil cover and improved the environment around the DSs

Al Badiah Al Shamaliyah DS and New Dair Alla DS were fully able to cover the waste after leveling at the time of the ex-post evaluation, using equipment procured under the project (see photos below). These DSs were also able to use the procured water trucks to spray the landfill site with water to prevent dust from being blown up, and to use sprayers to spray insecticide onto the

[8] By leveling the ground, the waste does not pile up in the disposal site, and the DS can be used for longer. The number of years the DSs can be used were unknown since MOLA does not estimate them.

site to efficiently prevent the breeding of pests. In these DSs, there were few bad smells and little scattering of waste. In Al Ekaider DS it was noted that soil covering had been implemented even at the time of planning and continued until the ex-post evaluation. In Al Duleil DS and Al Huseyneyat DS, it was observed that some areas were not adequately covered by soil for the reasons mentioned above (see photos below).

Al Badiah Al Shamaliyah DS

New Dair Alla DS

Al Duleil DS

Al Huseyneyat DS

Status of Soil Covering at the DSs

Photos: Taken by the evaluator.

(c) Operation of the DSs after it has snowed

At the time of planning, Al Ekaider DS and Al Huseyneyat DS did not have equipment to remove snow, which sometimes prevented them from operating when it had snowed. In these DSs, the snow removal attachments and small wheel loaders procured under the project were used to remove snow, enabling them to operate even after it had snowed.

(d) Extending the life of vehicles by cleaning them with high pressure car washing machines

In four of the five DSs, the procured high pressure car washing machines are being used to wash the vehicles, which is expected to prolong the life of the vehicles. In Al Huseyneyat DS, at the time of the ex-post evaluation the procured machine was not in use as it had broken down, but they had a larger machine that was used to clean the vehicles of the project.

(3) Reduction of waste transport costs for the municipalities by using the TSs

It was expected that municipalities that had been delivering waste to distant DSs at the time of planning would be able to use a TS nearby because the project increased capacity of the TSs, thereby reducing their waste transportation costs.

This effect has been achieved through the establishment of the new Al Taybeh TS. West Irbid and Al Taybeh municipalities had been using Al Ekaider DS before the project was implemented, but the project has enabled them to use the newly constructed Al Taybeh TS. The distance that waste was transported by these municipalities was significantly reduced from 44.6 km to 11.7 km

and from 48 km to 6.7 km, respectively. This effect has also been partially manifested in the four other TSs. TS staff explained that, at the time of planning, municipalities had to transport waste to distant DSs if the compactor at the TS broke down, or if there was a long waiting time at the TS. Since implementation of the project this has not occurred.

From the above examples, it can be assumed that the project has resulted in a reduction in waste transport costs for the municipality. The amount of reduction could not be calculated due to a lack of information on the transport of waste at the time of planning.

3.3.2 Impacts

3.3.2.1 Intended Impacts

It was expected that the project would improve the waste management situation and contribute to improved sanitation and living conditions in the northern region, as well as improve the living conditions of refugees. This evaluation investigated whether there are concrete examples of this. At the time of planning, the project was implemented in a situation where social services had deteriorated due to the influx of refugees, leading to increased dissatisfaction among host communities. Therefore, the evaluator also studied whether this dissatisfaction had been reduced, and whether the project had contributed to it.

(1) Impact on improving sanitation and living conditions in the northern region

(a) Opinion of the staff of the JSCs

According to officials of the Joint Service Council[9] (JSC), which is responsible for the operation and maintenance of the project's TSs and DSs, at the time of planning the amount of waste in the project's TSs and DSs had risen rapidly due to the population increase caused by the influx of refugees. Collection and disposal of waste could not keep pace and were in disarray. In due course they were able to collect and manage waste without any problem, because the equipment of the project improved the efficiency of waste management, and the number of refugees had stopped increasing. They believe that sanitary conditions in the city had improved as a result.

(b) Opinion of residents living near the facility

As discussed in section 3.3.1.2 Qualitative Effects (1)(a), the living conditions around the TS improved significantly due to closure of the adjacent DS in Aghwar Shamaliyah TS, Rabiet Al-Kura TS and Al Taybeh TS.

(c) Opinion of the general public

The evaluator conducted street interviews with 50 citizens in the main cities in the project area, and asked about waste collection and sanitation during the influx of Syrian refugees and during

[9] JSC is a support organization for local authorities that operates TSs and DSs and cleans and greens public facilities.

the ex-post evaluation.[10] First, when asked if the waste collection situation had worsened due to the influx of Syrian refugees, 28 (56%) said it had worsened, 18 (36%) said it had not changed, and four (8%) did not remember. When asked whether the influx of refugees had worsened the sanitation in the city, 27 (54%) said it had worsened, 19 (38%) said it had not changed and four (8%) could not remember. The 36% - 38% of respondents who said there had been no change may be because in Jordan household waste can be disposed of at any time in waste containers in the street (Figure 2) and there is no door-to-door collection, so some citizens are not aware of the details of the waste collection situation.

Twenty-eight respondents who said that 'the waste collection situation had worsened' were asked whether the situation had improved since then - Twelve (43%) said it had, 12 (43%) said it had not, and four (14%) were not sure. Nearly half the respondents felt that the situation had improved, but some did not.

Finally, the respondents were asked if they knew of any foreign organizations supporting waste management: Seven out of 50 respondents (14%) said they knew of some organizations, but there was no clear answer as to the name of the organization; no one mentioned JICA. Citizens' awareness of the project appears to be low. Thus, from the results of these interviews, it can be said that the project's contribution to the improvement of sanitation and living conditions in the northern region of the country was limited.

(d) Opinion of NGO staff working in the northern region

Officials from OXFAM and Future Pioneers (both British NGOs), which are implementing activities related to waste recycling and composting in the northern region, were asked about the impact of the project on improving sanitation and living conditions in the northern region. These are civil society organizations that assist developing countries. Both organizations believed that the project has contributed to strengthening the capacity of TSs and DSs. It may have indirectly contributed to improving sanitation and living conditions in the northern region, but it was difficult to identify specific examples of this contribution.

[10] Interviews were conducted in Irbid, Mafraq, Jerash and Ajloun cities. These are the capital cities in the four northern governorates, which had experienced a large influx of Syrian refugees. In addition, interviews were also conducted in the city of Al Taybeh, which is using the newly established Al Taybeh TS. The interviews were conducted from 9th to March 29, 2024. The sample size was ten people in each city, a total of 50 people. The target population was those who had lived in the vicinity of the facility from the time of planning the project, and they were selected using a quota sampling method (a type of significant sampling method in which certain conditions are set to select the sample). The age groups were 21 people in their 30s, 21 in their 40s, 4 in their 50s, and 4 in their 60s. There were 35 men and 15 women. The evaluator tried to have an equal number of men and women, but it was difficult to find women who were willing to participate in the interviews. Therefore, there were more men. As many Syrian refugees who fled to Jordan live with the host communities and have the same access to waste management services, respondents were selected for interview without making a distinction between host communities and refugees.

(2) Impact on improving the living condition of refugees

Al Huseyneyat DS receives between 30 and 35 tons of waste from Zaatari refugee camp daily, while Al Duleil DS receives about ten tons of waste from Azraq refugee camp daily (see Figure 1 for the location of the refugee camps). Strengthening the capacity of these DSs through the project may contribute to the proper management of waste in the refugee camps. When the NGO officials mentioned above and officials of JSC, DS and TS were asked for specific examples of these contributions, they believed the project may have indirectly contributed to an improvement in living conditions of the refugees, but that specific examples were not known. This is because an improvement in living conditions requires not only waste collection, but also improved water supply, housing and others, and the project has not implemented any activities that directly contribute to an improvement in living conditions in the camps. The evaluator could not conduct a quantitative survey on changes in the living environment of the refugees due to the limited period of survey for this evaluation. Therefore, the evaluator was unable to identify any examples where the project directly contributed to improve the living environment of refugees.

(3) Impact on reducing dissatisfaction of the host community with social services

Of the 27 respondents in street interviews who said that 'sanitation had deteriorated due to the refugee influx,' 20 (74%) stated that their emotional status had become worse due to the worsening sanitation in the city. Of these 20, only four (20%) said that their emotional status had improved since then. The host communities' dissatisfaction with social services is a complex issue not only about waste management, but also about water supply, education, employment, housing and many others. This is thought to be the reason why some respondents have not felt any improvement.

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.

2) Resettlement and Land Acquisition

Resettlement and land acquisition were not planned and have not occurred.

3) Gender Equality

There were no specific positive or negative impacts on gender equality.

4) Marginalized People, People's Well-being and Human Rights

The survey investigated whether the project has contributed to improving the living conditions of Syrian refugees and reducing the dissatisfaction of host communities. As noted above, no specific examples could be identified.

5) Unintended Positive/Negative Impacts

(a) Establishing a model for an indoor TS

Interviews with staff of the newly established Al Taybeh TS confirmed that the following effects have been achieved. This TS is one of the first three indoor TSs in the country, and these effects can serve as a model for future planning of constructing indoor TSs in the country.

- The TS has a lower environmental impact compared with conventional TSs, because the hopper and compressor are installed indoors and there is a treatment facility for the leachate. In addition, the floor of the building hardly needs to be cleaned, reducing the workload and water consumption (see photo below on the right).
- Compressed waste is automatically loaded into containers, and only a few staff are needed for the loading. The weighing device built into the compressor prevents overloading.
- Waste delivered from municipalities at night can be stored in containers and then transported the next morning, and there is no need for the drivers to work at night (see photo below on the left).

An Arm Roll Truck and Containers at Al Taybeh TS

Indoor Hopper and Compressor at Al Taybeh TS

Photos: Taken by the evaluator.

(b) Contribution to environmental education

A sorting and recycling factory at Aghwar Shamaliyah TS and a compost production factory at Rabiet Al-Kura TS were constructed by UNDP with financing of the Government of Canada after closure of the adjoining DS. They are open to visits from students at neighboring schools for the purpose of environmental education.

As indicated above, although the qualitative effects expected from the project have generally been achieved, both operation and effect indicators were below the target. Although the project contributed to improving sanitation and living conditions in the northern region to a certain extent, no examples of its direct contribution to improving the living conditions of refugees could be

identified. This project has only achieved its objectives 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

At the time of this evaluation, the importance of waste management in the National Development Plan '*Jordan 2025* (2016 - 2025)'; and the importance of improving urban waste management and policies such as expanding the functions of the TSs stated in the National Strategy are expected to continue, and support sustainability of the effect of the project.

No policy or institutional issues are identified regarding sustainability of the effect of the project.

3.4.2 Institutional/Organizational Aspect

At the time of the ex-post evaluation, the ministry with jurisdiction over waste management was MOLA, which has jurisdiction over 104 municipalities in the country. The department in charge of waste management at MOLA is the Solid Waste Management Department. This was set up in 2017 in view of the need for a department with specialist knowledge.

At the time of the ex-post evaluation, the JSCs or municipalities were operating and maintaining the TSs and DSs of the project. The names and number of personnel in these JSCs and municipalities are shown in Table 10. Only the Al Shoneh Al Wsta TS is operated and maintained by the municipality.

JSCs and municipalities are staffed as required according to their role and the number and size of the facilities they manage. Regarding the staff allocation for the TSs and DSs, Al Taybeh TS had insufficient number of drivers and restricted the amount of waste accepting until February 2024. This restriction was lifted in March 2024 when the number of drivers was increased from two to four. Other TSs and DSs were staffed with the necessary personnel for operation and maintenance, and no staffing problems were observed.

Table 10: Name of the Institutions and Number of Personnel Engaging the Operation and Maintenance of the Facilities of the Project (as at End of December 2023)

JSC/Municipalities/TS/DS	No. of Staff
Irbid JSC	
Aghwar Shamaliyah TS	89
Rabiet Al-Kura TS	22
Al Taybeh TS	16
Al Ekaider DS	112
Other facilities and sectors	75
Total	314
Ajloun JSC	
Ajloun TS	38
Other facilities and sectors	54
Total	92
Al Shoneh Al Wsta Municipality	
Al Shoneh Al Wsta TS	13
Other facilities and sectors	249
Total	262

JSC/Municipalities/TS/DS	No. of Staff
Mafraq JSC	
Al Huseyneyat DS	77
Other facilities and sectors	39
Total	116
Al Badiah Al Shamaliyah JSC	
Al Badiah Al Shamaliyah DS	32
Other facilities and sectors	31
Total	63
Zarqa JSC	
Al Duleil DS	38
Other facilities and sectors	198
Total	236
Aghwar Al Westa JSC	
New Dair Alla DS	80
Other facilities and sectors	0
Total	80

Source: Document provided by MOLA.

3.4.3 Technical Aspect

There is no equipment from the project that was not used due to technical problems or that was used extremely infrequently at the time of the ex-post evaluation. There are technicians who have been trained in the training component of the project at each facility, and technology transfer is also taking place through daily operations. Tractor heads and semi-trailers are used in compliance with the revised maximum loading weights.

When checking if advice in the training component was followed, it was found that access roads had been constructed in Al Badiah Al Shamaliyah DS and New Dair Alla DS in accordance with the advice. Although none of the facilities were using the recommended checklist for periodic inspection of equipment as it was, each facility had developed their own daily and periodic inspection forms for inspection, operation and maintenance, using the checklist for reference. In Ajloun TS, staff members used software they had developed to carry out operation and maintenance work on equipment and spare parts and to prepare reports. This self-help efforts improved work efficiency.

The operation and maintenance of the indoor Al Taybeh TS requires special tasks, such as loading waste onto the arm-roll truck via the control panel, and replacing the sensors attached to

the truck. The staff of the TS have been carrying out these special tasks without a problem, using the skills they learnt in training component and guidance from equipment suppliers.

As mentioned above, no technical issues related to sustainability were found.

3.4.4 Financial Aspect

The annual budget for MOLA is shown in Table 11. The budget has increased year on year, and the expenditure situation is satisfactory. The proposed budget for 2024 is 180,729,000JD, a slight decrease compared to the previous year; MOLA considers that this will not affect its activities, as additional budget is expected to be provided if necessary. The planned budget for 2025 is 183,789,000JD, which is slightly higher than in 2024.

Table 11: MOLA's Annual Budget and Actual Expenditure

(Unit:1,000JD)

Fiscal Year	Budget Allocation	Actual Expenditure
2021	142,262	137,523
2022	165,840	154,942
2023	184,637	184,637

Source: Reply to the questionnaire by MOLA, and 2023 budget report of the government.
Note: Fiscal year of Jordan is from January to December.

The budget for the development of waste management facilities in MOLA is shown in Table 12. The budget for execution of the national strategy is increasing. The expenditure of the items in 2023 was less than the expenditure in 2022 because construction of the new Al Ekaider sanitary landfill, supported by the French Development Agency (AFD), had been delayed and there was no expenditure for this.

Table 12: Annual Budget for the Development of Waste Management Facilities of MOLA

(Unit: 1,000JD)

Items	Actual Expenditure			Budget	
	2021	2022	2023	2024	2025 (plan)
Rehabilitation of existing DSs	0	100	100	100	100
Implementation of National Strategy	3,865	5,000	4,000	7,000	9,000

Source: 2023 budget report of the government.

Revenue in 2023 for the JSCs and municipalities managing the project's facilities is shown in Figure 3. The main source of funding for the JSCs is a grant from the Ministry. The Irbid JSC and the Mafraq JSC collect fees from the municipality for use of their facilities, while the other JSCs do not. All the JSC in Jordan collect fees from municipalities and other entities using their facilities by the nuisances and waste collection fees bylaw. But not all of them have fully

committed to pay the due fees because of its limited financial resources. All JSCs charge a fee for waste delivered by private companies.

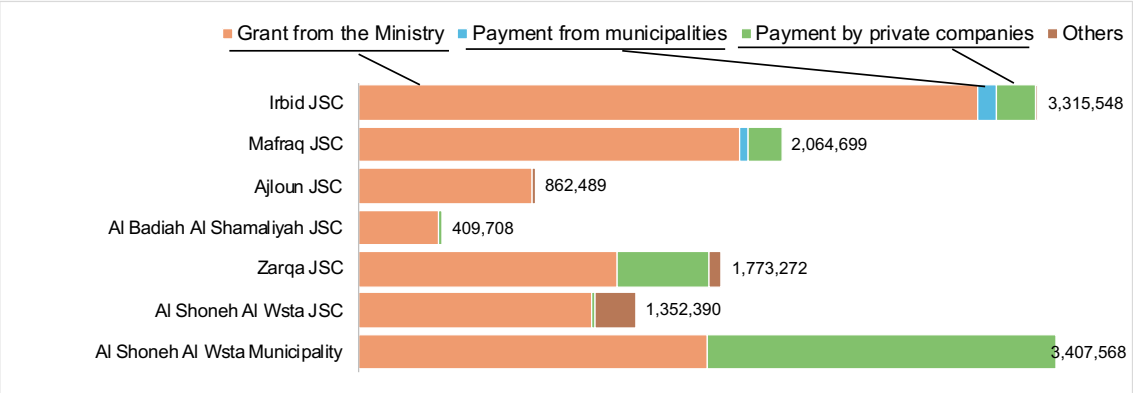


Figure 3: Revenue of JSCs and Municipalities that Operate and Maintain the Project's Facilities (2023, in JD)

Source: Illustrated by the evaluator based on the document provided by MOLA.
Note: The revenue of Al Shoneh Al Wsta Municipality includes the tax payment from the private sector in addition to facility user fees.

JSCs and municipalities are allocated grants based on the size of their operations and workload. Revenue covers the costs of personnel, fuel for vehicles, maintenance and repairs that are required to operate the facilities, so there are no financial problems associated with the operation of the facilities.

3.4.5 Environmental and Social Aspect

In the 5 TSs of the project there are almost no bad smells, noise, dust or vibration, and no negative impact on the surrounding environment was observed. The operation and maintenance management has been properly implemented, and the improvement in the surrounding environment achieved by the project is expected to continue in the future. The following issues were found regarding the DSs.

- As mentioned above, there was waste scattered around the premises of Al Duleil DS and Al Huseyneyat DS. Waste levelling and soil covering there was not properly conducted in some areas because the sites are small, and excavation of the land is difficult due to the rocky terrain. MOLA is aware of the challenges for these DSs and is preparing to convert Al Duleil DS into an indoor TS, and Al Huseyneyat DS into a sanitary landfill in future. These DSs are frequently cleaned, and there is no waste dispersed into the surrounding area.

- The evaluator checked the DSs in Google Maps, and found there were fires in Al Badiah Al Shamaliyah DS (see photo on the right). She also studied images of the satellite Sentinel-2 for the past seven years and found intermittent fires each year. The frequency of fires has been decreasing since completion of the project according to images taken by the Sentinel-2 satellite over the past seven years. MOLA confirmed that fires are sometimes caused by methane gas emitted from the waste, and that they promptly extinguish the fires by covering them with sand. There is no land use in the vicinity of the DS, and there is no social impact from the fires on the surrounding environment.

Fire in Al Badiah Al Shamaliyah DS
Source: Google map (August 2024)

The facilities of the project have some minor issues in terms of environmental and social considerations, but improvements are expected.

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

All the equipment procured by the project is in operation and well utilized, except for three high pressure car washing machines. Daily and regular maintenance of the equipment, periodic inspections and repair of breakdowns are carried out by the staff in charge. Operation and maintenance of the equipment are well done.

Three of the nine high pressure car washing machines procured were not in use. The facility that owns these three units has a larger high-pressure washer than the procured equipment and washes the vehicles of the project using this. It is planned to transfer the two machines owned by Aghwar Shamaliyah TS and Rabiet Al-Kura TS to Al Ekaider DS, and for them to be used there. The machine of Al Huseyneyat DS is being repaired; once repaired, it will be used at the DS for cleaning smaller vehicles.

Projects supported by other donors to the waste management sector in the target area include the construction of a new sanitary landfill in Al Ekaider and the conversion of Al Huseyneyat DS to a sanitary landfill, which are being implemented by AFD with EU funding, and OXFAM's recycling projects. The implementation of these donor-supported projects is expected to ensure sustainability of the effects of this project.

Slight issues have been observed in the operation and maintenance in terms of environmental and social considerations; 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 waste management in the northern region of the country, which is hosting Syrian refugees. The project procured the necessary equipment for the TSs and the DSs, thereby helping to improve the sanitation and living conditions in the region.

The project was in line with the development policy and needs of Jordan, consistent with Japan's ODA policy at the time of planning, and there were no problems with the plan and approach of the project. There was no plan for collaboration with other JICA projects. As planned, coordination with the UNDP enabled a rapid response to urgent needs. Accordingly, the relevance and coherence of the project are high.

Equipment was procured as planned, including the compactors and semi-trailers required for the TSs to compact and transfer waste, and the excavators and bulldozers required at the DSs for final disposal. The project period exceeded the plan, but the project costs were within the plan. As a result, the efficiency of the project is high.

As operation and effect indicators, the project was expected to increase the amount of waste transferred by the TSs, and the amount handled for final disposal by the DSs. At the time of the ex-post evaluation these amounts had not reached the targets. A slowdown in economic activity and target values being too high are considered the main reasons for not achieving the targets. The expected qualitative effects, such as improving the environment around the TSs and hygienic landfill in the DSs, have generally been achieved. The project contributed to the improvement of sanitation and living conditions in the northern region to a certain extent, which was expected as an impact. It was not possible to identify any examples that the project directly helped improving the living conditions of refugees. This project has only achieved its objectives to a certain extent. Therefore, the effectiveness and impacts of the project are moderately low.

There are some minor problems in the operation and maintenance of the facilities of the project in terms of environmental and social considerations, 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 satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) Measurement of amount of waste received at the project's facilities

As stated in section 3.3.1.1. 'Operation and Effect Indicators,' at the time of the ex-post evaluation, at Aghwar Shamaliyah TS, Rabiet Al-Kura TS, Ajloun TS, Al Badiah Al Shamaliyah DS and Al Duleil DS, weighing bridges had been installed but were not in use due to malfunctioning. The waste delivered to the sites is not measured. Accurate knowledge of the amount delivered is essential for planning and facility operation. MOLA should encourage the JSCs managing these facilities to ensure that the defective weighing bridges at these facilities are repaired, and the amount of waste they are receiving is measured.

(2) Frequent cleaning of premises of Al Duleil DS and Al Huseyneyat DS

As noted in the effectiveness section, leveling and covering has not been done in some areas in Al Duleil DS and Al Huseyneyat DS. These DSs are, respectively, planned to be converted into an indoor TS and a sanitary landfill in future. Meantime, it is important to continue the proper operation and frequent cleaning of the facility to avoid negative impacts on the surrounding environment.

4.2.2 Recommendation to JICA

None.

4.3 Lessons Learned

(1) Verification of the effect of improved operation of TSs and DSs through several operation and effect indicators

The operation and effect indicator for the project set at the time of planning was the amount of waste the facilities received. The indicator depends on the operation and maintenance of the facility, as well as the economic situation and waste collection. The per capita waste generation rate used for calculating the target values could be unreliable.

Therefore, future similar projects should consider adopting not only the amount of waste received, but also other operation and effect indicators. For example, for measuring operational efficiency of TSs indicators, such as reduced waiting time for delivery vehicles and a reduced number of days when the facility is inoperable due to hopper breakdowns, can be operation and effect indicators. For the implementation of hygienic landfill at DSs, the frequency of fires can be used an indicator - this can be measured using satellite images or by installing fire sensors in the DSs.

It is necessary to ensure the reliability of the per capita waste generation rate for setting targets when using the volume of waste received as an indicator.

(2) When preparing specifications for the procurement of vehicles, carefully check local laws and road conditions

In this project, a problem occurred in which the gears on the shaft of the procured tractor heads were damaged. The local laws and regulations were studied, and the maximum gross weight was clearly stated in the specifications at the time of procurement of the tractor head in the project, but the number of axles required for the gross weight was not stated. Tractor heads with a maximum loading capacity of 23 tons was procured by the project in accordance with the specifications. However, when investigating the cause of the above problem, it was found that the traffic laws of Jordan required three or more axles for tractor heads with a maximum load capacity of 23 tons, but the procured tractor heads had two axles. (Afterwards, JICA and the executing agency discussed the matter, took necessary measures; and at the time of the ex-post evaluation, the tractor heads were being used without any problems.) To prevent such problems, when preparing specifications for vehicle procurement, it is important to check local laws in detail, investigate the local terrain and road conditions and ensure that the specifications can withstand these conditions.

(3) Specifications should be drawn up with sufficient care to ensure that the equipment can be properly connected

In this project, the height of the connection of the procured tractor head and the semi-trailer did not match, resulting in damage to parts of the connection. When two types of equipment are to be connected, specifications should be drawn up with great care to ensure that both can be connected without any problem.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

Close coordination in collaboration with UNDP

MOLA greatly appreciates the close coordination between JICA project officials and UNDP in this evaluation of the project, which contributed to the establishment of the new Al Taybeh TS. JICA staff and consultants confirmed the specifications and quality of UNDP's works through frequent site visits, ensured that the equipment of the project was properly installed, and advised MOLA on issues and solutions; this was particularly useful in achieving effective coordination.

5.2 Additionality

Responding to urgent needs in conflict-affected areas through coordination and collaboration with international organizations

The project selected the area of waste management as support in response to an urgent need in the context of the Syrian crisis, where there is no difference between host communities and refugees as beneficiaries. The project also positively considered collaboration with UNDP and contributed to the construction of the new Al Taybeh TS, which is essential for improving waste management in the northern region. Equipment was procured that could be used effectively in the future, while considering the urgency of the assistance. The project is a good example of assistance in a conflict-affected country, where the urgent need was addressed in coordination with international organizations while considering equitable benefits and contributed to the continued effectiveness of the assistance.

(END)

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.

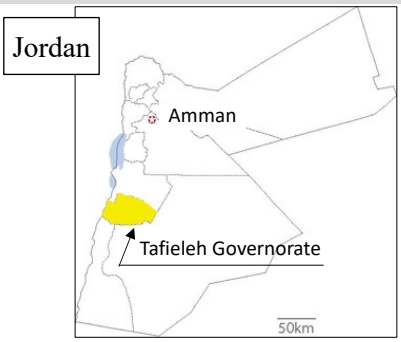
Operation and maintenance of the facilities developed by the project is well done in general. Operation and maintenance of the water distribution monitoring system is not in place, but the

[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.

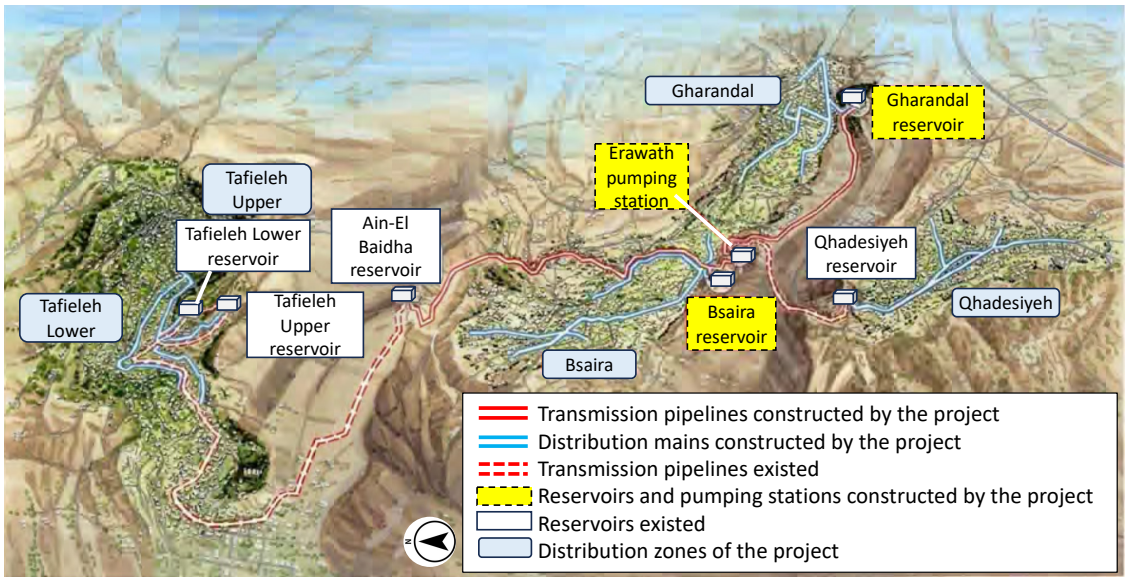


Figure 1: Map of Location of the Facilities Constructed by the Project

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 Bsaira 2: Construction by second contractor	December 2014 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.

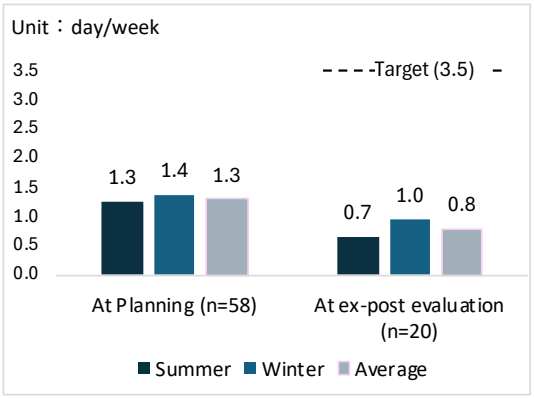


Figure 2: Number of Days of Water Supply in the Southern Region of Tafieleh Governate at the Time of Planning and at the Ex-post Evaluation

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.

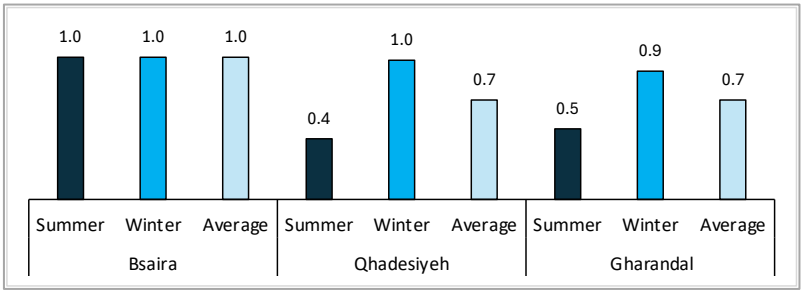


Figure 3: Number of Days of Water Supply in Southern Region of Tafieleh Governorate at the Ex-post Evaluation (unit: days/week, n=20)

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.

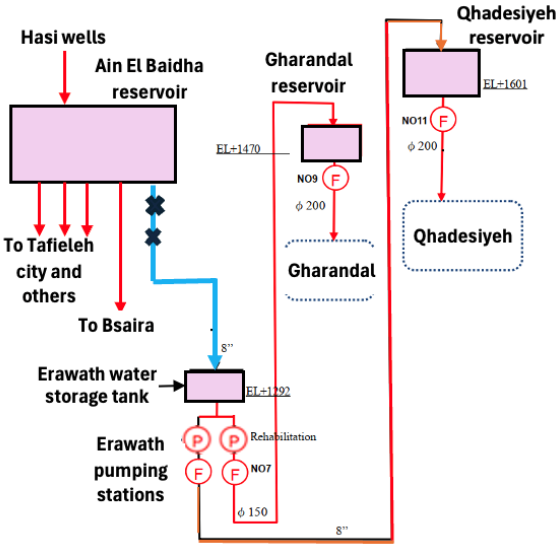


Figure 4: Distribution Diagram of Qhadesiyeh and Gharandal

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.

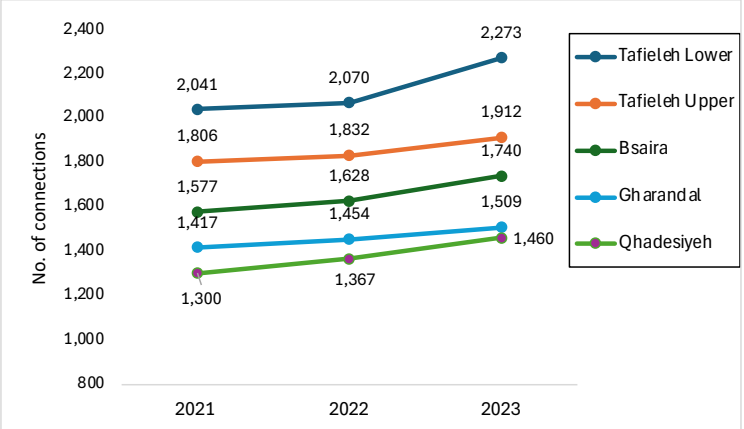


Figure 5: Number of Water Supply Service Connections in the Project Area

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".

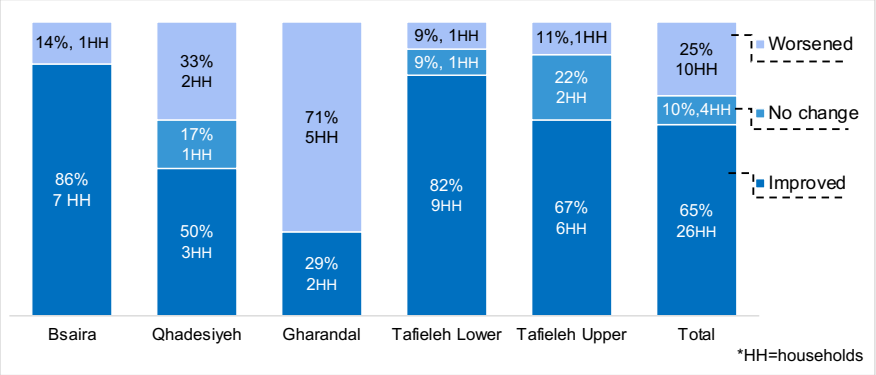


Figure 6: Status of Improvement of Water Supply Services (n=40)

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)

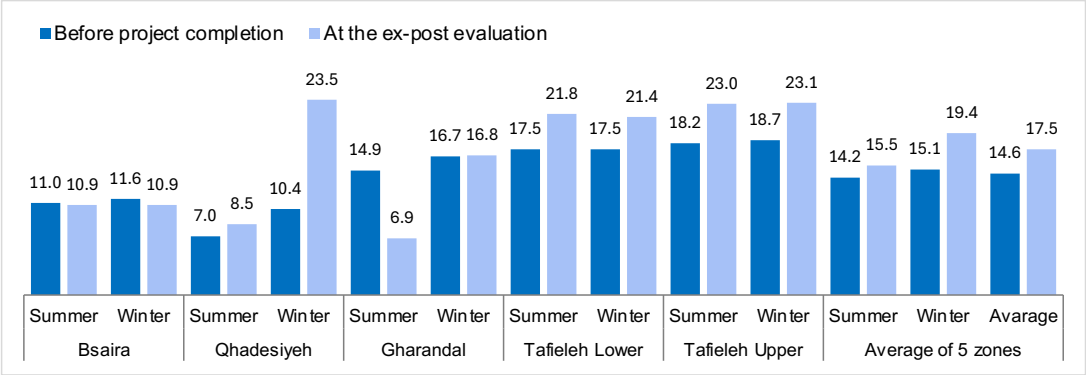


Figure 7: Hours of Water Supply at Ex-post Evaluation (Unit: hours/week, n=40)

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.

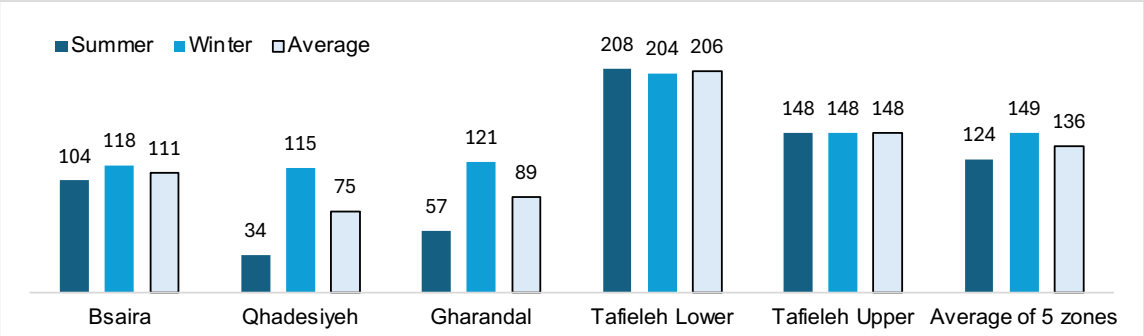


Figure 8: Water Usage per Person Per Day at the Ex-post Evaluation

(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

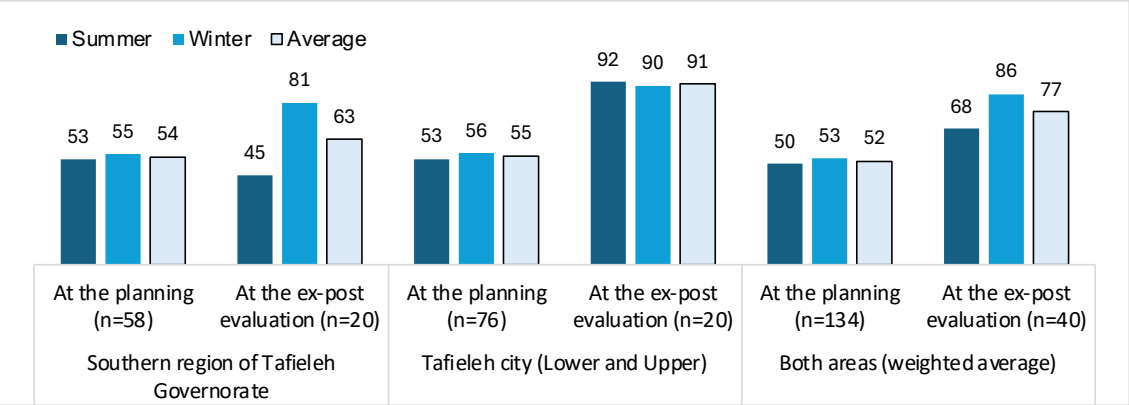


Figure 9: Water Usage per Household at the Time of Planning and at Ex-post Evaluation

(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.

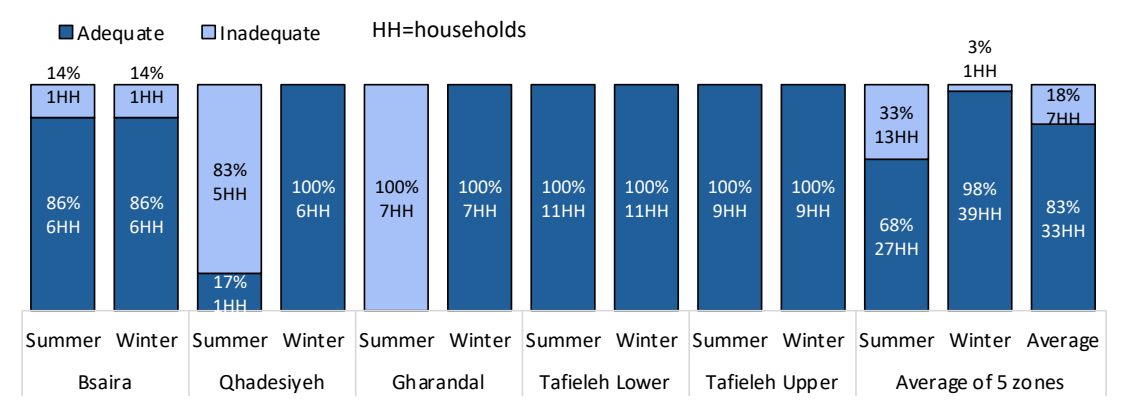


Figure 10: Are you Getting an Adequate Amount of Water for Your Daily Life? (n=40)

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.

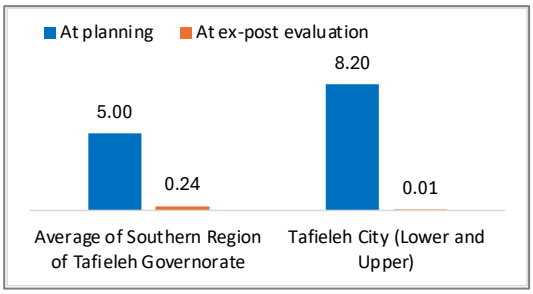


Figure 11: Amount of Water Supplied by Water Lorries (Unit: m^3/household/month)

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.

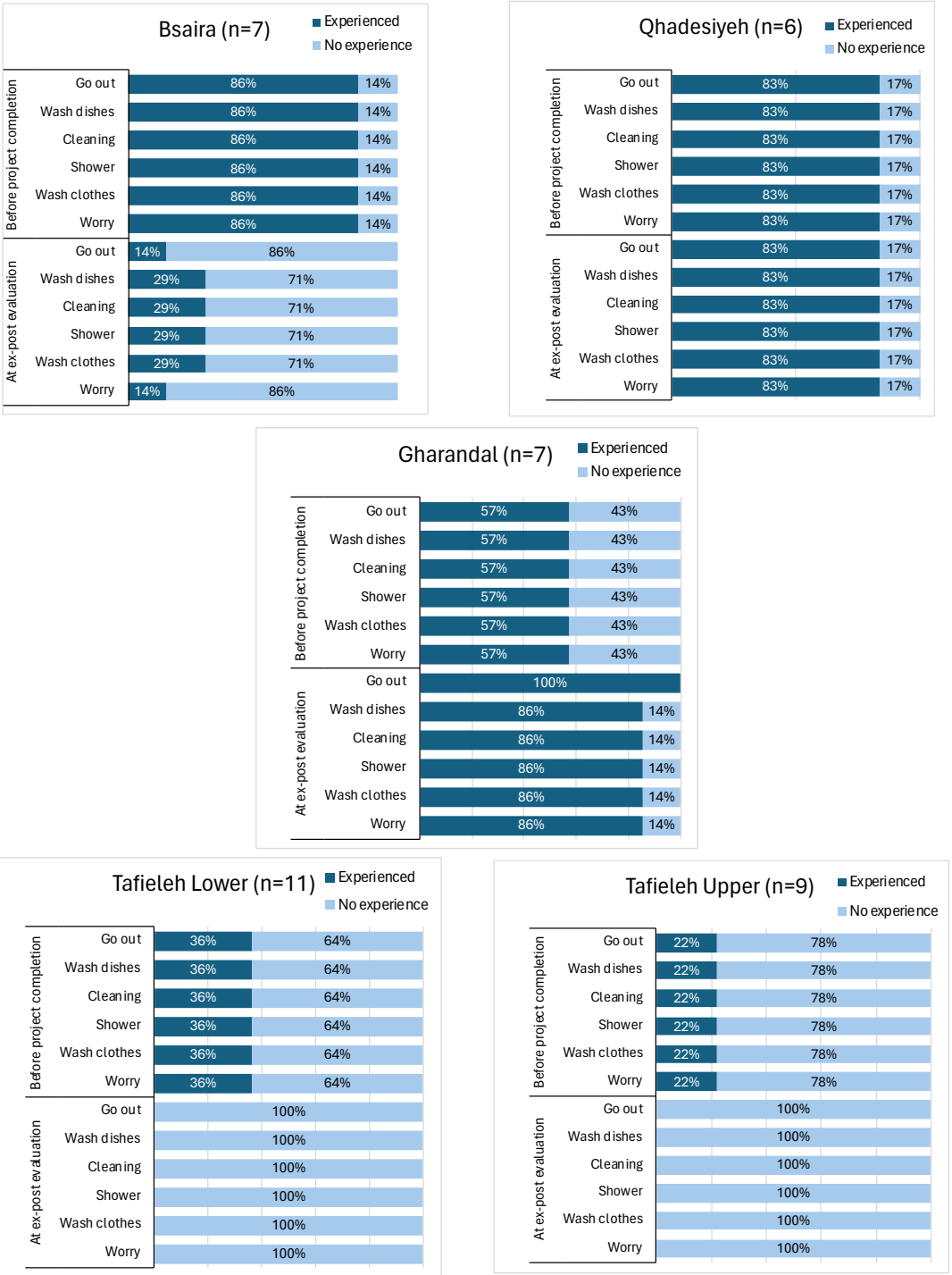


Figure 12: Whether the Improved Water Supply by the Project has Relieved the Inconvenience and Psychological Burden on Residents in their Daily Lives

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).

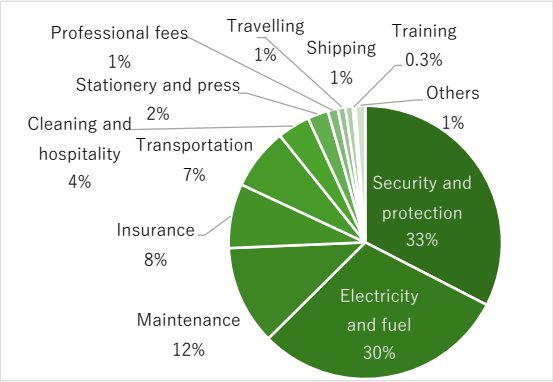


Figure 13: Breakdown of the Operation and Maintenance Costs of Tafieleh Water Office

(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)